



**Supplemental
Environmental Impact Assessment (EIA)
Report**

For

**The North-South Commuter Railway Project
(Malolos-Tutuban)
Solis-Blumentritt-Tutuban (SBT) Section**

VOLUME I: MAIN REPORT

(Final Report)

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Department of Transportation

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List of Abbreviations

Abbreviation	Definition
%	percent
°C	degrees Celsius
µg/L	microgram per liter
µg/NCM	micrograms per normal cubic meter
A	Ampere
AASHTO	American Association of State Highway and Transportation Officials
AC	Alternative Current
ACP	Architectural Code of the Philippines
ADB	Asian Development Bank
AFC	Automatic Fare Collection
APHA	American Public Health Association
As	Arsenic
AS	Aggrieved Stakeholders
ASTM	American Society for Testing Materials
AS/NZS	Australian Standards/New Zealand Standards
ATP	Automatic Train Protection
ATS	Automatic Train Service
BBB Program	Build!Build!Build! Program
BCDA	Bases Conversion Development Authority
BFP-SRU	Bureau of Fire Protection Special Rescue Unit
BOD	Biochemical Oxygen Demand
BSWM	Bureau of Soils and Water Management
BT Section	Blumentritt-Tutuban Section
BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
BSWM	Bureau of Soils and Water Management
CBI	Computer Based Interlocking
CCA	Climate Change Adaptation
CCTV	Closed Circuit Television
Cd	Cadmium

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
CEMP	Contractor's Environmental Management Plan
CEMAP	Contractor's Environmental Management Plan
CER	Compliance Evaluation Report
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cmol/kg	centimole per kilogram
CMR	Compliance Monitoring Report
CMVR	Compliance Monitoring and Validation Report
CN-	Cyanide
CO	Carbon Monoxide
CoC	Chain of Custody
COPC	Chemicals of Potential Concern
COVID-19	Coronavirus Disease
CR	Critically Endangered Species
CTC	Centralized Train Control
Cu	Copper
DAO	DENR Administrative Order
dB	Decibels
dBA	A-weighted Decibels
DC	Direct Current
DCM	Deep Cement Mixing
DD	Data Deficient
	Detailed Design
DENR	Department of Environment and Natural Resources
DENR-EMB	Department of Environment and Natural Resources – Environmental Management Bureau
DENR-MGB	Department of Environment and Natural Resources – Mines and Geosciences Bureau
DIA	Direct Impact Area
DIV	Dutch Intervention Values
DMC	DENR Memorandum Circular
DMO	DENR Memorandum Order
DO	Dissolved Oxygen

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
DoE	Department of Energy
DOH	Department of Health
DOLE	Department of Labor and Employment
DOLE-BWC	Department of Labor and Employment, Bureau of Working Conditions
DOLE-OSH	Department of Labor and Employment, Occupational Safety and Health
DOTC	Department of Transportation and Communications
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
DPWH-BSDS	Department of Public Works and Highways Load and Resistance Factor Design – Bridge Seismic Design Specifications
DRR	Disaster Risk Reduction
E&M	Electrical and Mechanical
ECA	Environmentally Critical Area
ECC	Environmental Compliance Certificate
ECP	Environmentally Critical Project
ECQ	Enhanced Community Quarantine
EGF	Environmental Guarantee Fund
EIA	Environmental impact assessment
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMF	Environmental Monitoring Fund
EMB-CO	Environmental Management Bureau – Central Office
EMB MC	Environmental Management Bureau Memorandum Circular
EMB-RO	Environmental Management Bureau – Regional Office
EMF	Environmental Monitoring Fund
EMP	Environmental Management Plan
EMoP	Environmental Monitoring Plan
EO	Executive Order
EN	Endangered Species
EPA	Environmental Protection Agency
EPRMP	Environmental Performance Report and Management Plan

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
EPRP	Emergency Preparedness and Response Plan
ERA	Environmental Risk Assessment
ETCS	European Train Control System
EW	Extinct in the Wild
ESC	Environmental and Social Considerations
f	frequency
FMEA	Failure Modes and Effects Analysis
FS	Feasibility Study
FTA	Federal Transit Administration
FTA manual	FTA Transit Noise and Vibration Impact Assessment Manual
GBV	Ground Borne Vibration
GC	General Consultant
GCQ	General Community Quarantine
GCR	Greater Capital Region
GES	General Effluent Standards
GRM	Grievance Redress Mechanism
GSM-R	Global System for Mobile Communications - Railways
Hg	Mercury
Hz	Hertz
IATF	Inter-Agency Task Force
ICP	Inductively Couple Plasma
IEC	Information, Education, Communication
IFC	International Finance Corporation
IIA	Indirect Impact Area
in/s	inch per second
IMP	Impacts Management Plan
IUCN	International Union for Conservation of Nature
JDT	Japan International Cooperation Agency Design Team
JICA	Japan International Cooperation Agency
kL	kilolitre
km	kilometre

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
km/h	kilometer per hour
km/h/s	kilometer per hour per second
kWh	kilowatt-hour
L	Liter
LC	Least Concern
LCD	Liquid Crystal Display
LC50	Lethal Concentration 50
LDPE	Low Density Polyethylene
Ldn	Day-night average sound level
LED	Light Emitting Diode
Leq	Equivalent continuous sound pressure level
LGU	Local Government Unit
LRFD	Load and Resistance Factor Design
L _v	Root mean square velocity in decibels
m	meter
m ²	square meter
m ³	cubic meter
MBAs	Methylene Blue Active substances
MCRP	Malolos-Clark Railway Project
MCLUPZO	Manila City Comprehensive Land Use Plan and Zoning Ordinance
MECQ	Modified Enhanced Community Quarantine
MERALCO	Manila Electric Company
MGB	Mines and Geosciences Bureau
mg/kg	milligrams per kilogram
mg/L	milligram per liter
min	minute
mL	milliliter
mm	millimeter
MMDA	Metro Manila Development Authority
MRF	Materials Recovery Facility
MSDS	Material Safety Data Sheet

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
MT	Metric Ton
MMT	Multipartite Monitoring Team
Mpa	MegaPascal Pressure unit
MPN	Most Probable Number
NBSAP	National Biodiversity Strategy and Action Plan
NBCP	National Building Code of the Philippines
NCCA	National Commission for Culture and the Arts
NCR	National Capital Region
ND	Not Detected
NDRRMC	National Disaster Risk Reduction and Management Council
NFPA	National Fire Protection Association
NLEX	North Luzon Expressway
NLEX-SLEX	North Luzon Expressway-South Luzon Expressway
NPCC	Philippines Noise Standard, Noise Control Regulations
NSCP	National Structural Code of the Philippines
NSCR	North-South Commuter Railway
NGO	non-government organization
NHCP	National Historical Commission of the Philippines
NIPAS	National Integrated Protected Areas System
NLEx	North Luzon Expressway
NLRC	North Luzon Railway Corporation
NM	National Museum
Non-ECP	Non-Environmentally Critical Projects
NO ₂	nitrogen oxide
NO _x	Nitrogen Oxides
NPCC	National Pollution Control Commission
NSCR	North-South Commuter Railway
NSCR Clark Ex	North-South Commuter Railway Clark Extension Project
NSCR Calamba Ex	North-South Commuter Railway Calamba Extension Project
NSRP	North South Railway Project
NT	Near Threatened

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
O ₃	Ozone
OCC	Operations Control Center
OCS	Overhead Contact System
ODA	Official Development Assistance
OSH	Occupational Safety and Health
OTS	Other Threatened Species
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAP	Project Affected Persons
PAR	Philippine Area of Responsibility
PA system	Public Address system
Pb	lead
PCB	Polychlorinated Biphenyls
PCO	Pollution Control Officer
PD	Presidential Decree
PEC	Philippine Electric Code
PEIS	Programmatic Environmental Impact Statement
	PHIVOLCS Earthquake Intensity Scale
PEISS	Philippine Environmental Impact Statement System
PEPRMP	Programmatic Environmental Performance Report and Management Plan
PET	Polyethylene Terephthalate
PGBC	Philippine Green Building Code
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PHP	Philippine Peso
pH	potential of hydrogen
PID	Photo Ionization Detector
PMO	Project Management Office
PM _{2.5}	Particulate matter with diameters that are generally 2.5 micrometers and smaller
PM ₁₀	Particulate matter with diameters that are generally 10 micrometers and smaller
PNR	Philippine National Railways
PPE	Personal Protective Equipment
PPM	Parts Per Million

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
PPV	Peak Particle Velocity
PSA	Preliminary site assessment
psi	pound per square inch
PTFE	Polytetrafluoroethylene
QA/QC	Quality Assurance/Quality Control
QRA	Quantitative Risk Assessment
RA	Republic Act
RAP	Resettlement Action Plan
RBC	Radio Block Centre
RMS	Root Mean Squared
ROW	Right-Of-Way
RSL	Regional Screening Levels
SB	Solis-Blumentritt
SBT	Solis-Blumentritt-Tutuban
SCRCP	South Commuter Railway Project
SDA	Soil Disposal Area
SDP	Social Development Plan
sec	Second
SEL	Sound Exposure Level
SLEX	South Luzon Expressway
SLR	Sea Level Rise
SMR	Self-Monitoring Report
SPL	Sound Pressure Level
SO ₂	Sulfur Dioxide
SO _x	Sulfur Oxides
STEL	Short Term Exposure Limit
SWL	Sound Power Level
t	Tonne
TCLP	Toxicity Characteristic Leaching Procedure
TD	Twin Disk
TMS	Train Management System

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Abbreviation	Definition
TPA	Third-Party Audit
TPH	Total Petroleum Hydrocarbons
TSC	Technical Scoping Checklist
TSP	Total Suspended Particles
TSS-1	Traction Substation Number 1
TSS	Total Suspended Solids
TWA	Time Weighted Average
UP-NOAH	University of the Philippines Nationwide Operational Assessment of Hazards
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USEPA RSLs	United States Environmental Protection Agency Regional Screening Levels
US FTA	United States Federal Transit Administration
V	Volt
VEC	Valued Environmental and Social Components
VdB	Velocity in decibels
VOC	Volatile Organic Compounds
VU	Vulnerable Species
VVVF	Variable Voltage Variable Frequency
WBG	World Bank Group
WBG (EHS)	World Bank Group - Environmental, Health and Safety Guidelines on Noise Management
WBG-IFC	World Bank Group-International Finance Corporation's
WiFi	Wireless Fidelity
WN	Wildhaber Novikov
WQG	Water Quality Guidelines

EXECUTIVE SUMMARY

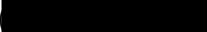
This report presents the results of the Supplemental Environmental Impact Assessment (EIA) Report conducted for the North-South Commuter Railway (NSCR) Project (Malolos-Tutuban) (Solis-Blumentritt-Tutuban (SBT) Section) to guide the implementation and monitoring of measures aimed at mitigating the identified negative impacts of the Project on the people and the environment.

PROJECT FACT SHEET

Project Name	North-South Commuter Railway (NSCR) (Malolos-Tutuban) Project Solis-Blumentritt-Tutuban (SBT) Section			
Project Location	Location		Length (km)	
	Region:	NCR	Solis-Blumentritt (SB)	1.04
	Host City:	Manila City	Blumentritt-Tutuban (BT)	0.53
	Section	Solis – Blumentritt Blumentritt – Tutuban	Total Length	1.57
	Barangays:	Barangays 152, 155, 157, 159, 160, 161, 162, 163, 164, 165, 184, 185, 186, 198, 200, 203, 204, 213, 214, 216, 217, 218, 221, 227, 228, 231, 232		
Nature/ Type of Project	Elevated Railway System			
Summary of Major Components	Project Components			
	Components	Details/Specification		
	Tracks:	Track gauge: 1,435-mm, equipped with elastic prestressed sleeper fixed on concrete bed; Railway track set at minimum of 15 m and a maximum of 30 m along the entire alignment.		
	Structure Type:	Estimated span length of viaduct structure with cast in-situ/pre-cast segmental pre-stressed box girder: 40 m Superstructure (structural form): consists of box concrete, box steel rebar and box post tensioning. Substructure (structural form): consists of pier head, pier stem and pilecap concrete and rebar.		
	Railway System:	a) Train Operation (commuter, commuter express and airport limited express service) • SB Section: double track railway viaduct • BT Section: separate single track railway b) Rolling Stock • Capacity of not less than 2,242 passengers (seating + standing) per train set, and an operational speed of 120 km/hr, fully air-conditioned. c) Signaling System • European Train Control System (ETCS) Level 2 (L2) d) Power Supply System • Receiving Power: DC 1,500V supplying system; service provider is MERALCO. • Traction substation (TSS-1): approximately 3,000 m² located along the viaduct. • Power Distribution (station, signal equipment room, communication equipment room, etc) e) Communication System • Digital radio communication system and an optical fiber network for the railways and relevant stations.		

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Project Name	North-South Commuter Railway (NSCR) (Malolos-Tutuban) Project Solis-Blumentritt-Tutuban (SBT) Section	
		f) Maintenance Road and Boundary Fence • Boundary Fence: wire mesh type with a height of 2.6 m . • Maintenance Road: 200 mm thick concrete pavement with 200mm base course on both sides of the longitudinal drainage system. Road width is 5 m including drainage system.
	Drainage Facilities:	• The drainage system consists of (1) exterior storm drainage for viaduct surface discharge and (2) pavement surface drainage system for surface runoff discharge from maintenance roads or paved surfaces through curb inlet gullies and drainage pipelines. • At-grade drainage is designed on one side of the Project ROW only, in consideration of the future plan to construct freight rail parallel to the Project.
	Emergency System:	a) System/ Design Application • Emergency Generator • Weather and Seismic Monitoring System • Public Address System • Emergency stairs
	Temporary Facilities:	a) Temporary Yard: area of approximately 38,000 m ² • Consist of Office (Contractor and Engineer), Laboratory, Workers' Quarter (400 workers), Warehouse, Rebar, Formwork Fabrication Yard, Batching Plant, Segment Casting Yard, and Storage Area. b) Access Routes • Road Realignment of Old Antipolo Street • Access Road to MERALCO • Temporary Access Roads
	Historical Structures for Relocation and Preservation:	Solis Signal Tower/ Casitas de Tondo is recommended to be relocated, elevated, and restored to avoid damages that may be brought about by flooding or fire in coordination with the National Historical Commission of the Philippines.
	Pollution Control Devices:	a) Air Pollution Control Facilities b) Noise Control System c) Water Pollution Control System d) Solid Waste Management System
Utility Requirements		
	Fuel Requirement:	a) Construction: estimated at 3,908 kL for the use of heavy equipment, transport, and service vehicles. b) Operation: estimated at 20,000 liter/year for the use of back-up generators at stations during power interruption and for the service vehicles.
	Power Supply:	a) Construction: estimated power requirement is 1,453,680 kWh. b) Operation: estimated power requirement for the SBT Section is included in the overall consumption for the NSCR System.
	Water Supply:	a) Construction: estimated total water consumption is 61,906 kL and estimated monthly water consumption of 1,673 kL/month. b) Operation: Minimal during the operation. TSS-1 is unmanned most of the time except for periodic inspection and required maintenance. Two flushing toilets are built in the design of the TSS-1 to be used mainly by visiting inspectors and other staff or guests on rare occasion
	Construction Materials:	• Locally sourced sand, steel, cement, etc. • Railway tracks and the tension membrane for roofing will be sourced outside the country. • Molds and erection girder will be fabricated through outsourced skilled experts from overseas.
	Existing Utilities Within ROW:	• Overhead electric posts, high voltage cables, telephone and communication cables exist inside and near the construction area.

Project Name	North-South Commuter Railway (NSCR) (Malolos-Tutuban) Project Solis-Blumentritt-Tutuban (SBT) Section
Project Cost	PHP 16,474,000,000.00
Construction Period	July 2022 to June 2024 (2 years)
Commercial Operation Date	SB: May 2022 BT: October 2025
Operation	20 years (minimum)
Proponent Details	
Project Proponent	Department of Transportation (DOTr)
Office Address	DOTr Head Office, Pinatubo Street corner Osmeña Street, Clark Freeport Zone, Angeles City, Pampanga Telephone Number: (02) 790-8300
Authorized Representative	 Undersecretary for Railways
EIA Preparer Details	
Consultant	JICA Design Team 10 th Floor IBP Tower, Jade Drive, San Antonio, Pasig City, 1600, Philippines Phone no.: 8638-1594
Sub-Consultant	AECOM Philippines Inc.  Associate Director, Environment) 14th Floor, Bonifacio Stopover Corporate Center, 2nd Avenue corner 31st Street Bonifacio Global City, Fort Bonifacio, Taguig City, 1634, Philippines Phone no.: +63 998 968 5488 E-mail address: 

PROCESS DOCUMENTATION

EIA Team

JICA Design Team (JDT) engaged AECOM Philippines Inc. (AECOM) to conduct an EIA study and prepare the Supplemental EIA Report for the North-South Commuter Railway (NSCR) Project (Malolos-Tutuban) (Solis-Blumentritt-Tutuban (SBT) Section). The EIA study team are listed in **Table ES - 1**.

Table ES - 1 EIA Study Team Composition

Name	Role	EIA Preparer Registration Number	Technical Study Conducted
Consultant			
	Project Lead, Environment Expert		EIA Process and Review
	Environment Expert		Terrestrial Ecology
	Noise Specialist		Noise Assessment
	Environmental Specialist		EIA Process
Sub-Consultant			
	Project Director / EIA Specialist /		EIA Process
	Project Manager / Terrestrial Wildlife Specialist / Terrestrial Ecology Lead		Terrestrial Wildlife

Name	Role	EIA Preparer Registration Number	Technical Study Conducted
Consultant			
	Assistant Project Manager		EIA Process
	Soil Quality and Contamination Lead / Peer Reviewer		Soil Quality and Contamination
	Geologist / Geohazards Specialist		Geohazards
	Geologist / Geohazards Specialist		Geohazards
	Terrestrial Ecologist		Terrestrial Wildlife
	Terrestrial Ecologist		Terrestrial Vegetation
	Surface Water Quality Specialist		Surface Water Quality
	Surface Water Quality Specialist		Surface Water Quality
	Air Quality and Noise Specialist		Ambient Air Quality
	Environmental Scientist		Ambient Air Quality
	Chemical Engineer		Soil Quality and Soil Contamination
	Chemical Engineer		Environmental Risk Assessment
	Geologist		Soil Quality and Soil Contamination
	GIS Specialist		Land Use
	Environmental Assistant		EIA Process

EIA Study Schedule

The schedule of EIA activities is outlined in **Table ES - 2**.

Table ES - 2 EIA Study Schedule

Activity	Schedule	Venue/Area
Public Consultations		
Information, Education and Communication (IEC) Campaign Meetings	06 August 2020	Online via Zoom
	08 October 2020	Online via Skype
	11 November 2020	Online via Skype
	19 March 2021	Online via Zoom
Stakeholder Consultation Meetings (SCMs)	3 February 2018	Brgy. 224 Covered Court, Manila
	7 June 2018	Brgy. 224 Covered Court, Manila
	20 August 2018	Dapitan Sports Complex, Manila
	28-29 October 2020	Online via Zoom
	3 November 2020	Brgy. 224 Covered Court, Manila
	4 December 2020	Brgy. 224 Covered Court, Manila
	13-15 January 2021	Brgy. 228 Covered Court, Manila; Online via Zoom
	30 March 2021	Online via Zoom
	12 May 2021	Online via Zoom
	2 June 2021	Online via Skype
	15-16 June 2021	Online via Zoom

Activity	Schedule	Venue/Area
Field Surveys		
Soil Quality and Contamination	11 November 2020	Project Site
Terrestrial Vegetation	30 October 2020	Project Site
Terrestrial Wildlife	28 October, 04 to 05 and 09 November 2020	Project Site
Surface Water Quality	30 October 2020	Project Site
Ambient Air Quality	17 to 19 November 2020	Project Site
Noise	17 to 19 November 2020 22 to 23 March 2021	Project Site
Vibration	04 to 06 November 2020	Project Site

EIA Study Area

The Solis-Blumentritt-Tutuban (SBT) Section will be located in the City of Manila, in the National Capital Region (NCR) of the island of Luzon in the Philippines. The Project will utilize the existing Right-of-Way (ROW) of the Philippine National Railways (PNR), a state-owned railway operator and attached agency of the DOTr. The alignment of the SBT Section will traverse 27 barangays in the Tondo District, a highly urbanized and densely populated area of the country's capital.

DIRECT AND INDIRECT IMPACT AREAS

The direct impact areas of the Project are defined as the area of the Project ROW with an estimated length of 1.57 km and width ranging from 15 to 30 m extending up to 100 m from the edge of the Project ROW. The direct impact area (DII) is composed of 27 barangays in the City of Manila.

The indirect impact areas (IIA) include a wider area of the host barangays and adjacent barangay close to the project site. Section 10 of DAO 2017-15 were used as reference in the identification of direct and indirect impact areas for the Project. The IIAs identified during construction and operation are not the same considering the difference of environment during construction and operation. The direct and indirect impact areas for this Project are shown in **Table ES - 3**.

Table ES - 3 EIA Study Area (Direct and Indirect Impact Areas)

Impact Areas	Remarks
Direct Impact Areas (DIA)	<i>In terms of biophysical impact:</i> The area within the estimated total 1.57 km length of the SBT Section, and the existing PNR-ROW, with approximate width of 15 to 30 m, with a further potential direct impact area extending up to 100 m from the boundary of the ROW on both sides to take account of; • Noise Impacts • Dust Impacts <i>In terms of socio-economic impact:</i> a) Solis-Blumentritt Barangay 161, 162, 163, 164, 165, 184, 185, 186, 198, 200, 203, 204, 213, 214, 216, 217 b) Blumentritt-Tutuban Barangay 152, 155, 157, 159, 160, 218, 221, 227, 228, 231, 232 The barangays that will be traversed by the SBT section include 184, 200, 198, 186, 203, 185, 161, 204, 162, 217, 165, 164, 227, 218, 228, 155, 221, 231, 160, 232, and 159 while those located within 100m from the edge of the ROW are barangays 163, 214, 213, 216, 152, and 157.
Indirect Impact Areas (IIA)	Other barangays within the host Cities and nearby LGUs who will benefit from the rapid economic growth in the region and the entire country.

EIA SUMMARY

Alternatives Considered

Several alternatives were assessed to develop the SB and BT sections and the Project's traction substation with minimal environmental and social impacts. These includes the structure alternatives, technology alternatives, alternative locations of the traction substation, and vertical alignment alternatives.

- Structure alternative options - Given the factors considered, especially the Project site's susceptibility to flooding, both the SB and BT sections will be constructed as elevated viaducts with cast in-situ/pre-cast segmental pre-stressed box girder.
- Alignment alternative options - The Project has taken into consideration two alternatives for the horizontal route to be utilized. The first option proposes to utilize the existing railway ROW of PNR along the turning sections of the SBT lines, and another option involves the use of the existing PNR ROW along the ST line.
- Technology alternatives - Electric Multiple Unit (EMU) trains are generally preferred on commuter and suburban rail networks around the world due to their fast acceleration and pollution-free operation; this will be utilized for the Project.
- Traction substation location – Out of the seven options considered for the traction substation location, two options that were subject to the final evaluation are Option A and Option B. Ultimately, Option B was chosen as the location of TSS-1 since this provides the most optimal location with respect to both SB and BT sections, as well as the power source (MERALCO).

No Project Option

If the addition of SBT section will not push through, commuters will have a longer travel time since there is no direct connection from Blumentritt to Tutuban. Commuters will also have two less travel route options along the NSCR Project and the NSCR Calamba Extension.

SUMMARY OF BASELINE ENVIRONMENT

The Land

Soil Quality and Contamination

Methodology

A preliminary site assessment (PSA) was conducted in accordance with ASTM E-1527 and the Guidelines for Site Characterization provided in Memorandum Circular No. 2017-003 (MC 2017-003) by DENR-EMB in order to identify potential sampling sites for the soil quality and soil contamination assessment. This includes review of all relevant environmental documents such as historical land uses within the study area with focus on potentially contaminating activities, historical satellite/aerial images, previous environmental investigation reports, and geotechnical investigation reports.

Soil sampling and laboratory analyses of samples from two stations with four samples were also done to assess the soil quality and contamination in the Project alignment and was compared to local guidelines and screening levels including Bureau of Soils and Water Management (BSWM) Soil Fertility Rating and DAO 2013-22, Revised Procedures and Standards for the Management of Hazardous Wastes, Dutch Intervention Values from the Soil Remediation Circular 2013 of the Dutch Ministry of Infrastructure and the Environment, 2020 Regional Screening Level by the United States Environmental Protection Agency.

Baseline Environment

Soil samples were classified based on the Unified Soil Classification System (USCS). Surface samples from SS01 were identified to be very soft, brown, low plasticity clayey silt while samples from 0.5 m bgs depth were soft, dark green, low to medium plasticity sandy clay. Surface samples from SS02 were identified to be soft, dark brown, low plasticity sandy silt while samples from 0.5 m bgs depth were gray gravelly sand. No hydrocarbon staining nor odor was detected in all soil samples (V/O = 0/0) and the PID readings did not indicate the presence of any volatile organic compounds in all soil samples.

Soil pH is “adequate” as per BSWM standards. Surface soils were slightly alkaline while soils at 0.50 m bgs depth were moderately alkaline. Based on these results, surface soils and soils at 0.50 m bgs are deemed not suitable for agricultural purposes.

For soil contamination, TPH C₁₅-C₂₈, Barium, Copper, Zinc, Cadmium, Lead, Nickel, Iron, Manganese, Mercury, Mineral oil, and TCLP Barium were detected in all soil samples. TPH and other heavy metal concentrations did not exceed in any of the adopted screening criteria. TCLP concentrations did not exceed local hazardous waste standards provided in DAO 2013-22, hence excavated soils for disposal will be classified as non-hazardous waste. In addition, Arsenic concentrations detected in all analysed soil samples exceeded the United States Environmental Protection Agency Regional Screening Level (USEPA RSL) of 3 mg/kg via the ingestion pathway.

Based on the site assessment, the detected concentrations may likely be attributed to naturally occurring background concentrations as arsenic is generally present in all soils in concentrations ranging from 0.1 to 40 mg/kg. According to a study conducted by Pfeiffer et al. (1990), plant samples in polluted areas of Metro Manila were reported to have arsenic levels ranging from 0.1 ppm to 17.9 ppm, with 50% of all samples having concentrations higher than 3 ppm. This could be verified by further soil sampling and testing or laboratory analysis. Further investigation should be made prior to construction.

Terrestrial Vegetation

Methodology

The baseline assessment of existing vegetation was undertaken using the transect walk survey. Two transect walks (SB Section, BT Section) were performed for the entire SBT section. All encountered vascular plants in various forms were enumerated and listed in the data sheet. Opportunistic samplings involving listing of species outside the transect area were also carried out to account for the maximum possible species in the area. Secondary data from NSCR Project EPRMP (2015) was also incorporated for a robust baseline data.

In addition, vegetation was assessed using indicative ecological values for vegetation communities, species inventory, endemism and conservation status, density, frequency, dominance, and protected vegetation communities; that may be affected by the proposed Project. Impacts were determined based on proposed areas to be cleared of vegetation (in terms of location and hectareage), and at which Project phase they are to occur.

Baseline Environment

A total of 123 plant morpho-species in 195 individuals belonging to 54 families were recorded along the SBT Section with a very high species diversity ($H' = 4.68$). Threatened tree species are present along the alignment, represented by few individuals of forest trees such as Narra (*Pterocarpus indicus*) and an endemic species of Is-is (*Ficus ulmifolia*) and an exotic tree represented by large-leafed mahogany (*Sweitenia macrophylla*).

All trees (with DBH $\geq$ 5cm) and other threatened species, endemics, and/or native found within the SBT ROW will be part of the tree inventory process required by the DENR. Together with other resilient tree

species, narra is one of the notable tree species in the alignment, hence, appropriate management and monitoring strategies to ensure the continued survival of its population (as well as other threatened species) will be developed.

Twelve plant growth habit were observed from the 123 species recorded along the alignment. The SBT Section were dominated by tree with 37 species and herb/forb with 33 species, other plant growth habits were shrub with 16 species, climber with 13 species, grass with 11 species, palm, and sedge with three species each, bamboo and ferns with two species each, and cactus, herb (aquatic), orchid with one species each.

From the identified species, 95 species were exotic/introduced, 23 native non-endemics, two Philippine endemics, and three morphospecies that were identified up to genus level only. In terms of conservation status based on IUCN 2020, one species was categorized as Endangered, three Vulnerable, 43 Least Concern, four Data Deficient, and 66 were Not Assessed. Under DAO 2017-11, one species was categorized as vulnerable species.

Terrestrial Wildlife

Methodology

The terrestrial wildlife survey was conducted along the SBT Section and transect line was established to survey birds. An observer walked along the alignment completing the whole stretch in at least 1.5 hours and at the most 2 hours. All individuals observed and/or heard were noted using the following information: species name and number of individuals. Secondary data from NSCR Project EPRMP (2015) was also incorporated for a robust baseline data and to cover seasonal sampling requirement.

Terrestrial fauna was assessed using indicative ecological values for species richness/diversity, distribution range with emphasis on endemics, conservation status, and threatened species.

Baseline Environment

A total of 468 bird individuals in 15 species belonging to 12 families were documented in the SBT Section with high species richness and abundance ($H' = 3.27$). Two (2) endemic species were recorded during the survey; these are *Rhipidura (javanica) nigritorquis* or Philippine pied fantail and (*Dendrocopos*) *Picoides maculatus* or Philippine pygmy woodpecker. Both species were categorized as Least Concern (LC) under the IUCN Red List of Threatened species 2020 and was not included in the list under the Philippine Wildlife Act of 2001 (RA9147) as stipulated in DAO 2019-09.

There were no threatened species recorded in this survey. Additionally, species listed under Convention on International Trade of Endangered Species (CITES) are no longer included as threatened species based on DAO 2019-09.

Four (4) species were observed to be abundant along the SBT Section - these are *Collocalia esculenta* or glossy swiftlet, *Pycnonotus goiavier* or yellow-vented bulbul, *Passer montanus* or Eurasian tree sparrow and *Aplonis panayensis* or Asian glossy starling. Four species (27%) were categorized as Abundant; five (33%) were Common; and six (40%) were Frequent.

The main bird-habitat associations for the SBT Section survey were non-forest with 11 species (73%). Non-forest habitats dominate the alignment which accounts and strongly corresponds to the dominance of the observed bird-habitat associations.

The Water

Surface Water Quality

Methodology

Water quality sampling at the two surface water quality sampling sites was conducted through a combination of *in-situ* measurements and grab sampling. The two surface water quality sampling sites are individually located in South Antipolo Canal and Antipolo Creek. *In-situ* parameters were measured using calibrated handheld meters. Moreover, grab sampling was done using a TeleScoop – Water Sampler. Water quality sampling was done in accordance with DENR guidelines.

After the collection, appropriate reagents were added, and the samples were then cool stored to approximately 4°C using ice and transported for laboratory analysis. A DENR-accredited laboratory, Hi-Advance Philippines, Inc., analyzed the samples using provided in DMC 2016-012, *EMB Approved s of Analysis for Water and Wastewater*, and the Standard s for the Examination of Water and Wastewater, published by the American Public Health Association, American Water Works Association and the Water Environment Federation (2012).

Results of the laboratory analysis of the water samples were assessed using the Class C Water Quality Guidelines (WQG) provided in DAO 2016-08, *Water Quality Guidelines and General Effluent Standards of 2016*.

Baseline Environment

Both South Antipolo Canal and Antipolo Creek show high levels of organic pollution and impacts associated with sewage and waste disposal from surrounding households and commercial establishments. Concentrations of BOD, phosphate, fecal coliform, phenols, cyanide, oil and grease, and DO did not meet the DAO 2016-08 Class C WQG. Potential pollutants currently impacting the two creeks based on site observations and field interviews may include wastewater from dishwashing, laundering, and car washing, domestic solid wastes including human excreta, unconsumed domestic animal feeds, and oil and grease from bicycle and motor shops, and road surface run-off.

The Air

Ambient Air Quality

Methodology

The air quality impact assessment was conducted through primary data collection in two (2) established stations close to SBT section. Parameters includes TSP, PM₁₀, PM_{2.5}, SO₂, NO₂, CO, Pb, and O₃ using approved air sampling ologies outlined under DAO 2000-81, *Implementing Rules and Regulations of the Philippine Clean Air Act of 1999* and DAO 2020-14, *Establishing the Breakpoints for Particulate Matter 2.5 (PM_{2.5}) Air Quality Index (AQI) and Amending Section 5(a) of DAO 2013-13 “Establishing the Provisional National Ambient Air Quality Guideline Values for Particulate Matter 2.5 (PM_{2.5})”*.

The ambient air quality sampling results were then compared with the Philippine Clean Air Act (CAA) standards. The NAAQS for Source Specific Air Pollutants from Industrial Sources/Operations as provided in the CAA was the basis for comparison of the sampling results. It is intended for the protection of public health, safety and general welfare which must be complied throughout the project lifetime. The 24-hour readings were compared with the NAAQGV of the CAA. The NAAQGV are typically used during the baseline studies to assess the air quality of an air shed or a region/locale prior to the implementation of the Project. The PM_{2.5} results were compared to the DAO 2020-14 PM_{2.5} standard.

Baseline Environment

All particulate and gaseous pollutants monitored were below their respective NAAQS and NAAQGV except for PM_{2.5} and O₃. The major source of these pollutants is vehicular traffic which is heavy in the area. Ground level ozone is not emitted directly into the air but is created by chemical reactions between NO_x and VOCs when pollutants emitted by vehicles react with sunlight. Based on Annex A of the DAO 2000-81 (Air Quality Indices), the air quality in the Project site is considered as *acutely unhealthy*.

Ambient Noise and Vibration Quality

Methodology

Baseline monitoring was conducted to establish typical noise and vibration levels at representative locations within the Project site and to identify existing noise and vibration sources. The ambient noise quality sampling was conducted at four sampling stations (ANV1, ANV2, Station 1 and TSS-1) gathering 24-hour noise readings in 5-minute intervals. The measured ambient levels were compared to the NPCC Environmental Quality Standards for Noise in General Areas, World Bank Group/International Finance Corporation Environmental Health and Safety ((EHS) Guidelines on Noise Management and Environmental Quality Standard for Noise. Vibration monitoring was undertaken at two sampling stations (ANV1 and ANV2) to determine typical vibration levels in relation to and the potential for human annoyance and compared to US Federal Transit Administration US FTA Transit Noise and Vibration Impact Assessment Manual (Report 0123) (FTA Manual) (2018).

Baseline Environment

The closest noise and vibration sensitive buildings are predominantly residential and located immediately adjacent to the existing railway corridor. The baseline noise levels adjacent to these receptors are exceeded the standards for all time periods.

The major source of noise may be attributed to nearby transport corridors (road and rail), commercial activities and domestic noise from the densely populated residential dwellings. Local noise at each location also included residential activity and animal noises, such as dogs barking and bird noise.

Measured baseline vibration levels were below the threshold of perception and the levels where people in residential and institutional buildings typically experience annoyance. This result is considered typical for metropolitan areas that do not feature a notable source of vibration.\

The People

Methodology

Collection and review of primary data through field activities and secondary data from sources including the local and national government were conducted. The main reference documents are the RAP Reports for the SB and BT Sections and NSCR Calamba Ex Project EIS. The activities undertaken include data processing and analysis as well as cross-checking and validation of primary and secondary information with DOTr, the RAP team, and the engineering team.

Stakeholder engagement activities were also undertaken in accordance with the JICA Guidelines, DAO 2017-15 (the Guidelines on Public Participation under the PEISS) and EMB Memorandum Circular 2020-30 (Interim Guidelines on Public Participation in the Implementation of the PEISS (PD 1586) During the State of National Public Health Emergency).

Baseline Environment

Demography

There are a total of 2,622 project-affected persons (PAPs) (50.3% male, 49.7% female) from 688 project-affected households (PAHs) with average household size ranging from 3 to 5. Of the PAHs, 55 or 8.0% own a business or enterprise in their household location. Aside from the households, 79 business owners will be affected and 87 employees.

Majority of the affected population fall under the age groups (21-40 and 41-59) considered to be part of the labor force. The educational attainment of the PAPs include high school graduate (25.5%), college level (16.4%), college graduate (14.6%) and the rest responded none or did not receive education (5.1%).

There are 277 vulnerable households identified in the RAP survey, 28.2% of which have single vulnerability while 12.2% have multiple forms or a combination of vulnerabilities. Aside from the socially and economically vulnerable households, some persons are also physically and emotionally vulnerable during transfer which totals to 459 PAPs mostly elderlies and babies/toddlers.

Local Economy

Manila has a 1st class income classification with main economic activities in the manufacturing and service sectors. Among the cities in NCR, Manila is at 9th place out of 16 cities for the average income. The sources of monthly income of the PAHs include employment, enterprise or business, remittances, rent, livestock, among others. 1,154 household members contribute to household income, which translates to an average of 1-2 members per household. Majority of household income is derived from wages (62.9%), followed by income from enterprises/self-employment (27.8%), and income from remittances (9%).

Infrastructure and Services

Manila Electrical Company (MERALCO) distributes power supply while Maynilad Water Services, Inc. (Maynilad) provides Level III water supply in the project area. Project-affected power utility facilities include utility poles and power lines owned by MERALCO and the National Grid Corporation of the Philippines (NGCP). Project-affected water supply facilities include pipes, water lines, and drainage canal. PAHs access water through own metered connection (48.0%), shared communal faucet (41.7%), buying from vendors (7.7%) and deep wells (1.0%). Other facilities affected by the project include a school (Lakandula Elementary School), clinic, chapel, multi-purpose hall, barangay hall, grotto and basketball covered court.

Public Health and Safety

Heart disease, cancer, pneumonia, cerebrovascular disease and tuberculosis are the leading causes of mortality in Manila (2018). Majority (95.1%) of households in Manila have sanitary toilets (2015). The rest of the households used pail system and others (2%), closed pit (0.8%) and open pit (0.7%) while another 1.4% have no toilet facility. Manila residents mainly rely on bottled water as a source of supply for drinking water and own use faucet connected to water system for cooking.

Land Use

Based on the Manila Comprehensive Land Use Plan, the project ROW is surrounded by high density residential, medium intensity commercial, and general public open space. Majority of the ROW are already categorized as government owned. The total affected area of the SBT Section is estimated at 40,692 m². Only 11,383 m² of the estimated land area requires conversion to government land as part of the project ROW. Residential land accounts for the biggest portion at 8,474 m². Furthermore, a portion of the NLEx-SLEx Connector Road Project of the DPWH overlaps with the Solis-Blumentritt section of

the Project (1.04km) but ongoing coordination between the Project and DPWH for project design compatibility, site validation, ROW acquisition, and RAP policies.

Cultural Heritage

Casitas de Tondo or Solis Signal Tower is the only old PNR structure identified to be directly affected by the SBT Section. The structure is to be relocated and incorporated in the design of the Tutuban Station.

Public Access and Traffic Management

The SBT Section is traversed by Hermosa Street and Solis Street to its north and Raxabago Street or Yuseco Street to its south. The existing roads that run parallel to SBT Section are Antipolo Street to its northeast and Old Antipolo Street to its southeast. These roads link with major roads such as Abad Santos Avenue and Juan Luna Street that are frequented by various types of vehicles. Modes of land public transport in Manila include bus, taxi, FX, jeepney, and tricycle while informal land transport systems are *kalesa*, pedicab and *kuliglig*. Aside from PNR railways, LRT is also an existing railway system that link with the NSCR and NSCR Ex projects. Additional access roads will be constructed to access the Solis-Blumentritt-Tutuban Triangle area and MERALCO substation.

MAIN IMPACTS AND MITIGATING MEASURES

Table ES - 4 presents the identified potential impacts associated with the development of the SBT Section, along with the proposed mitigating measures to avoid or minimize these impacts. The impact assessment focused on the impacts associated with the study areas covered during the baselining activities which include soil quality and contamination, terrestrial ecology, surface water quality, ambient air quality, noise, and vibration. However, additional baseline surveys on soil quality, terrestrial ecology, surface water quality, air quality, noise and vibration, once the location of construction facilities outside the Project ROW have been identified. These study areas were chosen considering the nature and type of the project, and the requirements of the Department of Transportation (DOTr) and the Japan International Cooperation Agency (JICA). Social and cultural impacts of the SBT Section such as displacement of settlers and encroachment of historical structures were assessed separately and are presented in the Resettlement Action Plan (RAP) for the North-South Commuter Railway Project (Solis-Blumentritt Section) and the Handling of Historical Heritages Report, respectively.

To address the identified environmental and social impacts, the hierarchy of mitigation (i.e. avoid > mitigate/minimize > rehabilitate/offset) was followed in identifying appropriate mitigation/s to potential impacts associated with the development of the SBT Section. The table below also presents option for prevention or mitigation.

Table ES - 4 Integrated Summary of the Main Impacts and Mitigating Measures

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
PRE-CONSTRUCTION PHASE		
Soil quality	Generation of solid wastes	• Development and implementation of a Solid Waste Management Plan (to be included as part of the Contractor's Environmental Management Plan) as part of Contractors' engagement • Minimize the production of wastes that will be treated or eliminated • Establishment and enforcement of daily site clean-up procedures by the Contractors • Provision of a Materials Recovery Facility • Provision of 75 liter waste bins with covers and label at strategic locations in work areas (i.e., one every 80 square meters) for segregated storage of different types of solid wastes, including hazardous wastes • Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed in these

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
		• Disposal of non-recyclable wastes such as trash bags, non-recyclable plastic, glass, non-recyclable paper to a sanitary landfill • Disposal of residual wastes through the Local Government Unit (LGU) • Disposal of hazardous wastes to a DENR Accredited Facility. Securing of appropriate permits from DENR such as Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes.
Terrestrial vegetation	Vegetation removal and habitat loss	• Prior to cutting activities, a pre-clearing plan be developed and implemented by the DOTr. The pre-clearing plan will also include but not limited to the following: delineation on the ground of specific areas to be cleared of vegetation, listing and characterizing trees for relocation, endemic and/or threatened plants that will be affected, recommending specific /s in removing or relocating vegetation, acquisition of tree cutting permit from the DENR prior to cutting, and handling of trees, endemic and threatened species be relocated and their management procedures until they are fully established in their relocation area within the project site vicinity, as much as practicable. • Use of hazardous chemicals/herbicides/pesticide for vegetation clearing/ removal will be prohibited and not allowed in any portion of the SBT Section ROW. • Provision of corresponding number of tree seedlings following DENR MO 2012-02 (usually 1:100 replacement ratio) will be provided by the DOTr in lieu of trees to be cut or relocated trees that will not survive.
Terrestrial flora and fauna	• Threat to abundance, frequency, and distribution of important species • Further reduction of green spaces in urban areas	• Establish or utilize existing relocation areas (preferably proximal to or within the SBT Section ROW) in lieu of the areas affected by vegetation clearing. Relocated trees will be prioritized to be transferred within project site vicinity or confined within the City of Manila, as much as possible. The DOTr has several relocation areas established and approved by the DENR based on earlier studies for the NSCR. This will be accomplished in close coordination with the DENR having the mandate to designate re-vegetation areas.
Terrestrial vegetation	Generation of debris from vegetation removal and tree cutting	• All debris generated during vegetation removal and tree cutting will be managed based on DENR Administrative Order #2001-34 (Implementing Rules and Regulations of RA 9003). RA 9003 is the Philippine Ecological Solid Waste Management Act of 2000. • The 5Rs (i.e. Refuse, Reduce, Reuse, Repurpose, and Recycle) of solid waste management will be observed and implemented in handling generated debris from vegetation removal and tree cutting. To illustrate, usable logs that will be generated will be turned over to the local DENR office. Said logs are usually converted into chairs and desks for use by other local government offices in the area such as the Department of Education • Leaves and other easily degradable plant parts could be used as composting materials by the locals and/or in farm areas. • Note that there will be no burning of any type of solid wastes generated during the vegetation removal and tree cutting. • DENR and LGU accredited companies will be engaged in the tree cutting and vegetation removal procedures.
CONSTRUCTION PHASE		
Soil quality	Generation of excess soil for disposal from earthwork activities	• Minimize ground disturbance as much as practicable and stabilize areas as quickly as possible • Preparation of a Spoil Management Plan as part of the Project's Construction Environmental Management Plan • Maintain stable cut and fill slopes at all times • Soil Disposal Areas (SDAs) should not be located on (1) irrigated rice fields, (2) slopes of more than 25 degrees, (3) where geological structure is unfavorable to stability, (3) on slopes that are subjected to stream erosions, (4) on areas identified to be protected or are special status habitats, (5) within 100 m from waterbodies or drainage line, whether permanent or seasonal, (6) on areas where adequate health and safety procedures are not in place, (7) areas of groundwater discharge, sources of drinking or irrigation water and (8) areas where permanent stabilization of disposal spoils will be difficult • Documentation of disposal should also be in place and be available for review/audit, if needed. A Transportation Management Plan will be prepared and implemented for disposal of surplus soil to identify haul routes, truck queuing and parking procedures, dust control and prevention of mud-tracking. Disposal of the surplus soil will be

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
		controlled through regular inspection/monitoring of the disposal area; height limit of excavated soils will not be more than 2 m; earth cuts will be spread once transferred/ disposed • Disposal sites will not be located where they can cause future slides, impact agricultural activities, or be washed off in watercourses. • Engineering intervention will also be considered to control potential soil erosion in the SDA. • Disposal sites will also not be located in sensitive areas such as residential areas or parks and in areas with current or future agricultural use • Also, consider planning excavation while considering weather conditions (e.g., minimizing excavation during rainy season as much as possible). Stockpile wet/damp soils in designated staging areas and ensure that they are sufficiently dry prior to transport • Bunds and silt fences should be used to protect watercourses from soil run-off during the rainy season. For long term storage during the rainy season, soil storage heaps will be graded to flat tops and covered or vegetated with soil stabilizing grasses. As best practice, spoils should be hauled out as soon as excavated. All spoils should be removed and disposed prior to rains
Surface water quality	Siltation and sedimentation of waterways	• Implementation of erosion prevention measures and provision of sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in construction site entrances and exits) • Appropriate drain channels will be installed to facilitate proper drainage of excess water used during construction. • Provision of covers for stockpiled loose earth especially before heavy rains are expected • Limit stockpile height of loose earth up to 2 m only • Minimize removal of vegetation cover as much as practicable • Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season) • Immediate removal of loose earth materials from the site, or whenever practicable
Occupational health and safety	Potential human health impacts if humans are chronically exposed to soil via incidental ingestion (i.e., incidental ingestion of dust particles if soils are disturbed)	• Information dissemination of potential hazards associated with soil ingestion • Provision of appropriate PPE to minimize direct contact with soil (e.g., face mask, gloves, goggles) • Provision of decontamination area for workers to ensure personnel are properly sanitized/cleaned during breaks or after working hours to prevent incidental ingestion. • Implementation of a Dust Control Plan (to be included as part of the Contractor's Environmental Management Plan) to minimize dust generation. For dry season, conduct water spraying to avoid dust clouds. Regular monitoring through visual inspection will be conducted to assess effectivity of dust control measures • Regular hand washing and avoidance of touching the face and eating using bare hands or work gloves. Contractor will provide hand washing facility and soap at strategic areas along the alignment where works are being carried out, including fabrication yards, maintenance areas, etc. First Aid kits and first-aiders will be available and strategically deployed. • An Occupational Health and Safety Management Plan (to be included as part of the Contractor's Environmental Management Plan) will be prepared to cover all occupational health and safety concerns. A Contact Management Plan specific to handling of arsenic impacted soils will be incorporated in the Occupational Health and Safety Management Plan. • Conduct of detailed sampling surveys to verify extent of soil contamination prior to construction. Conduct of necessary action depending on the level of impacts detected during the sampling and preparation of a contaminated soil management plan. • For the general public, additional studies may be conducted to determine arsenic concentrations in public areas for a more informed decision as a way forward. • Working conditions should comply with Republic Act 11058, Department Order 198 - 2018 and DOLE Department order No. 13 'Guidelines governing occupational safety and health in the construction industry.
Soil quality	Generation of solid wastes	• Development and implementation of a Solid Waste Management Plan (to be included as part of the Contractor's Environmental Management Plan) as part of Contractors' engagement

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
		• Establishment and enforcement of daily site clean-up procedures by the Contractors • Minimize the production of wastes that will be treated or eliminated • Provision of a Materials Recovery Facility • Provision of 75 liter waste bins with covers and label at strategic locations in work areas (i.e., one every 80 square meters) for segregated storage of different types of solid wastes, including hazardous wastes • Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed in these • Disposal of non-recyclable wastes such as trash bags, non-recyclable plastic, glass, non-recyclable paper to a sanitary landfill • Disposal of residual wastes through the Local Government Unit (LGU) • Disposal of hazardous wastes to a DENR Accredited Facility. Securing of appropriate permits from DENR such as Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes.
Soil quality	Generation of construction wastes including excess soil	• Development and implementation of a Solid Waste Management Plan (to be included as part of the Contractor's Environmental Management Plan) as part of Contractors' engagement • Establishment and enforcement of daily site clean-up procedures by the Contractors • Provision of a Materials Recovery Facility • Proper sorting of waste for disposal and designation of appropriate temporary storage area. Provision of 75 liter waste bins with covers and label at strategic locations in work areas (i.e., one every 80 square meters) for segregated storage of different types of solid wastes, including hazardous wastes. • Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed in these • Recycling of wastes including soil, as much as possible • Use of leftover concrete and metals for suitable alternative projects • Disposal of non-recyclable wastes such as trash bags, non-recyclable plastic, glass, non-recyclable paper to a sanitary landfill • Disposal of residual wastes through the Local Government Unit (LGU) • Disposal of hazardous wastes to a DENR Accredited Facility. Securing of appropriate permits from DENR such as Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes.
Surface water quality	Contamination of waterways with domestic wastewater from construction sites and construction camps	• Requiring of contractor to prepare and effluent management plan as part of its CEMMP • Installation and maintenance of a temporary septic tank system or provision of portable sanitation facilities (e.g., portalets) in construction camps and work areas throughout the alignment • Disposal of wastewater through DENR-accredited waste haulers. This hauler will be regularly audited on their compliance with the DAO 2016-08 and DAO 2021-19 WQG and GES and other related policies, and the sanitary facilities will be regularly monitored for performance. • Prohibition of construction workers from disposing wastewater in South Antipolo Canal and Antipolo Creek • Temporary discharge permits may be secured as necessary for the disposal of construction wastewater
Geohazard susceptibility to: - Ground shaking - Liquefaction (entire alignment is highly susceptible to liquefaction)	Liquefaction in the event of an earthquake or due to heavy load construction activities may result to bearing failures, floatation of embedded structures, damage to overlying structures, which can lead to casualties, property damage, and	• The earthquake loading capacity of the SBT Section structures will be designed to resist earthquake ground motion based on projected PGA values from the West Valley Fault. • Contractor will adhere to seismic and structure design standards adopted in the detailed design as provided in NSCP (2015), the DPWH Guide Specifications Load and Resistance Factor Design (LRFD) - Bridge Seismic Design (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015) and AASHTO LRFD (2015). • Pile foundations will be deep enough to reach the load bearing strata based on the geotechnical study conducted. • Temporary facilities such as the camp, office, storage area, and casting yard will be situated on areas without liquefiable and/or soft soils that may weaken during an earthquake. • Contractor will prepare and implement an Emergency Preparedness and Response Plan (EPRP, to be included as part of the Contractor's Environmental Management Plan) which includes emergency protocols during seismic events.

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
	disruption of operations.	
Surface water quality	Contamination of waterways through accidental spills of oil, lubricants, and other chemicals	• Proper handling and disposal of potential contaminants coming from construction sites through DENR-accredited hazardous waste haulers (e.g. contaminated ballasts) • Training of personnel involved with transport of materials to ensure safe and effective material transport operations • Prohibition of use of unapproved toxic materials • Localized storage of waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and disposal in appropriate off-site facilities • Use of machines and equipment that are properly rated, with applicable certification and appropriate for the task and regular proper maintenance of all vehicles and machinery • Heavy equipment operators will be certified for the use of their respective heavy equipment to document their competency and they along with the workers will undergo safety induction and training. • Provision of oil and grease traps in the wash bays • Provision of spill containment kits • Development of Spills Prevention, Management and Emergency Response Plan to handle occurrences of accidental spills
Surface water quality	Contamination of waterways with solid waste from construction/ demolition sites and camps	• Prohibition of construction workers from disposing solid wastes in South Antipolo Canal and Antipolo Creek • Implementation of solid waste management measures (see Table 5.1.1 for details)
Surface water quality	Contamination of waterways through concrete and drilling wastewater spills	• Reconditioning and reuse of bentonite slurries to lessen the amount of slurry to be disposed. • Storage of concrete wastewater in large PTFE containers to avoid spillage on-site • Disposal of wastes through a DENR-accredited wastewater hauler • Installation of settling tanks/drying ponds for concrete and drilling wastewater in the absence of wastewater haulers • Disposal of dried waste in line with the project's Solid Waste Management Plan
Surface water quality	Aggravation of flooding conditions due to excavation and earthwork activities	• Sufficient and effective drainage and dewatering systems such as drain channels and sumps will be installed to facilitate proper drainage of excess water used during construction. Pits, excavations, and other depressions where water may accumulate will also be dewatered regularly. • Contractor will prepare a Flooding Management Plan (to be included as part of the Contractor's Environmental Management and Monitoring Plan) which will include installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project • Contractor will provide erosion and sediment controls such as slope protection, silt screens, drain channels, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways especially during masonry and earthmoving activities. • Waste bentonite slurry will be properly handled in accordance with RA 9003 and stored temporarily in bentonite tanks to prevent siltation. • The Solid Waste Management Plan (to be included as part of the Contractor's Environmental Management Plan) will be strictly implemented. Waterways within the site will be regularly cleaned and unclogged of solid wastes. • Implement an awareness campaign for surrounding communities to not dispose their garbage in the waterways near the site.
Ambient air quality	Generation of fugitive dusts, particulate, and gaseous pollutants	• Fugitive dust from vehicular traffic, material handling activities, and other facilities that generate dust, excavation, and earthmoving will be controlled by management of vehicle speeds and application of regular water suppression (i.e. water sprinkling) to roads and stockpiles whenever visible dust is observed. • Trucks that carry material will have speed limits of 10 km/hr in construction areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/municipal roads in accordance to JMC 2018-001 (<i>Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data</i>).

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
		• Trucks and vehicles that transport construction material, spoils, and construction equipment will be covered to prevent spillage and fugitive emissions of dust. • Immediate clean-up and light water sprinkling will be conducted in case of accidental spillage of soil or dusty materials in haul roads or public roads. • Controls to prevent the build-up of mud and/or soil in wheels will be installed at the construction site exits. These controls may include the installation of wheel and truck wash facilities and/or use of mud mats to prevent mud and soil from getting into public roads. • Workers will be provided with the appropriate personal protective equipment and safety protocols will be implemented pursuant to RA 11058 (<i>An Act Strengthening Compliance with Occupational Safety and Health Standards and Providing Penalties for Violations Thereof</i>), its Implementing Rules and Regulations (DO 2018-198), and the Bureau of Working Conditions-Department of Labor and Employment (BWC-DOLE) Occupational Safety and Health Standards (<i>The Guidelines Governing Occupational Safety and Health in the Construction Industry, 1998 [DO 13]</i>) to protect them from disease associated with dusts. • Regular dust monitoring will be conducted within the project site to ensure that the levels of air quality pollutants are within the DAO 2000-81 (<i>Implementing Rules and Regulations of the Philippine Clean Air Act of 1999</i>) standards. Station ANV2 as shown in Figure 4.4.1 may be used as monitoring stations once the Project goes into construction phase. • Traffic management guidelines will be incorporated in worker's and EPC contractor's induction seminar. • Fuel efficiency will be maximized through scheduling of vehicle and equipment movements in order to minimize both idle time and distances travelled. Trucks and vehicles are not allowed to idle on site or roads while waiting. • Vehicles and construction equipment will be regularly maintained in order to increase efficiency, reduce fuel use, and help reduce costs associated with equipment downtime. • Equipment dispatch will be monitored closely in order to eliminate unnecessary use and to increase efficiency of use. Stationary equipment (Air Pollution Source Installations (APSI)s) will be applied for a Permit to Operate (PTO) under the DENR-EMB. Monitoring of the APSI/s will depend on the requirements stipulated in the PTO. • Contractors' vehicles and construction equipment will undergo the mandatory government vehicle emission tests prior to the start of construction. The vehicles will be properly maintained, and emission tests will be conducted annually during the construction phase to ensure that emissions are within air pollution targets.
Ambient air quality	Emissions of fugitive dusts	• Consider and ensure that bunkers and conveyors are sited in a leeward position to minimise the effects of wind. • Aggregate material will be delivered in a damp condition and regular light watering/sprinkling will be conducted to reduce the dust emissions. • Aggregate stored on site in stockpiles will be contained in three-sided storage bunkers with windshields that project 0.5 meters above the bunker wall. Drive-over in-ground aggregate storage bins will be shielded on at least two sides to 0.5 meters high for the full-length and width of the bin. If overhead aggregate storage bins are not totally enclosed, aggregate will not be loaded within 0.5 meters of the top of the walls. • Conveyors will be designed and constructed to prevent fugitive dust emissions. This may include roof covering, installing side protection barriers, and equipping the conveyor with spill trays which direct material to a collection point. • Mixer loading areas will be roofed and enclosed on either two (drive through) or three sides. Water sprays and a robust curtain of suitable design will be installed to suppress dust generated during mixer truck loading. Weigh bins and hoppers will be enclosed on three sides and roofed where a front-end loader is used. The roof will extend 2 meters in front of the bin. • Any material spills will be removed by dry sweeping. Water will not be used in cleaning up spills except if appropriate drainage is installed in the point where washing down would be preferable to generating dust by sweeping. • Fabric filters (Baghouse) incorporating fabric cleaning devices will be installed on each cement storage silo. The filter and design characteristics of the filter system should be capable of ensuring that the maximum concentrations of fugitive dusts do not exceed the DAO 2000-81 standards. The fabric filters will be serviced and maintained regularly

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
		in accordance to manufacturer's recommendations and adequate access to the filters will be provided to allow for regular inspection and maintenance.
Ambient noise and vibration	Noise generated by construction works at the that causes an increase in noise or vibration affecting amenity at nearby sensitive receptors Vibration from construction works cause structural damage to buildings and underground services.	• Development of a Construction Noise and Vibration Management Plan (CNVMP; to be included as part of the Contractor's Environmental Management Plan), including good practice noise and vibration management techniques. • During planning, the following will be considered: • Selection of quieter construction equipment where practicable. Construction equipment will be fitted with silencers, acoustic enclosures or other noise attenuation measures where possible. • The location of noisy construction equipment within the site. Generators, refueling and laydown sites etc. will be located as far away from sensitive receptors as possible. • Undertaking noisy construction activities at the same time or within a restricted area to reduce the number of sensitive receptors exposed to noisy works. • Locating site buildings or walled enclosures around especially noisy activities or clusters of fixed noisy construction equipment. • Where practicable, limiting heavy construction vehicle movements to normal working hours and designing traffic routes to limit the amount of accelerating and braking and avoid local roads, where practicable. • Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works. • Scheduling high levels of vibration during the day where feasible • Substitution of construction equipment that emits lower vibration levels were feasible, e.g. smaller vibratory rollers, particularly within safe working distances (10 meters) • Compliance monitoring where safe working distances cannot be maintained (10 meters) to demonstrate compliance or trigger further mitigation measures to reduce vibration where levels exceed acceptable thresholds • Prior to the commencement of relevant works, undertake pre-condition surveys of above and below ground infrastructure to establish construction vibration limits in consultation with asset owners (when this information is available). • Pre-condition assessments of residential and other sensitive assets prior to commencement of sheet/bored piling, vibratory rolling or other high impact works where these works are located within 25 meters of buildings sensitive to vibration (greater distances may need to be considered if the construction plan changes) • Development of the following plans to support the CEMP and out-of-hours permit process for specific work activities: • Noise Abatement / Control Plan • Noise Monitoring Plan • Compliance Action Plan • Public information and complaint response procedure
Cultural Heritage	Relocation of Solis Signal Tower (Casita)	• Incorporating and relocating of the Solis Signal Tower to Tutuban Station
Social and economic conditions	Relocation of PAPs and structures	• Preparation of RAP and Land Acquisition Plan according to international and in-country regulatory requirements and social considerations
Social and economic conditions	Disturbance to livelihood	• Provision of alternative livelihood program in coordination with relevant government agencies and the LGU. Fair compensation for business establishments that will be affected
Social and economic conditions	Temporary employment for local and non-local manpower	• Prioritization of hiring locals and providing equal opportunity for all qualified applicants including women and PWDs
Public health and safety Occupational health and safety	Influx of Project personnel which may come from various locations may cause transmission of communicable diseases or	• Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. A Pandemic Response Plan (to be included as part of the Contractor's Environmental Management Plan) will be prepared and compliant with the applicable guidelines released by the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases.

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
	sicknesses which can be brought about by bacteria, viruses, or their carriers such as certain insects, animals, ill individuals and unsanitary conditions.	Working conditions should comply with Republic Act 11058, Department Order 198 - 2018 and DOLE Department order No. 13 'Guidelines governing occupational safety and health in the construction industry'
Community access	Fencing that will be installed during construction activities may block pedestrian access and obstruct routes typically used by the community	Provision of alternate routes or safe access points in between the alignment for pedestrians that might be affected
Traffic Management	Traffic congestion	Conduct of Traffic Impact Assessment and preparation of Public Access and Traffic Management Plan
OPERATION PHASE		
Geohazard susceptibility to: - Ground shaking - Liquefaction (entire alignment is highly susceptible to liquefaction)	Railway structures and facilities will be subjected to strong seismic loading in case of a major earthquake along the West Valley Fault Liquefaction in the event of an earthquake may result to bearing failures, floatation of embedded structures, damage to overlying structures, which can lead to injury, property damage, and disruption of operations.	- Conduct of preventive maintenance/inspection on the integrity of structures; reinforce if necessary - Prepare and implement an EPRP (to be included as part of the Contractor's Environmental Management Plan) that includes emergency protocols, such as temporary suspension of train operations and evacuation, and post-event monitoring for major ground shaking events.
Geohazard susceptibility to: - Flooding - Tropical cyclone/ strong wind	Severe inclement weather may result to casualties, property damage, or disruption of operations.	- Prepare and implement an EPRP (to be included as part of the Contractor's Environmental Management Plan) that includes implementation of appropriate operation protocols for each PAGASA warning signal for tropical cyclones - Submission of a Climate Change Adaptation and Mitigation Plan which will be updated regularly based on latest predictions and technology. The report and updates will be submitted to JICA, as necessary.
Surface water quality	Pollution of surface water bodies located nearby the alignment	Train wagons will be regularly checked for leaks and maintained to ensure that the wagons are working efficiently
Soil quality	Soil contamination due to accidental spills of oils, lubricants or other chemicals, handling of contaminated ballasts and generation of hazardous wastes	- Use machines and equipment that are appropriate for the task and properly rated with applicable certification and conduct regular and proper maintenance - Heavy equipment operators will be certified for the use of their respective heavy equipment to document their competency and they along with the workers will undergo safety induction and training. - Working conditions should comply with Republic Act 11058, Department Order 198 - 2018 and DOLE Department order No. 13 'Guidelines governing occupational safety and health in the construction industry'.

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement												
		• Store bulk waste oils and lubricants in impermeable area and with appropriate labelling and secondary containment (i.e., 110% of waste volume capacity). Signages, fire extinguishers, barricades/controlled access will be in place. • Prepare a procedure manual for workers to prevent oil and chemical spills and also provide regular training to workers on proper handling and disposal of contaminated ballasts and to keep working and surrounding environment in good condition • Development of a Spills Prevention, Management and Emergency Response Plan to handle occurrences of accidental spills • Proper handling and disposal of potential hazardous wastes through DENR-accredited hazardous waste haulers. Securing of appropriate permits such as Permit to Transport and Hazardous Waste Manifest from DENR prior to disposal. • Prohibition of use of unapproved toxic materials • Use of machines and equipment that are properly rated and appropriate for the task (i.e., used within the capacity, no overloading) and regular proper maintenance of all vehicles and machinery • Containers/drip trays will be used to collect leakage during fuel refilling and repairs. • Provision of spill containment kits												
Surface water quality	Pollution of surface water from leaks of lubricant agents and used oil	• Use machines and equipment that are appropriate for the task and properly rated with applicable certification and conduct regular and proper maintenance • Heavy equipment operators will be certified for the use of their respective heavy equipment to document their competency and they along with the workers will undergo safety induction and training. • EPRP in case of spills and Health and Safety Management Plan (to be included as part of the Contractor's Environmental Management Plan) will be in place												
Ambient noise and vibration	The operation of the rail corridor causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria Vibration at sensitive receptors generated by the operation of Project causes human disturbance.	• Design to achieve NPCC, WBG, Japan and/or FTA guideline requirements whichever is applicable • Installation of a 2-meter high noise barrier extending the length of the SBT project alignment. The barrier would be located on both sides of each rail viaduct to achieve compliance with project criteria at nearby residential receptors. The inward facing wall of the barrier will be acoustically absorptive to reduce reflections. • Noise barriers will be constructed from a non-porous construction with no gaps and a surface density of at least 20 kg/m² at its thinnest point. • Absorptive noise barriers shall have a sound absorption coefficient equal to or exceeding that shown in the table below: <table><tr><td>Octave Band (Hz)</td><td>125</td><td>250</td><td>500</td><td>1k</td><td>2k</td></tr><tr><td>Sound Absorption Coefficient</td><td>0.7</td><td>0.8</td><td>0.9</td><td>0.9</td><td>0.8</td></tr></table>	Octave Band (Hz)	125	250	500	1k	2k	Sound Absorption Coefficient	0.7	0.8	0.9	0.9	0.8
Octave Band (Hz)	125	250	500	1k	2k									
Sound Absorption Coefficient	0.7	0.8	0.9	0.9	0.8									
Community access	Train infrastructure may block pedestrian access and obstruct routes typically used by the community	• Provision of alternate routes or safe access points in between the alignment for pedestrians that might be affected												
Public health and safety Occupational health and safety	Influx of passengers/visitors which may come from various locations may cause transmission of communicable diseases or sicknesses which can be brought about by bacteria, viruses or their carriers such as certain insects, animals, ill individuals and unsanitary conditions.	• Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. A Pandemic Response Plan (to be included as part of the Contractor's Environmental Management Plan) will be prepared and compliant with the applicable guidelines released by the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases. • Working conditions should comply with Republic Act 11058, Department Order 198 - 2018 and DOLE and Bureau of Working Conditions												

Project Phase / Envi. Aspect	Potential Impact	Options for Prevention, Mitigation or Enhancement
Occupational health and safety	Overheating of infrastructure and equipment	• Submission of a Climate Change Adaptation and Mitigation Plan which will be updated regularly based on latest predictions and technology. The report and updates will be submitted to JICA, as necessary.
Social and economic conditions	Increased in-migration and potential proliferation of ISFs	• Secure project ROW. Proper city planning incorporating concerns on influx of migrants and potential increase of ISFs
Social and economic conditions	Long term positive benefits: • Improved travel time • less road congestion • Enhanced development at station nodes • Improved community livability	

Various management plans listed below will be included in the overall Contractor Environmental Management and Monitoring Plan (CEMMP) during pre-construction and construction phases, Operations and Maintenance Plan during operation phase and Abandonment Plan during abandonment phase. To ensure the proper implementation of the Environmental Management Plan (EMP), sufficient budget allocation for EMP implementation needs to be covered under the Contractor's budget, and a copy of the EPRMP/ Supplemental EIA Report, the ECC and the EMP are included in the bidding documents for bidders to appreciate and understand the requirements of the Project in terms of its environmental safeguards.

ENVIRONMENTAL MONITORING PLAN

Table ES - 5 describes the framework for environmental compliance monitoring and environmental performance indicators that will be implemented for the SBT Section, as required by the Department of Environment and Natural Resources (DENR) Administrative Order (DAO) 2003-30. This framework covers the overall Environmental Monitoring Plan (EMoP) for the SBT Section, which will include the Department of Transportation's (DOTr's) self-monitoring plan, the engagement of a Third Party Auditor (TPA) for compliance monitoring, and DOTr's commitment to establishing an Environmental Monitoring Fund (EMF), and Environmental Guarantee Fund (EGF). It will also be included in the bidding documents for the Project along with the Project's Environmental Management Plan (EMP) to ensure full compliance of the Contractors with their complete and proper implementation. Furthermore, JICA discloses the results of the monitoring on its website to the extent that they are made public by the proponent. When third parties request for additional information on the results, JICA may disclose this information subject to the approval of the proponent.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

1. The Department of Transportation (DOTr) of the Republic of the Philippines is the primary entity of the executive branch of the Philippine Government responsible for the promotion, development, and regulation of transportation system networks and services in the country. Its main functions include policy formulation, industry/services regulation, infrastructure development, and international cooperation. The DOTr is also responsible for the maintenance and expansion of viable, efficient, and dependable transportation systems as effective instruments for national recovery and economic progress through the country's land, air, and sea transportation infrastructures.

2. In April 2017, the Philippine Government launched the Build!Build!Build! (BBB) Program that aims to accelerate public infrastructure expenditure to address the large infrastructure backlog in the country. As of April 2021, the BBB Program covers 62 infrastructure flagship projects including expressways, roads, bridges, railways, road-based public transportation, and mixed-use, industrial real estate developments, among others.

3. One of the key infrastructure projects of the BBB Program is the North-South Commuter Railway (NSCR) which is implemented by DOTr with assistance from the Japan International Cooperation Agency (JICA). Aimed at providing a commuter and intercity railway service connecting Metro Manila and its adjacent northern and southern suburban areas, the proposed railway system is deemed to be an important mass transit backbone of Metro Manila and the growth corridor of the Greater Capital Region (GCR) which comprises Region III (Central Luzon), National Capital Region (NCR)¹ and Region IV-A (CALABARZON).

4. Spanning 165.50 km, NSCR is further divided into three phases (each with Environmental Compliance Certificate (ECC)): North-South Commuter Railway Project (Malolos-Tutuban) ("NSCR Project") (37.90-km), NSCR Clark Extension Project (Malolos-Clark, including NCC Extension) ("NSCR Clark Ex Project")² (71.10 km) and NSCR Calamba Extension Project ("NSCR Calamba Ex Project")³ (56.50-km).

5. The NSCR Project is the phase that EMB first issued an ECC (ECC-CO-1503-0013) on April 28, 2015 through the submission of an Environmental Performance Report and Management Plan (EPRMP) (2015). The NSCR Project which is currently under construction to operate from the City of Malolos in the Province of Bulacan to Tutuban in the district of Tondo, City of Manila. The NSCR Project will utilize the existing right-of-way (ROW) of the Philippine National Railways (PNR) and will have 10 stations (**Figure 1.1.1**) and a depot.

6. In 2020, the Solis-Blumentritt-Tutuban (SBT) Section, also referred herein as "the Project", was proposed to be integrated at the southern portion of the NSCR Project that will run from Solis station to Blumentritt station (SB Section) and from Blumentritt station to Tutuban station (BT Section) to meet the future demand towards Blumentritt direction and to avoid a primary school to be traversed by the originally proposed direct operation between Solis station and Tutuban station.

7. The SBT Section has a total estimated length of 1.57 km with SB Section measuring 1.04 km and BT Section measuring 0.53 km (**Figure 1.1.2**). The SB section was originally covered by the NSCR

¹ Also known as Metropolitan Manila

² Previously known as the Malolos-Clark Railway Project (MCRP)

³ Also known as South Commuter Railway Project (SCRPP); Previously known as North-South Railway Project (NSRP) - South Line (Commuter)

Calamba Ex Project ECC (ECC-CO-1807-0018), while the BT section is a new railway segment. Furthermore, along SB Section, an area of approximately 3,000 m² was added to the scope of the NSCR Project for the traction substation (TSS-1) due to its proximity to a power source (MERALCO) and both SB and BT Sections. The boundary of the SB and BT sections are marked by the chainages provided in **Table 1.1.1**. **Table 1.1.2** provides the geographic positions of the start and end points of the alignment that define the SB and BT Sections as well as the center point and corner points A-D that define the area where the TSS-1 will be located. The geographic coordinates of the SBT Section and corner points of TSS-1 are also indicated in **Figure 1.1.2**.

Table 1.1.1 SBT Section Chainage

Railway Track Section	Chainage based on NSCR (Malolos-Tutuban)		Chainage based on NSCR Calamba Extension		Length (km)
	Start Point	End Point	Start Point	End Point	
Solis-Blumentritt (SB)	-0+255.864	-1+300.000	0+255.864	1+300.000	1.04
Blumentritt-Tutuban (BT)	-1+257.965	-1+791.000	1+348.950	0+815.915	0.53
Total Length					1.57

Table 1.1.2 Geographic Coordinates of the Boundaries of the SBT Section

Project Component	Geographic Coordinates				
Railway Track Section	Start Point		End Point		
Solis-Blumentritt (SB)	14°37'57.99" N 120°58'34.79" E		14°37'24.87" N 120°58'34.53" E		
Blumentritt-Tutuban (BT)	14°37'22.61" N 120°58'35.75" E		14°37'11.05" N 120°58'28.64" E		
Supporting Facility	Center Point	Point A	Point B	Point C	Point D
Traction substation (TSS-1)	14° 37' 25.70" N 120° 58' 32.01" E	14° 37' 27.75" N 120° 58' 31.52" E	14° 37' 25.57" N 120° 58' 32.91" E	14° 37' 24.80" N 120° 58' 32.78" E	14° 37' 25.08" N 120° 58' 31.07" E

Note: The geographic coordinates showing the project boundaries are based on WGS 84 datum.

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

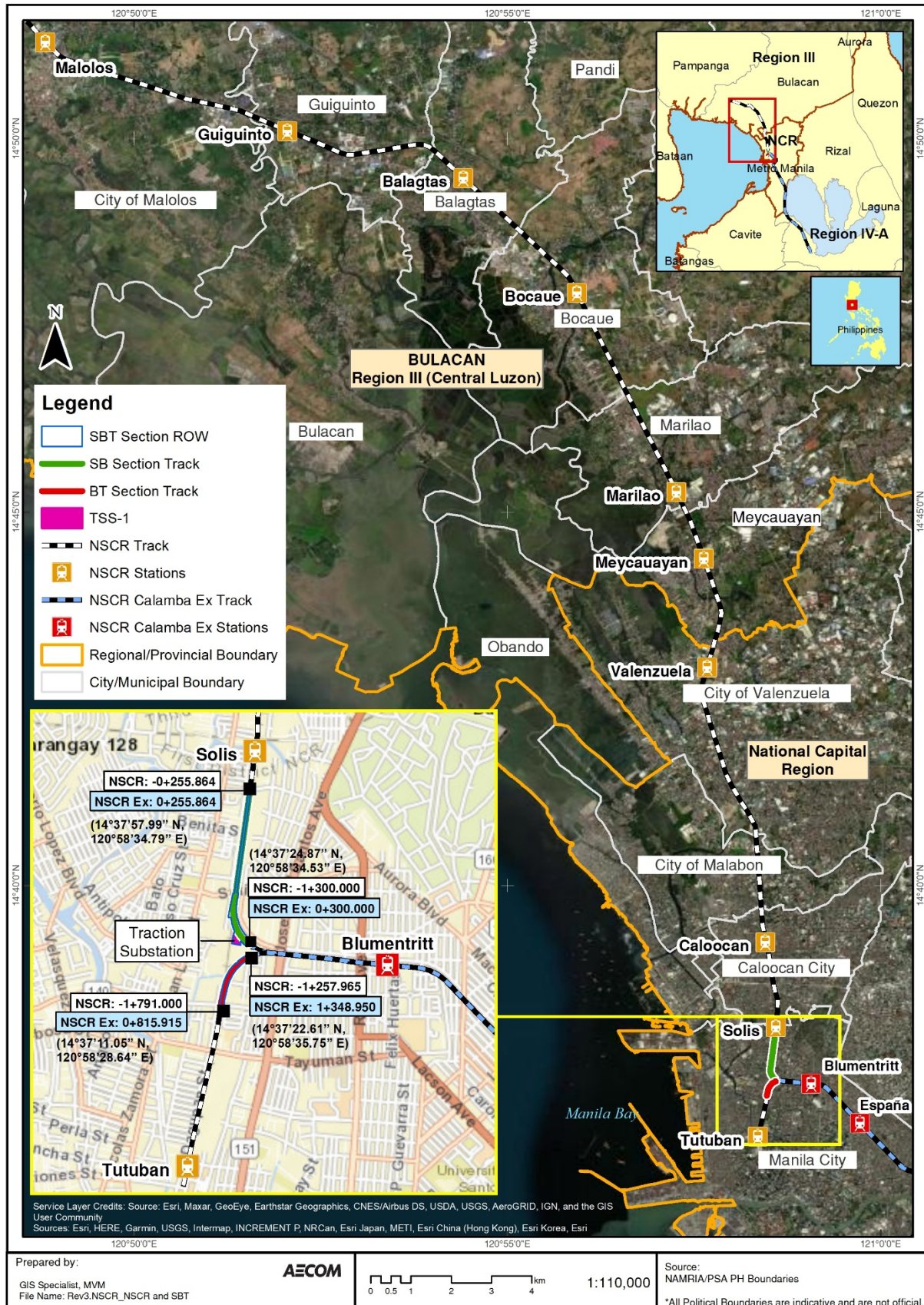


Figure 1.1.1 NSCR Project Alignment and its Proposed Modification

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

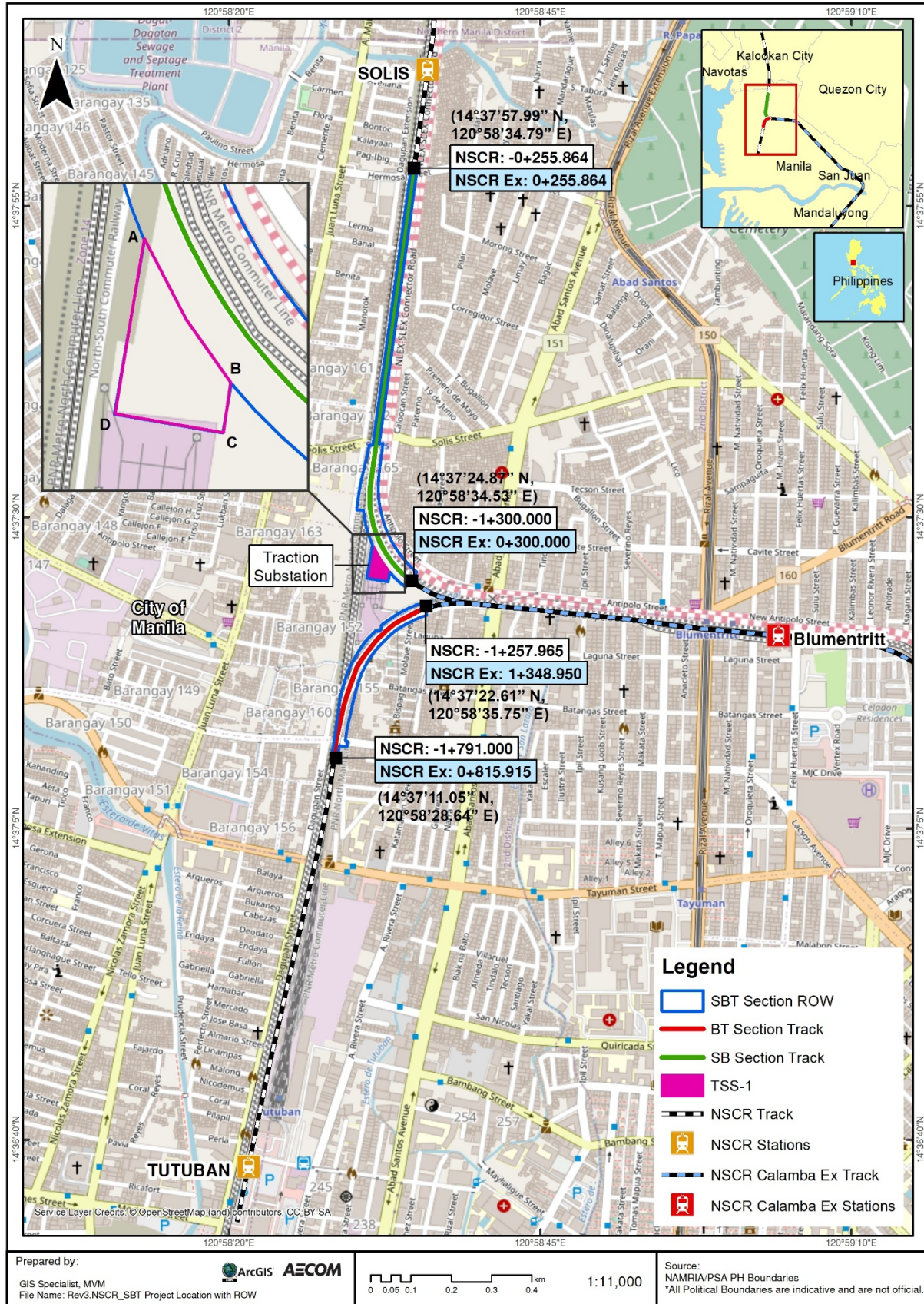


Figure 1.1.2 Project Alignment Modification of the SBT Section

1.2 EMB AND JICA REVIEW AND ECC AMENDMENT

8. In accordance with Environmental Management Bureau (EMB) Memorandum Circular No. (MC) 2014-005 and ECC-CO-1503-0013, ECC for the NSCR Project is required to be amended due to the proposed modifications. Furthermore, in August 2019, during a discussion between EMB and JDT about project modifications, EMB advised JDT to prepare a letter informing EMB of the modifications so that the case handler can review whether the Project is a minor or major amendment. If major, public consultation will be part of the activities to be complied with.

9. As such, DOTr submitted a letter and detailed project description to EMB on June 15, 2020 for the transfer of SB Section and inclusion of the new BT Section to the NSCR Project. The first ECC amendment was granted on July 2, 2020 (Annex A-1). Since no additional EIA report was required by EMB under the national law and having the ECC amended at the beginning of the study, additional EIA was not required for the Project based on JICA advice to JDT on July 21, 2020. Nevertheless, DOTr decided to proceed with the conduct of baseline environmental surveys and updating of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) for compliance monitoring requirements.

10. As TSS-1 was later added to the scope of NSCR Project, DOTr requested the inclusion of the TSS-1 to the NSCR Project ECC through an official letter (with brief description of TSS-1) to EMB in March 2021. Furthermore, JICA has decided in April 2021 to conduct environmental review of monitoring stage due to the significant impact of resettlement.

11. On July 28, 2021, EMB issued an official letter with evaluation report requiring additional information for an ECC amendment. DOTr submitted the additional information including revised project description, EMP and EMoP to EMB for the inclusion of TSS-1 and revised alignment length. The second amendment was granted on August 31, 2021 (Annex A-2).

1.3 SCOPE OF THE STUDY

12. The JICA Design Team (JDT) commissioned AECOM Philippines, Inc. (AECOM) to undertake a supplemental Environmental Impact Assessment (EIA) for the SBT Section that covers the conduct of environmental baseline surveys for the SBT Section through desktop and field surveys and updating of the EMP and EMoP of the NSCR Project EPRMP.

13. Baseline field surveys were conducted for environmental aspects including soil quality and contamination, terrestrial vegetation and wildlife, surface water quality, air quality, noise, and vibration. Stakeholder consultations were also conducted for the SBT Section. Socio-economic baseline and impact assessment are also covered in this report but studies on land acquisition, displacement, relocation, and livelihood programs for the direct project-affected persons (PAPs) of the SBT Section are detailed in the Resettlement Action Plans (RAP) for SB Section and BT Section.

1.4 PURPOSE OF THIS DOCUMENT

14. This supplemental EIA Report was developed to identify and assess the potential environmental and social impacts associated with the development of the SBT Section and to serve as guidance in the implementation and monitoring of measures to mitigate the identified adverse project impacts. The supplemental report contains updated and specific information necessary to obtain the ECC amendment from the DENR and serves as the main reference in the conduct of the JICA environmental review for the loan agreement of the NSCR Project.

2 PROJECT DESCRIPTION

15. This chapter describes the SBT Section, a consolidation of two separate railway segments, namely SB Section and BT Section, including the new TSS-1, which is the coverage of the ECC modification for the NSCR Project.

2.1 Project Background

16. The SBT Section is an additional section of the NSCR Project located at its southern portion in the City of Manila that comprises two segments – the SB Section, approximately 1.04 km in length, and the BT Section, approximately 0.53 km in length. The SBT Section is estimated at 1.57 km long in total that serves as the connection of the NSCR Project line with the NSCR Calamba Ex Project line. The project modification includes the TSS-1 between Solis station and Blumentritt station.

17. The SB Section was originally under the ECC (ECC-CO-1807-0018) for the NSRP – South Line (Commuter), now known as NSCR Calamba Ex Project. The BT Section is a new railway segment that started feasibility study (FS) in March 2020¹. With the proposed alignment modification, EIA process based on PEISS was undertaken for the SBT Section and the ECC (ECC-CO-1503-0013) for the NSCR Project was amended in July 2020. In January 2021, the location of the TSS-1 was finalized. An ECC amendment was granted for the NSCR Project to include the TSS-1 in August 2021. **Table 2.1.1** shows the major features of the ECC coverage of the two projects and the proposed modifications.

Table 2.1.1 ECC Coverage and Project Modifications

Project Name	ECC Issued	General Description	Proposed Modification for the ECC Coverage	Status
NSCR Project (Malolos-Tutuban)	ECC-CO-1503-0013 issued on April 28, 2015	The ECC covers the construction and operation of NSCR Project covering a total length of 37.90 km that traverses 10 cities/ municipalities from City of Malolos, Province of Bulacan, to Tutuban, City of Manila. It includes 10 elevated stations and a maintenance depot area in Valenzuela.	Addition of the SBT Section (SB and BT sections)	This minor modification was granted an ECC amendment on July 2, 2020.
			Updating of SBT Section length to 1.57 km due to change in chainage boundaries	This minor modification was granted an ECC amendment on August 31, 2021.
			Inclusion of the TSS-1 between Solis and Blumentritt	
NSRP – South Line (Commuter) ²	ECC-CO-1807-0018 issued on August 13, 2018	The ECC covers the construction and operation of the 56.50 km railway project traversing various cities in Laguna and Metro Manila as well as the City of Manila. It includes twenty (20) stations and a maintenance depot in Banlic, Calamba.	Transferring of SB Section to NSCR Project ECC	This proposed modification has been considered a minor modification. DENR granted the ECC amendment on July 2, 2020.

Source: Department of Environment and Natural Resources (2021). *Minor ECC Amendment for the DOTr's North-South Commuter Rail (NSCR) with Alignment from Malolos to Tutuban* (ECC-CO-1503-0013). Retrieved August 27, 2021 from https://www.jica.go.jp/english/our_work/social_environmental/id/asia/southeast/philippines/c8h0vm000097bksx-att/c8h0vm0000faggqzm.pdf.

¹ The detailed design for the SBT Section was completed in June 2021.

² Also referred to in this document as the NSCR Calamba Extension (NSCR Calamba Ex) Project.

18. When the SB Section was previously under NSCR Calamba Ex Project, JICA and Asian Development Bank (ADB) jointly funded the loan package. The NSCR Calamba Ex Project was issued an ECC during its FS stage. However, after an ECC was secured, the SB Section was removed from the package and proposed to be implemented under the NSCR Project that JICA solely funds. To align the EIS with the loan agreement, the existing ECC-CO-1503-0013 was amended to integrate the SBT Section, specifically to transfer the SB Section and to include the new BT Section to the NSCR Project. Part of the modifications to the ECC is the inclusion of the TSS-1, a component of the SBT Section. The project modifications are shown in **Figure 2.1.1** and further discussed throughout this chapter.

2.1.1 Project Location

19. The SBT Section is located at the southern portion of the NSCR Project, between its Solis and Tutuban stations, in Tondo District, City of Manila, National Capital Region (NCR) of Luzon in the Philippines. The Project directly traverses 21 barangays (184, 200, 198, 186, 203, 185, 161, 204, 162, 217, 165, 164, 227, 218, 228, 155, 221, 231, 160, 232, and 159) and covers additional six barangays not traversed by the Project but are within 100 m from the ROW (163, 214, 213, 216, 152, and 157). These barangays are also shown in **Figure 2.1.4**.

2.1.2 Solis-Blumentritt-Tutuban Section

20. The SB Section starts at approximately 256 m south of Solis Station and runs towards the boundary of NSCR Calamba Ex Project. The BT Section, on the other hand, runs from the NSCR Calamba Ex Project going southwestward to connect with the NSCR Project running to Tutuban. These sections serve as the connection between the NSCR Project line, and the NSCR Calamba Ex Project line. The geographic coordinates of the SB and BT sections are shown in **Table 2.1.2**.

21. Currently, the PNR Metro North Commuter Shuttle Train operates along the proposed SB Section while the PNR Metro South Commuter Train runs along the proposed BT Section. The SB Section runs parallel to the proposed NLEx-SLEx Connector Road of the Department of Public Works and Highways (DWPB) which also utilizes the space above the PNR ROW.

Table 2.1.2 Location, Chainage and Coordinates of the SBT Section

Railway Track Section	Location	Starting Point		End Point		Length (km)
		Chainage	Geographic Coordinates	Chainage	Geographic Coordinates	
Solis-Blumentritt (SB)	Manila	-0+255.864	14°37'57.99" N 120°58'34.79" E	-1+300.000	14°37'24.87" N 120°58'34.53" E	1.04
Blumentritt-Tutuban (BT)	Manila	-1+257.965	14°37'22.61" N 120°58'35.75" E	-1+791.000	14°37'11.05" N 120°58'28.64" E	0.53
Total Length						1.57

Notes:

- Chainage is based on engineering drawings of the NSCR Project line. This has equivalent chainage in the NSCR Calamba Ex Project wherein SB is from 0+255.864 to 1+300.000 and BT is from 1+348.950 to 0+815.915.
- Geographic coordinates are based on WGS 84 datum.
- This information may be subject to minor modification upon completion of the DD stage.

Source: Department of Environment and Natural Resources (2021). *Minor ECC Amendment for the DOTr's North-South Commuter Rail (NSCR) with Alignment from Malolos to Tutuban* (ECC-CO-1503-0013). Retrieved August 27, 2021 from https://www.jica.go.jp/english/our_work/social_environmental/id/asia/southeast/philippines/c8h0vm000097bksx-att/c8h0vm0000fggqzm.pdf.



Source: AECOM Philippines (2021)

Figure 2.1.1 Proposed Alignment Modifications

22. As the Project is located in Tondo, the most populous among administrative districts comprising Manila, the existing land uses of the surrounding area are mostly classified as high-density residential zone which are characterized mainly by low-rise or medium-rise residential buildings for exclusive use as multi-family dwellings with mixed housing types. Other surrounding land uses are classified as commercial, institutional, transport and utility zones. Notable physical features at the boundaries of SB and BT sections and other surrounding places of interest are presented in **Table 2.1.3** and **Figure 2.1.2**.

Table 2.1.3 Notable Physical Features Directly Adjacent to SBT Section

Ref. No.	Notable Physical Features	Feature Type/ Description	Directional Reference
SB Section			
1	Hermosa Street	Access Road (crosses the railway line)	North
2	NLEx-SLEx Connector Road	Elevated Access Road (parallel to the railway line)	East
3	NHA Dagupan Medium Rise Building	Residential Buildings	West
4	Gregorio De Jesus Elementary School	Primary School/ Educational Institution	West
5	Solis Street	Access Road (crosses the railway line)	East, West
6	Built-Up Area	Mixed use structures (mostly residential) and Maria Guizon Basketball Court beside Meralco Power Grid Station	South
BT Section			
7	Meralco Power Grid Station	Power Utility	North
8	Old Antipolo Street (a portion now called Molave Street)	Access Road (parallel to the railway line but built-up areas are in between them)	Northeast to South
9	Laguna Street	Access Road (near the railway line)	Northeast
10	South Antipolo Canal	Drainage Canal (parallel to the railway line)	East, South
11	Yuseco Street/ Raxabago Street	Access Road (crosses the railway line)	South

Source: AECOM Philippines (2021).

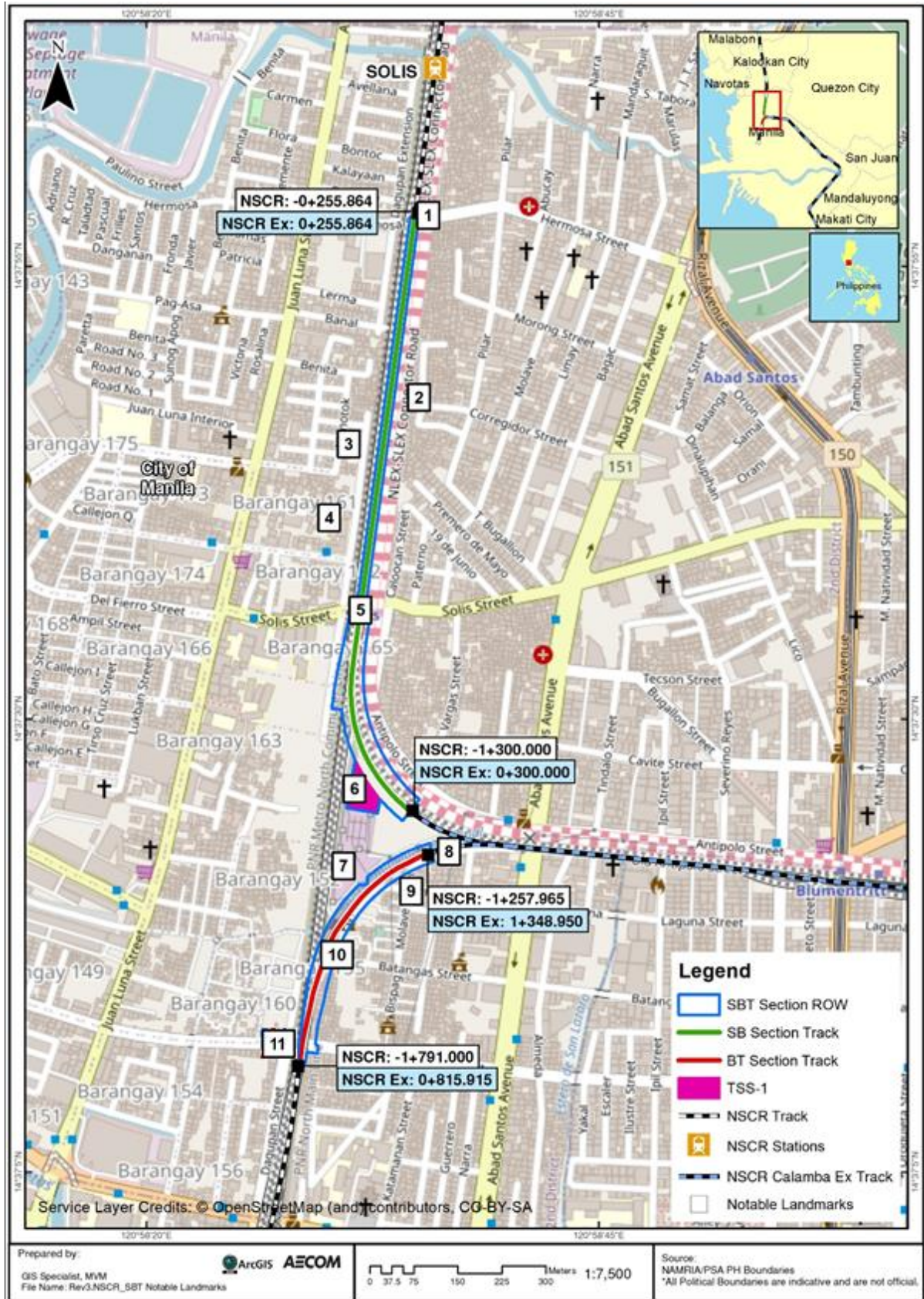


Figure 2.1.2 Notable Landmarks Surrounding the Project Area

Source: AECOM Philippines (2021).

23. **Table 2.1.4** lists ongoing developments within the vicinity of the location of the SBT Section that may need to be considered in the project planning and environmental management. Possible overlaps with the timelines of these other development projects and that of the SBT Section are accounted to address potential conflicts or additional impacts that may be encountered in the area in case of simultaneous project implementation.

Table 2.1.4 Other Development Projects in Manila

Name of Project	Description	Implementing Office	Status
NLEx-SLEx Connector Road Project	8-km, 4-lane elevated toll expressway extending the NLEx southward from the end of Segment 10, C3 Road in Caloocan City to PUP Sta. Mesa, Manila and connecting to the Skyway Stage 3, mostly traversing existing PNR rail tracks	DPWH	Ongoing ROW Acquisition and Construction (Started in 2019)
Moriones Bridge (B01794LZ)	Widening of Moriones Bridge in Tondo, Manila and crossing Estero dela Reina located 1.40 km south of SBT Section	DPWH North Manila District Engineering Office	Ongoing (53% complete; Started in 2016)

Source: Department of Public Works and Highways (2021). *Infrastructure Projects*. Retrieved June 1, 2021 from <https://www.dpwh.gov.ph/dpwh/projects/infrastructure#>.

2.1.3 SBT Traction Substation

24. The traction substation (TSS-1) is required to convert electricity from the power utility supply to a form suitable to power the rail system. TSS-1 is estimated to occupy an area of approximately 3,000 m² to be located near the viaduct in Barangay 217, Tondo, Manila, with geographic coordinates as indicated in **Table 2.1.5** below.

Table 2.1.5 TSS-1 Geographic Coordinates

Railway Component	Geographic Coordinates				
	Center Point	Point A	Point B	Point C	Point D
TSS-1	14° 37' 25.70" N 120° 58' 32.01" E	14° 37' 27.75" N 120° 58' 31.52" E	14° 37' 25.57" N 120° 58' 32.91" E	14° 37' 24.80" N 120° 58' 32.78" E	14° 37' 25.08" N 120° 58' 31.07" E

Source: Department of Environment and Natural Resources (2021). *Minor ECC Amendment for the DOTr's North-South Commuter Rail (NSCR) with Alignment from Malolos to Tutuban* (ECC-CO-1503-0013). Retrieved August 27, 2021 from https://www.jica.go.jp/english/our_work/social_environmental/id/asia/southeast/philippines/c8h0vm000097bksx-att/c8h0vm0000fggqzm.pdf.

2.1.4 Impact Areas

2.1.4.1 Direct and Indirect Impact Areas

25. **Figure 2.1.4** shows the direct impact areas of the SBT Section. The direct impact areas of the SBT Section are defined as the area of the Project ROW with an estimated length of 1.57 km and width of 15 to 30 m extending up to 100 m from the edge of the Project ROW on both sides to take account of noise and dust impacts. As to the overall NSCR Project, the indirect impact areas include other barangays within the host city of Manila and other adjacent cities/ municipalities benefitting from the rapid economic growth due to stable and reliable means of transportation.

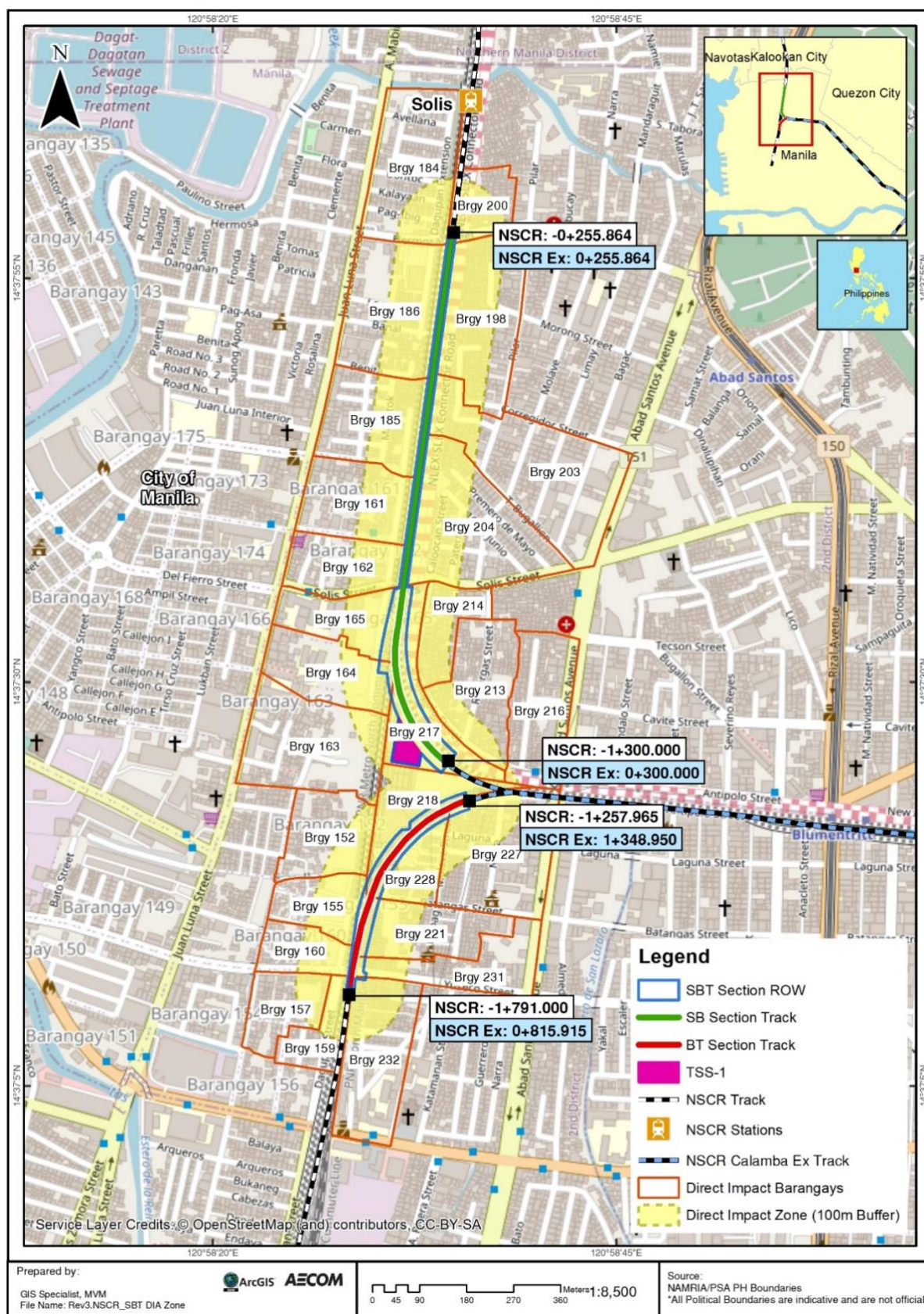


Figure 2.1.3 Direct Impact Areas of the Project

Source: AECOM Philippines (2021).

2.2 PROJECT RATIONALE

26. The development of the NSCR Project of the DOTr aims to provide a commuter and intercity railway service connecting Metro Manila and its adjacent northern and southern suburban areas. This is in response to the worsening traffic congestion in NCR, Central Luzon, and CALABARZON³ Regions. The estimated transport cost in Metro Manila is PhP 3.5 billion per day and PhP 2.4 billion in the adjacent provinces of Bulacan, Rizal, Laguna, and Cavite. Without government intervention, transport cost is projected to increase to PhP 5.4 billion per day and PhP 5.9 billion, respectively, by 2035 (JICA, 2019)⁴. The NSCR Project is envisioned to be an important mass transit backbone of the Philippines to facilitate the efficient distribution of goods and movement of people and mitigate the many economic losses associated with severe traffic congestion and inadequate transportation infrastructure.

27. To further improve the interoperability and connectivity of the NSCR Project with the NSCR Calamba Ex Project, the DOTr has proposed the development of the SBT Section. The additional SBT Section connects the Solis Station of the NSCR Project with the Blumentritt Station of the NSCR Calamba Ex Project, and the Blumentritt Station of the NSCR Calamba Ex Project with the Tutuban Station of the NSCR Project. Connecting these stations provide commuters two more travel route options for their convenience. By the year 2025, the SBT Section is projected to support the estimated daily ridership of NSCR Project at 262,000 and NSCR Calamba Ex Project at 516,000. The proposed TSS-1 is required to secure stable power supply to the overhead contact system (OCS) of the SBT Section.

2.3 PROJECT ALTERNATIVES

28. Several alternatives were assessed to develop the SB and BT sections and the traction substation with minimal environmental and social impacts to identify the most viable choices for the Project. These include alignment alternatives, structure alternatives, technology alternatives and alternative locations of the TSS-1.

2.3.1 No Project Option

29. If the SBT Section is not built, no train services directly connect the NSCR Project and the NSCR Calamba Ex Project, specifically between Solis station and Blumentritt station, and between Blumentritt station and Tutuban station. The NSCR Project terminates at Solis Station and the NSCR Calamba Ex Project terminates at Blumentritt Station. The disjoint between these railway lines interrupts the movement of trains affecting the efficient movement of people and the smooth distribution of goods resulting in substantial socio-economic losses for the expansion of Metro Manila in the North-South direction. Rail passengers who need to use both railways have to use alternative modes of transport or feeder modes to transfer from one railway to another. The use of feeder modes disrupts the flow of vehicular traffic along access roads between the two railway lines causing congestion, delays and inconvenience.

³ CALABARZON, also known as Region 4A, is one of the 17 administrative regions in the Philippines. The acronym is derived from the provinces of Cavite, Laguna, Batangas, Rizal and Quezon which composes the region.

⁴ Japan International Cooperation Agency, ALMEC Corporation. (August 2019). *Follow-up Survey on Roadmap for Transport Infrastructure Development for Greater Capital Region (GCR) Final Report Summary*. https://openjicareport.jica.go.jp/pdf/1000041638_03.pdf

2.3.2 Alignment Alternatives

30. The Project has taken into consideration two alternatives for the horizontal route to be utilized. The first option proposes to utilize the existing PNR ROW along the turning sections of the Solis-Blumentritt and Blumentritt-Tutuban lines, which is more preferred due to least involuntary resettlement, land alteration, and potential pollution impacts. Another alternative considered involves the use of the existing PNR ROW along the Solis-Tutuban line. **Table 2.3.1** compares these ROW alternative options in terms of technical, social and environmental aspects.

Table 2.3.1 Alignment Alternative Comparison

Item		Option A	Option B (Preferred)
Schematic Drawing			
Alignment	Length	1.60km	1.57 km
	Route	Direct line from Solis station to Tutuban station. Calamba extension line connects at Solis station	From Solis station to Tutuban station via Blumentritt station
	Station	0 station	0 station
	Structure Type	Viaduct	Viaduct
	Compatibility with existing development plans	Co-use of the PNR ROW with the future PNR freight line and DPWH NLEx-SLEx Connector Road	Co-use of the PNR ROW with the future PNR freight line and DPWH NLEx SLEx Connector Road
Technical Aspects	Traffic Demand Forecast	10 trains/hr between Solis to Malolos 1 train/hr between Solis to Tutuban 9 trains/hr from Solis to Calamba	9 trains/hr between Solis to Malolos 1 train/hr between Blumentritt to Tutuban 10 trains/hr from Blumentritt to Calamba
	Operation	Due to difficulties of shuttle operation between Solis and Tutuban, the number of trains from Solis to Tutuban is limited	As shuttle operation can be provided between Blumentritt and Tutuban, number of operating trains for NSCR Calamba Ex Project can be increased
	Design	Crossover between viaducts of NSCR Project line and NSCR Calamba Ex Project line is required. The gradient is not suitable for the main line to operate large number of trains	No cross over of viaducts.
	E&M	Substation is located north of Tutuban station with operation management from Valenzuela Operation Centre.	Substation location is required to change with possible modification on operation management from Valenzuela Operation Centre.

Item		Option A	Option B (Preferred)
	Cost (civil only)	PHP 1,760 million	PHP 1,727 million
	Start of Operation	May 2022	SB: May 2022 / BT: October 2025
Land Use	Land Use	Total: 25,404.44 m ² • 14,246.18 PNR land • 11,087.47 m² privately owned • 70.78 m² government-owned	Total: 43,601.96 m ² SB: 28,915.96 m ² • 8,469.30 m² PNR land • 284.00 m² privately owned • 19,966.16 m² government-owned BT: 14,686.00 m ² • 12,017 m² PNR land • 284.80 m² privately-owned • 2,383 government-owned (owned by PNR and Republic of the Philippines)
	Land acquisition	Total (private lots only): 11,087.47 m ² (residential/commercial/institutional for acquisition)	Total for SBT (private lots only): 20,858.86 m ²
		Total: 25,404.44 m ² (if including PNR land) • 14,246.18 PNR land required for ROW • 11,087.47 m² (residential/ commercial/ institutional for acquisition) • 70.78 m² road lots	Total for SBT: 45,799.83 m ² (if including PNR and government land) SB: 28,915.96 m ² • 8,753.30 m² for acquisition • 20,162.66 existing government ROW BT: 16,883.97 m ² for acquisition • 12,017.56 m² existing PNR ROW • 1,742.09 m² government ROW • 696.20 m² residential • 2,428.12 m² road lots
Social	Project Affected Households (PAHs)	260 PAHs The relocation of a school directly affects approximately 1500 students and 58 staff as they need to look for alternative schools elsewhere. This may also result to greater direct, indirect, and irreversible impacts such as disruption of classes and inaccessibility of the surrounding community to a nearby school, and loss of livelihood (i.e. teachers, school staff, local businesses surrounding the school, etc.)	696 PAHs Although this option requires relocation of more PAHs, the impacts of the resettlement can be addressed with provision of compensation and relocation assistance.
	Cultural Heritage	The Solis Signal Tower, or Casitas de Tondo, is the historical structure along the ROW	The Solis Signal Tower, or Casitas de Tondo, is the historical structure along the ROW
Environment	Protected Area	No nationally or locally declared protected area along the ROW.	No nationally or locally declared protected area along the ROW.
	Ecosystem	Vegetation removal and construction activities may cause the loss of threatened and/or endemic species and loss of habitat but can be mitigated through revegetation and tree replanting.	Vegetation removal and construction activities may cause the loss of threatened and/or endemic species and loss of habitat especially for bird species revegetation and tree replanting.
	Noise and Vibration	Nuisance to surrounding sensitive receptors due to railway noise and vibration but can be mitigated	Nuisance to surrounding sensitive receptors due to railway noise and vibration but can be mitigated

Item		Option A	Option B (Preferred)
	Flood	Located in low-lying area prone to flooding but can be mitigated with the construction of viaduct structures and resilient drainage system.	Located in low-lying area prone to flooding but can be mitigated with the construction of viaduct structures and resilient drainage system.
Evaluation of Options		This option is not recommended, considering constraints in operation, adaptability to future ridership, and the relocation of school building	This option is preferred considering the train operation can meet the demand forecast, avoid complication of structural design, and avoid relocation of school building. The overall cost is lesser than the other option .

Source: JICA Design Team (2021). [Comprehensive detail of SBT Section alignment alternative options]
[Internal engineering data]. Unpublished.

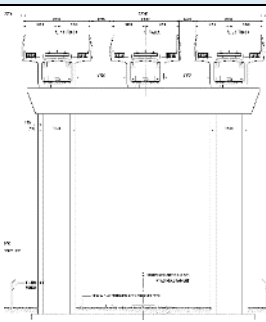
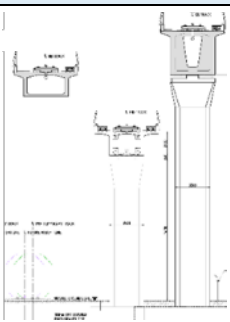
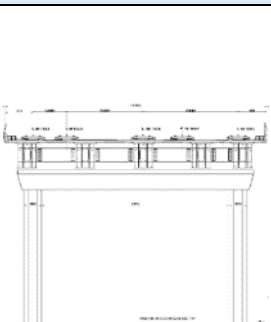
2.3.3 Structure Alternatives

31. The three structure alternative options in terms of viaduct structure design that were considered and assessed for the Project are as follows:

- 3 tracks with same level
- 3 tracks with lower track in center
- 4 tracks with same level

32. Underground structure and at-grade structure types were also considered but the viaduct structure was found to be the most feasible option due to the limited length between the elevated stations of NSCR Project (Solis and Tutuban) and NSCR Calamba Ex Project (Blumentritt) to allow gradient to go down.

Table 2.3.2 Structure Alternative Comparison

Items		Option A (Preferred) 3 tracks with same level	Option B 3 tracks with Lower track in center	Option C 4 tracks with same level
Sketch				
Design	Track	3 tracks	3 tracks	4 tracks
	Track height	All tracks are of the same height.	Lower track in center	All tracks are of the same height.
	Redesign required	No slope nor redesign of station required.	Requiring height change. Slope gradient goes over limit and turnout section is required to connect curve and straight line. Section has limited distance to make height change.	Blumentritt station needs to be redesigned to be higher and wider.

Items		Option A (Preferred) 3 tracks with same level	Option B 3 tracks with Lower track in center	Option C 4 tracks with same level
	ROW width	30 m	30 m	40 m
	Passenger demand	Can meet the passenger demand of Blumentritt-Tutuban	Can meet the passenger demand of Blumentritt-Tutuban.	Can meet the additional passenger demand expected being Tutuban station as a transit station to LRT 1.
Social	Land acquisition	Minimum land acquisition is required.	Minimum land acquisition is required.	Larger land area is required outside the PNR ROW causing land clearance to take longer than the other options.
Environment	Protected Area	No nationally or locally declared protected area along the ROW.	No nationally or locally declared protected area along the ROW.	No nationally or locally declared protected area along the ROW.
	Ecosystem	Vegetation removal and construction activities may cause the loss of threatened and/or endemic species and loss of habitat but can be mitigated through revegetation and planting of replacement trees.	Vegetation removal and construction activities may cause the loss of threatened and/or endemic species and loss of habitat but can be mitigated through revegetation and planting of replacement trees.	Vegetation removal and construction activities may cause the loss of threatened and/or endemic species and loss of habitat but can be mitigated through revegetation and planting of replacement trees.
	Flooding Risks	No inducement of existing flooding conditions in the area due to elevated and above-flood level clearance for supporting facilities. Climate change and flood levels based on 100-year flood hazard were considered for the drainage design.	No tracks are submerged in case of flooding.	No tracks are submerged in case of flooding.
	Noise	Noise generation along the railway but the installation of noise barriers and the implementation of other noise attenuation measures mitigates the impacts to the community.	Noise generation along the railway but noise mitigation may be complex due to varying structure height.	Noise generation along the railway but the installation of noise barriers and the implementation of other noise attenuation measures mitigates the impacts to the community.
Construction	Construction Time	Shorter than Option C and able to open at the target time of priority operation of SB Section.	Shorter than Option C and able to open at the target time of priority operation of SB Section.	Longer than Option A and Option B and unable to open at the target time of priority operation of SB Section.
	Construction difficulty	Less difficult than Option B with more vertical space	More difficult than Option A and Option C due to limited space to work and ongoing operation of PNR and construction of connector road vertically as well as horizontally.	Less difficult than Option A and Option B with more space vertically and horizontally.
Evaluation of Options		The option is preferred considering the existing design constraints,	The option is not feasible due to the limited vertical space.	The option is not feasible as the operation timeline does not meet the required criteria.

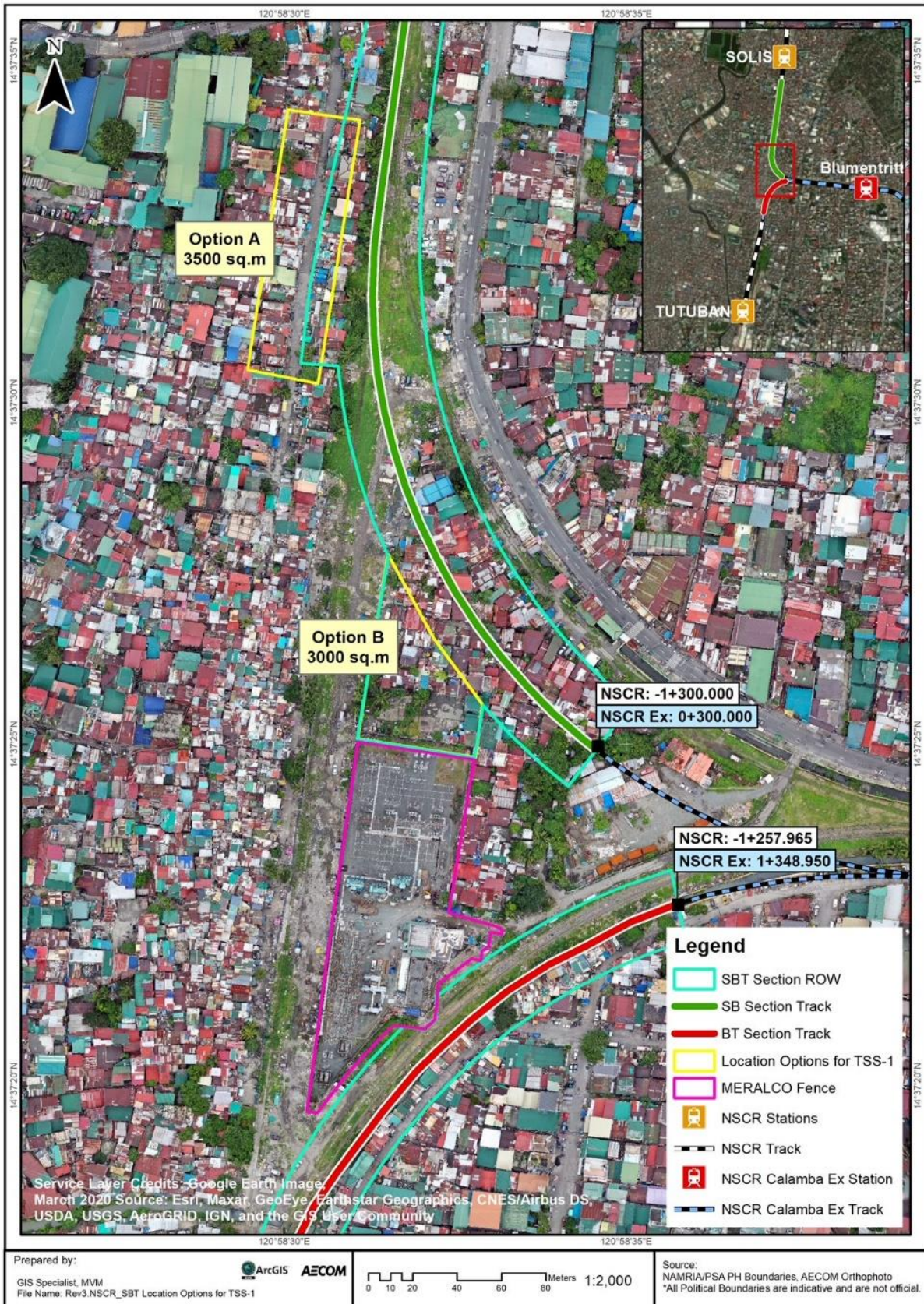
Items	Option A (Preferred) 3 tracks with same level	Option B 3 tracks with Lower track in center	Option C 4 tracks with same level
	feasibility of target start of operation, and lesser land acquisition and noise impact.		

Source: JICA Design Team (2021). [Comprehensive detail of SBT Section structure alternative options]
[Internal engineering data]. Unpublished.

2.3.4 Traction Substation Location Alternatives

33. Six options were considered for the location of the TSS-1 of the SBT Section and eventually narrowed down to two (**Figure 2.3.1**).

34. The two options that were subject to the final evaluation are Option A and Option B. Ultimately, Option B was chosen as the location of TSS-1 due to its proximity to the power source (Meralco substation) and to both SB and BT sections. **Table 2.3.3** shows the items considered in the final selection of the TSS-1 location.



Source: JICA Design Team (2020). [Comprehensive detail of all proposed SBT Section TSS-1 location options]
[Internal engineering data]. Unpublished.

Figure 2.3.1 TSS-1 Location Alternatives

Table 2.3.3 TSS-1 Location Alternative Comparison

	Item	Option A	Option B (Preferred)
Design	TSS-1 area	Approximately 3,500 m ²	Approximately 3,000 m ²
	Facility arrangement	The arrangement of the substation equipment and building is affected by future viaduct structure for the Solis-Tutuban (ST) section. The effects of the existing high voltage power lines of over TSS-1 need to be investigated.	The arrangement of the substation equipment and building is not affected by the future viaduct structure for ST Line.
	Power supply route	Necessity to consider underground power cables between the existing PNR line and future connection (ST) in case of receiving power from nearby MERALCO substation. Due to long distance from the location to Tutuban line, train operations may be restricted due to voltage drop.	Longer cables to Tutuban line but access to the MERALCO substation is easier than Option A.
	Required Design Period	Design period of 5.5 months with additional topographic survey and geotechnical investigation of about 3 to 6 months (might impact bidding schedule). Longer period than Option B.	Design period of 5.5 months. No additional topographic survey and geotechnical investigation required.
	Compatibility to development plan	Required to check compatibility of future viaduct and existing high voltage power lines.	No effect to the future viaduct structure.
Social	Land use	Residential, Road ROW	Residential, PNR ROW
	Land Acquisition	Required for 0.35 ha. Land acquisition costs approximately PHP 100.56 M.	Required for 0.30 ha. Land acquisition costs approximately PHP 146.65M.
	Affected Structures/ Households	About 84 structures (including medium-rise housing)	Less impact than Option A. About 44 housing structures/ 42 households
	Cultural Heritage	Near the Solis Signal Tower (Casitas de Tondo).	No cultural heritage structures within or near the substation location.
Environment	Protected Area	No nationally or locally declared protected area along the ROW.	No nationally or locally declared protected area along the ROW.
	Ecosystem	Threatened/ endemic species were recorded throughout the alignment which are widely available in Philippines. The ecosystem is highly urbanized and not a natural habitat due to the presence of a road and built-up areas mostly residential with a few trees/vegetation and the project area is not considered important habitat for the threatened species identified.	Threatened/endemic species were recorded throughout the alignment which are widely available in Philippines. The ecosystem is highly urbanized and not a natural habitat due to the presence of built-up areas mostly residential with a few trees/vegetation and the project area is not considered important habitat for the threatened species identified.
	Flooding	No inducement of existing flooding conditions in the area due to above-flood level clearance based on the climate change and flood levels based on 100-year flood hazard.	No inducement of existing flooding conditions in the area due to above-flood level clearance based on the climate change and flood levels based on 100-year flood hazard.
	Noise & Vibration	The traction substation is not expected to cause significant noise and vibration. No effect to nearby sensitive receptors due to minimal noise generation from equipment and employees during operation.	The traction substation is not expected to cause significant noise and vibration. No effect to nearby sensitive receptors due to minimal noise generation from equipment and employees during operation.
	Air Pollution	Air pollution is expected primarily due to fugitive dust emissions during construction but can be mitigated.	Air pollution is expected primarily due to fugitive dust emissions during construction but can be mitigated.
	Water Pollution	Water pollution is not expected as the nearest waterbody (Antipolo Creek) is approximately 120 m away from the proposed location. No	Nearest waterbody is approximately 10 m away from Antipolo Creek and might cause impact during construction but measures to

Item		Option A	Option B (Preferred)
		groundwater sources are utilized as extraction is prohibited due to depleted groundwater table.	mitigate the impact will be implemented. No groundwater sources are utilized as extraction is prohibited due to depleted groundwater table.
Construction	Accessibility to site	Accessible through Dagupan Extension as it is directly traversed	Accessible through an internal road within PNR ROW connected with Antipolo Street and requires additional access road to MERALCO and triangle area
	Cost	PHP 931 million	PHP 989 million
Evaluation of Options		Not recommended considering longer design period, additional cost for surveys, number of PAPs, and compilation of power supply.	The Option is preferred due to the following considerations: No required additional topographic survey and geotechnical investigation that may impact project schedule and cost. Easy access to a nearby MERALCO substation. Lower number of affected households and structures.

Source: JICA Design Team (2020). [Comprehensive detail of all proposed SBT Section TSS-1 location options]
[Internal engineering data]. Unpublished.

2.4 PROJECT COMPONENTS

35. The main components of the SBT Section include the 1.04-km SB Section, 0.53-km BT Section, and the 3,000-m² TSS-1. A description of these components, along with the supporting facilities, power supply system, communication system, emergency system, temporary facilities, and pollution control devices of the Project are presented below.

36. The Solis, Blumentritt, and Tutuban stations have been previously assessed and are already covered by their respective ECCs hence are not part of this SBT Section assessment.

2.4.1 Main Railway Line

2.4.1.1 Tracks

37. The skeleton track alignment of the SB and BT sections are shown in **Annex B-1 (Figure B-1)**. The railway tracks are equipped with elastic prestressed sleeper fixed on concrete bed.

2.4.1.2 Structure Type

(1) Viaduct

38. Both the SB and BT sections are proposed to be constructed as elevated viaducts with cast in-situ/pre-cast segmental pre-stressed box girder based on an assessment of potential environment impacts, cost efficiency, erection time, ground condition, and the project site's susceptibility to flooding. The cast in-situ/pre-cast segmental pre-stressed box girders for installation are estimated to have a span length of about 40 m and are typically designed as shown in **Annex B-1 (Figure B-2)**. An illustration of the cast in-situ/pre-cast segmental box girder is presented in **Annex B-1 (Figure B-3)**. The structural form for the superstructure covers box concrete, box steel rebar and box post tensioning while the structural form for substructure covers pier head, pier stem and pilecap concrete and rebar.

39. The schematic profiles of the SB and BT sections in **Annex B-1 (Figure B-4)** shows railway elevation ranging from 15 to 30 m.

2.4.2 Railway System

2.4.2.1 Train Operation

40. The NSCR Project system offers three types of train service: the commuter train, the commuter express train and the airport limited express train. Solis Station and Tutuban Station are under the NSCR Project and Blumentritt Station under the NSCR Calamba Ex Project.

41. The SB Section is a double track railway viaduct that runs along the NSCR Project line with one track going northwards to Solis Station, while the southbound track leads towards the Blumentritt Station of the NSCR Calamba Ex Project. The BT Section lies on a separate single track railway that has a northbound track going to Blumentritt Station, and a southbound track going towards Tutuban Station. However, only one train is currently planned to run from Tutuban to Blumentritt and vice versa, scheduled every hour.

42. The technical specifications of the electrical and mechanical system for the SBT Section are presented in **Annex B-1 (Table B-1)**.

2.4.2.2 Rolling Stock

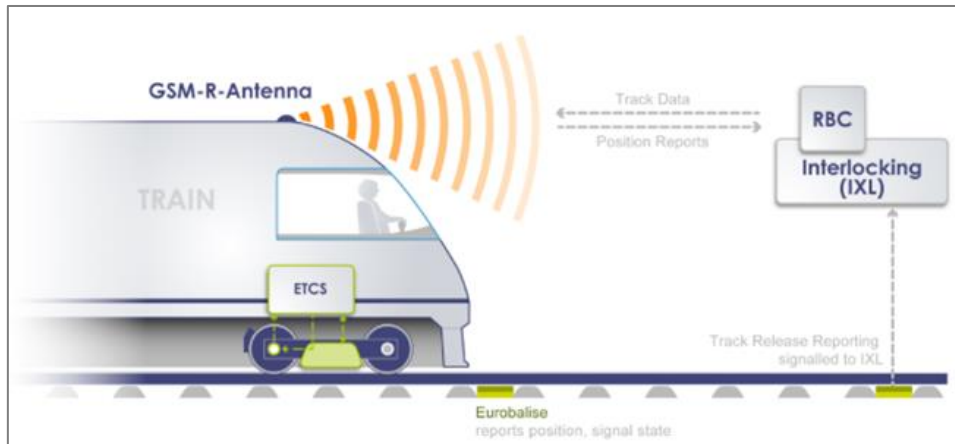
43. The commuter rolling stock has a capacity of not less than 2,242 passengers (seating + standing) per train set, has an operational speed of 120 km/hr, and is fully air-conditioned. The projected number of rolling stocks for BT Section by 2025 are listed in **Annex B-1 (Table B-2 and Table B-3)**. Other specifications of the commuter train are shown in **Annex B-1 (Table B-4 and Table B-5)**.

2.4.2.3 Signaling System

44. The European Train Control System (ETCS) Level 2 (L2) is used as the signaling system for the NSCR Project and therefore applied to the SBT Section. ETCS L2 is a digital radio-based signal and train protection system that uses Global System for Mobile Communications - Railways (GSM-R) based communication system to determine the position of the train, direction of travel, and issuance of movement authority. The system works with other functions such as Automatic Train Protection (ATP), Automatic Traffic Supervision (ATS) and Computer Based Interlocking (CBI). The train is continuously sending data to the Radio Block Centre (RBC) to report its exact position and direction. Eurobalises are used as passive positioning beacons. Trains refine their position with additional sensors such as accelerometers, odometers, or radar⁵. Based on GSM radio technology, GSM-R uses exclusive frequency bands to communicate the train with traffic control centers and devices beside the track⁶. **Figure 2.4.1** shows the schematic diagram of ETCS Level 2.

⁵ Thales Group (2021). *European Train Control System (ETCS)*. Retrieved April 6, 2021 from <https://www.thalesgroup.com/en/european-train-control-system-etcs>

⁶ European Commission (2017). *Delivering an effective and interoperable European Rail Traffic Management System (ERTMS) the way ahead*. Retrieved April 6, 2021 from <https://ec.europa.eu/transport/sites/transport/files/swd20170375-ertms-the-way-ahead.pdf>



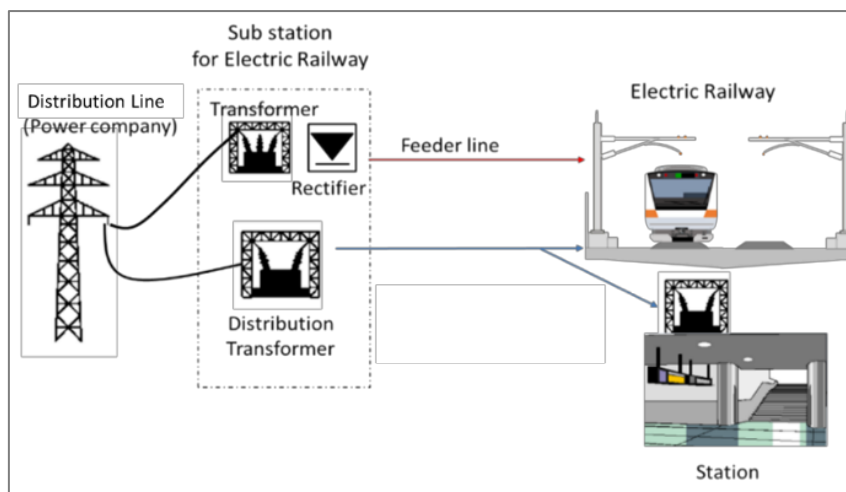
Source: Thales Group (2021). *European Train Control System (ETCS)*. Retrieved April 6, 2021 from <https://www.thalesgroup.com/en/european-train-control-system-etcs>

Figure 2.4.1 Schematic Diagram of ETCS Level 2

2.4.2.4 Power Supply System

(1) Receiving Power

45. The overall NSCR Project, including the SBT Section, requires a DC 1,500V supplying system in consideration of its compatibility with adjoining railway projects, the number of operating trains, interoperability, and total investment cost of rolling stocks and substations. Power is supplied by two lines from the power electric distribution companies of each jurisdiction area. For the SBT Section, the service provider is the Manila Electric Company (MERALCO). Adequate redundancies in the transmission and distribution of power are incorporated in the detailed design stage to ensure reliable power supply during operation. **Figure 2.4.2** illustrates the schematic chart of DC-type power supply system. The specific power supply schematic diagram for the SBT Section is shown in **Annex B-1 (Figure B-5)**.



Source: JICA Design Team (2021) *Signaling, Power Distribution, Power Supply and Communication System* [Internal engineering data]. Unpublished.

Figure 2.4.2 Schematic Chart of Power Supply System (DC type)

(2) Traction Substation (TSS-1)

46. A traction substation is required to be installed to secure stable power supply for the overhead contact system (OCS) of the SBT Section railway. The TSS-1 has an area of approximately 3,000 m²

located along the viaduct south of the SB Section as illustrated in **Annex B-1 (Figure B-6)**. The TSS-1 is the only supporting facility for the SBT Section.

47. The TSS-1 includes building a concrete retaining wall, raising the level, piling foundations to buildings and equipment, construction of an equipment building, outside equipment foundations, and installation of the various transformer equipment.

48. Specific to the TSS-1 equipment building, the foundation of bored piles deeper than 22 m and outside the equipment are provided with stable foundation. The methods to be used for the bored piles/foundation installation depend on the method statement to be proposed by the contractor.

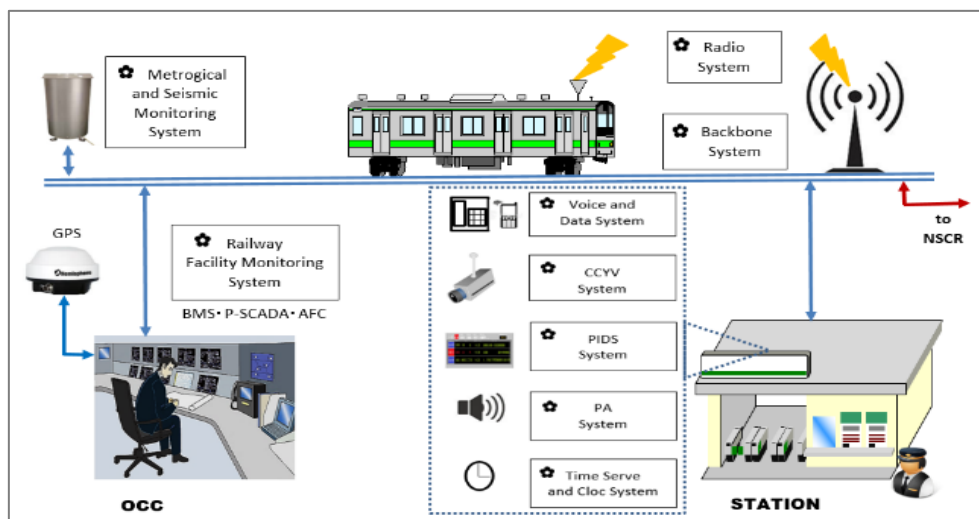
49. The ground level at TSS-1 is raised to 2 m with a surface treatment of 100 mm of gravel. The Equipment building and outside equipment is built on foundation structures that are a further 2.350 m above the finished ground level, ensuring equipment is 4.350 m above the existing ground levels and above expected flood levels.

(3) Power Distribution

50. The power distribution system is installed along the track to supply power to the various facilities involved in the operation of the SBT Section (e.g. station, signal equipment room, communication equipment room, etc.). The proposed TSS-1 located between Solis and Blumentritt converts the electric power from MERALCO to provide an appropriate voltage, current type, and frequency for the SBT Section.

2.4.2.5 Communication System

51. The communication system is an integral part of the safety and functionality of the train operation and convenience of passengers with connections among relevant railway facilities and systems. The railway system including the SBT Section utilizes a digital radio communication system and an optical fiber network for the railways and relevant stations. **Figure 2.4.3** presents the communication system overview.



Source: JICA Design Team (2021). *Signaling, Power Distribution, Power Supply and Communication System* [Internal engineering data]. Unpublished.

Figure 2.4.3 Communication System Overview

2.4.3 Supporting Facilities

2.4.3.1 ROW Boundary and Access Roads

(1) Maintenance Road and Boundary Fence

52. The railway corridor, or Project ROW, are identified and protected through the installation of a boundary fence along the ROW boundary. The fence is a wire mesh type with a height of 2.6 m.

53. A concrete maintenance road is laid over the entire length of the Project ROW. Construction time proceeds after the completion of the viaduct. The pavement for use constitutes 200 mm thick concrete with a 200 mm base course on one or other sides of the longitudinal drainage system. The width of the road measures 5 m including the drainage system.

(2) Road Realignment of Old Antipolo Street

54. Old Antipolo Street is an existing street in Barangay 228 which is partly located within the Project ROW. The street is connected to Batangas Street via Laguna Street. The location of Old Antipolo Street within the Project ROW overlaps with the construction space required for the viaduct erection. As a result, Old Antipolo Street was proposed to be realigned and included completely within the NSCR Calamba Ex Project ROW by connecting it to the existing Yuseco Street as shown in **Annex B-1 (Figure B-7)**. By connecting it to the existing Yuseco Street, the new road can be utilized for public use and as a maintenance road for the viaduct. For emergency purposes, the road is also designed as a fire lane with a road width of 6.1 m in accordance with the Fire Code of the Philippines.

55. The road realignment is designed for low speed and be all-weather. The completed realigned road level of Old Antipolo Street follows the existing road level and tie-in at the demarcation line with CPS-01 and the existing Yuseco Street. During the construction of NSCR Calamba Ex Project, Old Antipolo Street is closed to automobiles, but a public passage access is secured for locked-in residents since the ROW in the curve passes through landlocked areas where existing houses are located. A public access of 2.0 m offset within the ROW is provided to allow residents to access their houses. The Contractor secures the public access which kept open to the residents during construction.

56. During the construction of the piers adjacent to Yuseco Street for the NSCR Project, the PNR temporary track occupies a part of the new road area. After the construction of these piers, the PNR track is shifted towards NSCR Calamba Ex Project piers, and space for the new Old Antipolo Street is secured.⁷

57. The realignment of Old Antipolo Street also requires the relocation of the South Antipolo Canal. As such, the structure of the new canal is designed as a box culvert, while the new relocated and improved Old Antipolo Street is allocated on the box culvert canal. A typical cross section of the road realignment is shown in **Annex B-1 (Figure B-8)**. The carriageway of the road measures 6.1 m wide.

(3) Construction of Access Road to MERALCO

58. Additional access roads are constructed to access the SBT triangle area and MERALCO as shown in **Annex B-1 (Figure B-9)**.

2.4.3.2 Drainage Facilities

59. Drainage design objectives for the SBT Section include: (1) ensuring that the viaduct structures take runoff from the rail area to the identified discharge points, (2) introducing applicable improvement

⁷ Design Report on the Realignment of Old Antipolo Street (JICA Design Team, April 2021)

to canal/estero affected by the alignment and thus not contribute to any increased flood risk, (3) ensuring that drainage channels are not impeded during construction and (4) incorporating climate change into the design. Based on the drainage design report for the SBT Section, increase in the rainfall intensities is approximated at 10.0% to 20.0% based on Section 9 (Climate Change) of DPWH Design Guidelines, Criteria, and Standards (DGCS) Volume 3 (Water Engineering Projects) (2015). However, PAGASA's climate change projection (2011) suggests an increase in precipitation of 0.9 % to 63.0% for Luzon. As such, the average increase of these rainfall intensities is rounded up to 20.0%.⁸

60. The drainage systems of the SBT Section consist of exterior storm drainage and pavement surface drainage. The exterior storm drainage system collects and conveys surface discharge from viaduct located drainage systems. The pavement surface drainage system collects and conveys surface runoff discharge from maintenance roads or paved surfaces through curb inlet gullies and drainage pipelines.

61. At-grade drainage is designed on one side of the Project ROW in consideration of the future plan of the DOTr and PNR to construct a freight rail parallel with the Project.

(1) Realignment of South Antipolo Canal

62. The relocation of the Old Antipolo Street requires the realignment of the South Antipolo Canal and improvement of PNR reinforced concrete box culvert (RCBC) that is connected to Estero de Kabulusan.

63. The section of the proposed temporary drainage during construction and the new box culvert drainage design that replace the open canal are shown in **Annex B-1 (Figure B-10 and Figure B-11)**. The drainage realignment plan is shown in **Annex B-1 (Figure B-12)**.

64. A roughness coefficient value of 0.015 was applied to rectangular and circular reinforced concrete conduits (open and closed channels, and pipes) for the mainline at-grade drainage. The selection of the most appropriate structure was based on the existing topography and outfall elevation. All mainline at-grade drainage discharges by gravity. The re-aligned canal is designed or sized based on the drainage calculation using Manning's equation.

2.4.4 Emergency System and Design Application

65. The Emergency System of the SBT Section is part of the overall Emergency System of the NSCR Project. These include the following:

Table 2.4.1 Emergency System of SBT Section

System Application	Description
Emergency Generator	Emergency generators are installed to ensure the continuous supply of power in the event of fire, outage of an electric power company, or other disasters. Emergency power are automatically supplied using emergency generator within 10 seconds of detecting a power failure.
Weather and Seismic Monitoring System	This system consisting of rain gauge, seismograph, and water level sensors are installed to monitor natural disasters such as typhoons or earthquakes that may cause potential damage to the railway facilities and threaten the safety of passengers.
Public Address System	This system includes announcements on the status of train operations, precaution against trains approaching, and announce incidental information from Operations Control Center (OCC) and/or each local station for the safety and convenience of passengers. Speech generating devices are used for pre-recorded messages as needed.

⁸ Design Report for Drainage (Re-Design of Solis-Blumentritt-Tutuban) (JICA Design Team, April 2021)

System Application	Description
Design Application (i.e., emergency stairs)	Emergency stairs are provided on the viaduct as an evacuation route from the viaduct to the ground if the distance between stations is large and it is impractical to walk back to the nearest station. The emergency stairs are made of a concrete structure with cast-in-place pile, and footings and pier. It is constructed after completion of the viaduct erection, but the foundation and footing are constructed at the same time as the viaduct foundation work. The bridge piers and superstructures are constructed after the completion of viaducts as they interfere with temporary stock of viaduct segments.

Source: JICA Design Team (2020). *Environmental Impact Statement for North-South Commuter Railway Calamba Extension Project* (Volume I. Main Report).

2.4.5 Temporary Facilities

2.4.5.1 Construction Yard

66. A temporary construction yard of approximately 38,000 m² is located outside the ROW. The temporary facilities within the temporary construction yard are listed in **Table 2.4.2**.

67. The Contractor secures separate ECCs for the Rebar, Form Fabrication Yard, Batching Plant and Segment Casting Yard. The Contractor is also responsible for identifying the sites for the facilities. Selection of sites for construction camps and other construction facilities is to have sufficient distance of sensitive receptors such as residential housing areas, hospitals, schools, religious and cultural sites. The inclusion of the batching plant may not be required due to the small quantity of concrete needed.

Table 2.4.2 Temporary Facilities within the Temporary Construction Yard

Temporary Facility	Area (m ²)
Office (Contractor & Engineer), Laboratory	2,000
Workers' Quarter (400 workers)	3,000
Batching Plant	7,000
Warehouse	1,000
Rebar, Formwork Fabrication Yard	2,000
Segment Casting Yard	13,000
Storage Area	10,000
Total	38,000

Source: JICA Design Team (2021). *CP05c Construction Report* (Final) [Internal engineering report]. Unpublished.

68. Site offices, batching plants and segment casting yards need to secure the corresponding documents for the application of water and electricity supply. The provision of generators and water tanks may be necessary as well.

(1) Site Office

69. A main site office should be set up within the construction site so that the Contractor and Engineer can easily monitor daily construction activities. As for a laboratory, there is an option of sub-contracting the work. Thus, setting up a material laboratory in the temporary yard is evaluated at a later stage.

70. A satellite office may be needed when the main site office is far from the construction site. It is typically a container office equipped with electricity, water, and toilet facilities. A supervisor is stationed at this satellite office at all times.

(2) Warehouse, Storage, and Segment Casting Yard

71. Securing a segment casting yard is vital for the construction of the viaduct section. A casting yard is a confined area where all the concrete structures like segments, I-girders/ beams, and the like are casted. Fabricating segments in a separate area removes casting operations from the construction critical path and increases work efficiency by reducing overall construction time.

72. Materials for long time use are stored and managed in a material warehouse or a storage yard provided near a segment casting yard. Anti-theft measures are taken since important materials and equipment are stored in the warehouse. It should also be noted that temporary storage of machinery in flood-prone areas must be avoided, and machinery must be transferred to safe areas after the end of each working day.

73. A rebar & form fabrication yard is located within or near the construction site to reinforce the yard using concrete as a measure against heavy rain.

(3) Workers' Quarters

74. Should the specific SBT segment require workers' quarters, contractor with the supervision of DOTr complies with the DOLE guidelines governing OSH in the construction industry on the provision of suitable living accommodation facilities for workers. Hygiene management of the workers' quarters and impacts to the neighborhood is considered when constructing this facility. This includes consideration during and after the construction period where proper decommissioning of this facility is expected.

(4) Batching Plant

75. Based on site investigations, there are several suppliers of ready-mix concrete along the project alignment. The quality of concrete should be satisfactory since these supplier supply concrete to private companies and the DPWH. These suppliers provide various strength of concrete, low-strength to high-strength (8,000 psi), and they can provide 50 MPa concrete which are used in this project. As a result of interviews with these suppliers, it is assumed that they can supply sufficient concrete.

76. Provided that a contract package is 16 km and this is the only one segment casting yard, a batching plant may be provided in a segment casting yard to secure stable supply of concrete for fabrication of precast segments.

2.4.6 Pollution Management and Other Built-In Measures

77. The Project is expected to generate varying degree of impacts during construction and operation phases. The SBT section is expected to comply with local environmental rules and regulations on pollution control as well as mitigation measures as those stated in the Environmental Management Plan of this supplemental EIA (**Chapter 7**).

78. Built-in measures are referred to this report as those that has been considered in the engineering design of the Project intended to address significant environmental concerns that may affect the Project or may be caused by project activities. Built-in measures for this project focused on the following operational impacts:

- Flood risk
- Liquefaction
- Noise and vibration

79. Designing the SBT Section railway as a viaduct fully addresses concerns on flood risks due to increase in rainfall and extreme weather events induced by climate change and avoids costly flood control measures by as compared to developing an at-grade railway. Similarly, the proposed TSS-1 is constructed with a raised ground in consideration to possible flooding in the area. The final consideration to build the railway on a viaduct as opposed to at-grade structure also addresses concerns on possible impact of liquefaction.

80. With any railway system, noise and vibration is usually a concern of nearby sensitive receptors. Noise is mainly generated due to the interaction of the wheel and rail surfaces. The vibration caused by the interaction radiate sound from the wheels and the rail and other vibrating surfaces including parts of the rail car sides, suspension, etc. The railway project is designed with elastic fastener that can reduce the vibration and absorb the impact energy. Elastic railway fasteners work under repeated and alternating stresses as they are resistant to bending, torsion, fatigue, and corrosion.

81. Aside from the elastic fasteners which address noise and vibration due to wheel and rail interaction, a parapet wall is installed in either side of the viaduct which also act as a noise barrier.

2.4.7 Historical and Cultural Heritage

82. The Casitas de Tondo, or Solis Signal Tower, constructed around the late 19th to early 20th century, in Tondo, Manila, is the only historic structure directly affected by the SBT Section that was identified and assessed for the NSCR Project (Malolos-Tutuban) based on the NSCR Project Summary Paper (Preservation of Old PNR Buildings) (June 2017). The structure is situated within the PNR ROW and lies along the SB Section. To address destruction and damage risks, the Casitas de Tondo was decided to be relocated and incorporated in the design and station plan of the Tutuban Station of the NSCR Project based on the approval of the National Historical Commission of the Philippines (NHCP) on December 7, 2018. DOTR, through its Contractor, conducts the relocation and conservation works prior to construction. The conservation of the structure is done in close coordination with the NHCP, National Commission for Culture and the Arts (NCCA), and/or National Museum (NM) of the Philippines.

2.5 UTILITY AND OTHER RESOURCE REQUIREMENTS

2.5.1 Fuel Requirement

2.5.1.1 Construction

83. Fuel requirement during construction is estimated at 3,908 kL for the use of heavy equipment, transport, and service vehicles. **Table 2.5.1** shows the estimated fuel consumption per type of work during construction.

Table 2.5.1 Estimated Fuel Consumption during Construction

Construction Works	Estimated Fuel Consumption (kL at 70.0% load factor)
Site Preparation Works	152.80
Temporary Road Work above the Canal	34.31
Cast in situ Pile Construction	793.92
Footing Construction Machine	1056.81
Column Construction Machine	276.30
Pierhead Construction Machine	189.21

Construction Works	Estimated Fuel Consumption (kL at 70.0% load factor)
Erection of Box Girder Segment	576.53
Cast in Place Box Girder	191.02
Fabrication of Segment	414.29
Viaduct Drainage	95.92
Finishing Maintenance Road/ Fencing	10.63
Project Office	152.80
Total	3,908.27

Source: JICA Design Team (2021). *SBT Consumption Expectation* (Version 1) [Internal engineering data]. Unpublished.

2.5.1.2 Operation

84. Main power source for the Project is from MERALCO. Fuel requirement during operation is minimal and used for back-up generators at stations during power interruption and for the service vehicles for the overall NSCR Project. Fuel requirement during operations stage is estimated at 20,000 liter/per year.

2.5.2 Power Supply

2.5.2.1 Construction

85. Power supply is sourced using electricity source tapping or using a generator set. Contractor is required to submit an environmental and safety management plan for the use of generator sets. The estimated power requirement during the construction phase is 1,453,680 kWh. **Table 2.5.2** provides the breakdown of the power consumption.

Table 2.5.2 Estimated Power Consumption during Construction Phase

Site Office appliances	(Nos)	(W)	(Wh)	(kWh)	Daily (12 h)	Monthly (26 days)	36 months
Room Light	100	60	6,000	6.0	72.0	1,872	67,392
Computers	50	150	7,500	7.5	90.0	2,340	84,240
Pantry	3	500	1,500	1.5	18.0	468	16,848
Copy Machine	2	70	140	0.1	1.7	44	1,584
Printer	2	35	70	0.1	0.8	22	792
Air Conditioner	15	3300	49,500	49.5	594.0	15,444	555,984
Total (Contractor + Engineer Site Offices)							1,453,680

Source: JICA Design Team (2021). *SBT Consumption Expectation* (Version 1) [Internal engineering data]. Unpublished.

2.5.2.2 Operation

86. The estimated power requirement for the SBT section during the operation phase is included in the overall consumption estimate for the NSCR Project system. Assuming an annual power consumption rate of 415,136 kWh per kilometer of the railway and that 80.0% of the calculated total consumption is used during operation, the SBT Section is predicted to consume 464,952 kWh every year in the operation phase. The proposed TSS-1 provides the power requirement of the SBT section.

2.5.3 Water Supply

2.5.3.1 Construction

87. The total water consumption during the construction phase is calculated to be approximately 61,906 kL. This calculation provides an estimated monthly water consumption of 1,673 kL/month. **Table 2.5.3** provides a breakdown of the water consumptions.

Table 2.5.3 Estimated Water Consumption during Construction Phase

Description	Unit	Water Requirement for SBT	Remarks
Concrete Volume	liter (L)	32,765	Concrete Volume from BOQ
Water Usage	L	1,000	Water usage on site (may include water needs for bentonite mixing, dust suppression, cleaning before concreting, curing concrete, etc.)
Water Consumption at Site	kL	32,765	
Personal Consumption (Site)	man-day	101,452	
Water Usage	L/day	200	200 liter/man/day
Water Consumption at Site	kL	20,290	
Personal Consumption (Office)	man-day	44,252	average 46 man/office, 36 months
Water Usage	L/day	200	200 liter/man/day
Water Consumption at Site	kL	8,850	
Total	kL	61,906	36 months

Source: JICA Design Team (2021). *SBT Consumption Expectation* (Version 1) [Internal engineering data]. Unpublished.

2.5.3.2 Operation

88. Water requirement during the operation stage in the SBT section is minimal. TSS-1 is also unmanned most of the time except for periodic inspection and required maintenance. Two flushing toilets are built in the design of the TSS-1 primarily for domestic use of visiting inspectors and other staff or guests on rare occasion, therefore water consumption is considered as almost nil.

2.5.4 Construction Materials

89. The construction materials such as sand, steel, cement, etc. are sourced locally. On the other hand, the railway tracks are sourced outside the Philippines. Molds and erection girder are fabricated through outsourced skilled experts from overseas.

2.5.5 Existing Utilities Within ROW

90. The existing utilities within the ROW include overhead high voltage cables, telephone and communication cables and water lines. Cables, especially high voltage cables that obstruct construction activities are considered for relocation. Sufficient time are allotted for the relocation including consultations with relevant utility agencies and/or companies.

2.6 PROJECT SIZE

91. The summary of the footprint of the SBT Section and its ancillary facilities during the construction and operation phases are shown in **Table 2.6.1**. The SBT Section has a total length of 1.57

km and an area of approximately 4.17 ha during operations (including TSS-1). The required ROW width of the railway track is set at a minimum of 15 m up to a maximum of 30 m along the alignment of both sections.

Table 2.6.1 SBT Section Project Size

Component	Approximate Length (km)	Approximate Area (ha)
SB Section – including TSS-1	1.04	2.82
BT Section	0.53	1.35
Total	1.57	4.17

Source: Department of Environment and Natural Resources (2021). *Minor ECC Amendment for the DOTr's North-South Commuter Rail (NSCR) with Alignment from Malolos to Tutuban* (ECC-CO-1503-0013). Retrieved August 27, 2021 from https://www.jica.go.jp/english/our_work/social_environmental/id/asia/southeast/philippines/c8h0vm000097bksx-att/c8h0vm0000faggqm.pdf.

2.7 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAME

2.7.1 Project Phases

92. The SBT Section is a component of the NSCR Project hence its development is contingent on the overall development plan and schedule of the 37.90-km commuter rail. The major development phases of the SBT Section include the pre-construction phase, construction phase, operation phase, and decommissioning and abandonment phase. Activities associated with each of these phases are described in **Table 2.7.1**.

Table 2.7.1 List of Activities per Project Phase

Phases	Activities
Pre-Construction Phase Activities prior to construction include preparatory works like feasibility study and detailed engineering design.	• Land acquisition for the Project ROW • Resettlement of project-affected persons (PAPs) • Bidding and selection of General Consultant (GC) and Contractors • Preparation and review of site-specific Construction Environmental Management and Monitoring Plan (CEMMP) based on the EMP in the NSCR Project EPRMP (2015) and Supplemental EIA Report (2021) including Construction Plan, Drainage Plan, Traffic Management Plan (TMP), Waste Management Plan, Soil Management Plan, Emergency Preparedness and Response Plan, Occupational Health and Safety Plan, Energy and Water Conservation Program, etc. • Review of detailed design and updating of EIA as required • Conduct of 100% tree inventory and obtaining of tree cutting permit (TCP) • Utility Diversion Planning especially in open cut areas and viaduct sections if there is utility line. Overhead high voltage cables, telephone and communication cables exist inside and near the Project area. These cables need to be treated during construction planning stage especially high voltage cables. Those cables that obstruct construction activities must be relocated. Sufficient time are allocated for the relocation including consultation with relevant utility agencies. Exact locations of underground water pipes are checked through information gathering and trial excavations etc. • Identification and acquisition of construction yards for temporary facilities and other construction-related activities (outside ROW) • Conduct of environmental baseline surveys in identified temporary construction yards outside the Project ROW • Conduct baseline condition survey for concerned buildings within Project ROW and those adjacent or close to the Project ROW and temporary construction facilities with significant vibration source • Acquisition of Permits (e.g. Tree Cutting Permit, Building Permit, etc.) • Procurement of construction materials, rolling stock and E&M • Implementation of mitigation measures for pre-construction activities

Phases	Activities
	• Establishment and implementation of a grievance redress mechanism (GRM) • Conduct of public participation and involvement activities based on the local and international frameworks on public involvement and information disclosure such as IEC campaign, public consultations/ stakeholder consultation meetings to inform stakeholders (local establishments, local authorities, affected PAPs and community) on construction schedule and activities, potential environmental impacts, mitigating measures and GRM procedure • Hiring of Third Party Auditor (TPA) and External Monitoring Agent (EMA) • Finalization of Social Development Plan (SDP)
Construction Phase	• Preparation of the construction site which involves site clearance and grubbing/clearing of existing vegetation, demolition/ removal of existing structures along the project alignment, fencing and surface treatments, fitting of track works and catenary, and other earth-moving activities • Shifting of PNR rails • Preservation and relocation of Casitas de Tondo • Conduct of archaeological watch during excavation works • Transport of construction-related materials • Manufacturing of girder for elevated section • Construction of the railway tracks and viaduct structures, TSS-1 and temporary facilities • Road realignment of Old Antipolo Street and South Antipolo Canal • Implementation of environment mitigation measures, monitoring of construction activities. • Implementation of Traffic Management Plan • Monitoring and reporting to EMB and JICA • Public involvement and information dissemination • Provision of livelihood and income restoration to PAPs • Selection of Operator and training of staff
Post-Construction Phase	• Demolition of all temporary structures and facilities • Decommissioning and removal of construction machinery and equipment from the site • Clean-up and restoration/rehabilitation activities • Implement the EMP and EMoP • Monitoring and reporting to EMB and JICA • Public involvement and information dissemination
Operation Phase	• Test runs of the trains • Commercial operation (optional) • Maintenance work of passenger facilities such as the station, rolling stock, E&M System including power supply system, Automatic ticketing system • Implement the EMP and EMoP • Monitoring and reporting to EMB and JICA • Public involvement and information dissemination
Abandonment Phase (unlikely event that the operation of the Project is no longer deemed feasible to operate and maintain)	• Prepare and implement a decommissioning or abandonment plan • If soil contamination is present, the area is to be decontaminated through appropriate measures. The green buffer zone must be retained. • Monitoring and reporting to EMB and JICA • Public involvement and information dissemination

Source: JICA Design Team (2021). [Details on activities per project phase] [Internal engineering reports]. Unpublished.

2.7.2 Project Phases

2.7.2.1 Construction Package

93. As of July 2021, the building and civil engineering works for the viaduct structure of the SBT Section is included in one (1) contract package (CP-05). This is based on the size and nature of works taking into consideration the expected contract amount, required equipment, human resources as well as the financial standing of the expected eligible bidders.

2.7.2.2 Construction Schedule

94. The schedule of package CP-05 is presented in **Table 2.7.2**. The construction will commence upon securing all the needed regulatory requirements.

Table 2.7.2 Viaduct Construction Schedule as of April 2021

CP-05	2021	2022												2023												2024					
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Land Handover Initial Survey																															
Site Preparation																															
Geotechnical Investigation & Pile Load Test																															
Piling																															
Pile cap Construction																															
Column																															
Pierhead																															
Superstructure & CIS																															
Finishing work (including Deck Furniture)																															

Source: JICA Design Team (2021). CP05c Construction Report (Final) [Internal engineering report]. Unpublished.

95. The construction of the SBT Section is expected to be completed within 36 months. Thirteen months is set for the construction of the superstructure works. The overall schedule was planned based on 6 days per week, 24 hours per day and 70 percent of workability for holidays and inclement weather work setup. The key dates for the construction schedule are presented in **Table 2.7.3**.

Table 2.7.3 Key Dates for the Construction Schedule

Key Date	Month No.	Description
KD1	17	Provision of access to substation/ sectioning post to allow CPNS01 E&M Systems to commence power supply installation
KD2	22	Provision of access to station electrical rooms including power distribution rooms, cable rooms and related galleries/ ducts for CPNS01 to commence installation works
KD3	22	Provision of access to station areas to allow CPNS01 to commence cabling installation including signaling, communications, AFC, etc.
KD4	24	Completion of all viaduct/ bridges, including parapets, etc. and provision of access to allow CPNS01 to complete their track works
KD5	25	Provision of access to station equipment rooms including signaling, communications, UPS, AFC, etc. including galleries/ ducts to allow CPNS01 to commence installation works
KD6	26	Provision of access to station concourse/ platform paid and unpaid areas to allow CPNS01 to commence installation works
KD7	32	Provision of access to all viaduct/ bridges, station to allow CP03 and CPNS01 to commence integrated testing and commissioning using rolling stock
KD8	35	Provision of access to all viaduct/ bridges, and stations to allow the operator with CP03 and CPNS01 Contractors' support to commence trial run
KD9	36	Completion of the whole works

Source: JICA Design Team (2021). CP05 Package Key Dates [Internal meeting]. Unpublished.

2.8 WORK FORCE

96. The SBT Section of the NSCR Project requires approximately 426 skilled and non-skilled workers during the pre-construction and construction phases. During operations, the manpower requirement for the SBT Section is part of the overall workforce of the NSCR Project, estimated at 300 employees. These staff are responsible for manning the stations, operating and maintaining the NSCR Project and trains at the depot.

2.9 INDICATIVE PROJECT INVESTMENT COST

97. The indicative project cost for the SBT Section of the NSCR Project as of July 2021 is estimated at Sixteen Billion Four Hundred Seventy Four Million Pesos (PHP 16,474,000,000.00).

3 LEGAL AND INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL IMPACT ASSESSMENT

3.1 THE PHILIPPINE ENVIRONMENTAL IMPACT STATEMENT SYSTEM

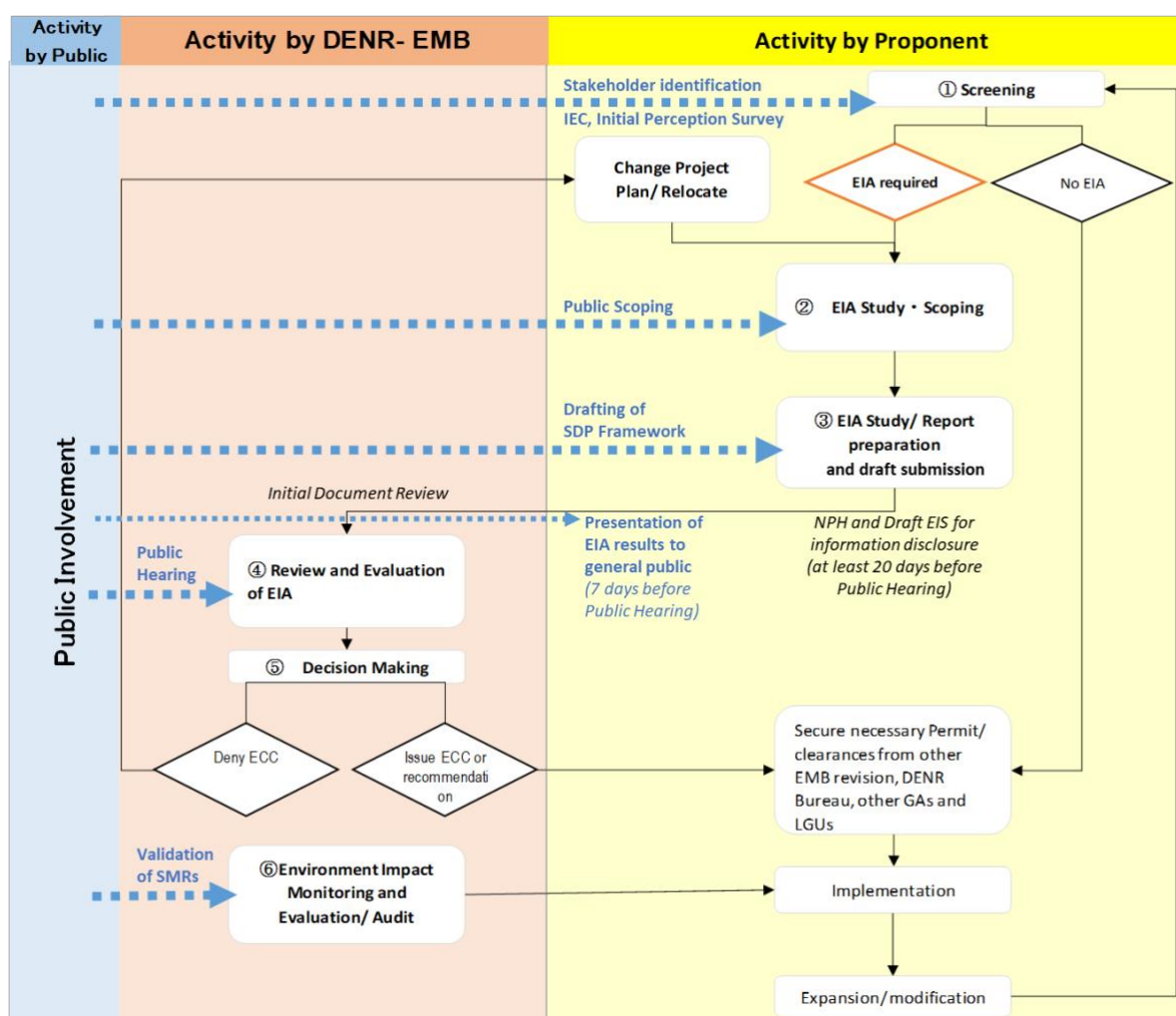
98. Presidential Decree No. (PD) 1586 (1977), Establishing an Environmental Impact Statement (EIS) System, including other Environmental Management Related Measures and for other Purposes or the Philippine Environmental Impact Statement System (PEISS), requires proponents of projects (whether public or private) that are classified as environmentally critical or to be located in an environmentally critical area (ECA) to secure an Environmental Compliance Certificate (ECC) prior to project implementation. An ECC is “a document issued by the Department of Environment and Natural Resources (DENR)/ Environmental Management Bureau (EMB) after a positive review of an ECC application, certifying that the Proponent has complied with all the requirements of the EIS System and has committed to implement its approved Environmental Management Plan (EMP) to address the environmental impacts. Legislation related to the PEISS that are relevant to the supplemental EIA study for the SBT Section are presented in **Table 3.1.1**.

Table 3.1.1 Philippine Legislation Relevant to the EIA Study

Legislation	Title
PD 1151 (1977)	Philippine Environmental Policy.
PD 1152 (1977)	Philippine Environment Code.
PD 1586 (1978)	Establishing an EIS System, including Other Environmental Management Related Measures and for Other Purposes.
Presidential Proclamation No. 2146 (1981)	Proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the EIS System Established Under PD 1586.
DENR Administrative Order No. (DAO) 1992-21	Amending the Revised Rules and Regulations Implementing PD1586 (EIS System).
DAO 1996-37	Revising DAO 1992-21, to Further Strengthen the Implementation of the EIS System.
Presidential Administrative Order No. (AO) 42 (2002)	Rationalizing the Implementation of the PEISS and Giving Authority, in addition to the Secretary of the DENR, to the Director and Regional Directors of the EMB to grant or deny the issuance of ECCs.
DAO 2003-30	Implementing Rules and Regulations (IRR) for the PEISS.
EMB Memorandum Circular No. (MC) 2007-002	Revised Procedural Manual (RPM) for DAO 2003-30.
DENR MC 2010-14	Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the PEISS.
EMB MC 2010-002	Clarification to DENR MC 2010-14 and Other EIS System Policy Issuances.
EMB MC 2010-004	Guidelines for Use of Screening and Environmentally Critical Area (ECA) Map Systems.
EMB MC 2011-005	Incorporating Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) concerns in the Philippine EIS System (EIA DRR/CCA Technical Guidelines).
EMB MC 2014-005	Revised Guidelines for Coverage Screening and Standardized Requirements under the PEISS amending relevant portions of MC 2007-002.
EMB MC 2016-001	Requiring Online Submission of Compliance Monitoring Reports (CMR) under the PEISS.
DAO 2017-15	Guidelines on Public Participation under the PEISS.
DAO 2018-18	Establishing a Centralized Management and Coordinative Mechanism at the Regional Offices of DENR, MGB (Mines and Geosciences Bureau), and EMB, and Designating the DENR Regional Director as the Regional Executive Director Providing Overall Command of Regional Operations.

Legislation	Title
DAO 2019-16	Streamlining the EIA Process and Requirements for Projects under the Build Build Build (BBB) Program.
EMB MC 2020-18	Adoption of DAO 2019-16 for ECC Processing of Non-Environmentally Critical Projects (Non-ECP) under the Build, Build, Build Program of the Government.
EMB MC 2020-30	Interim Guidelines on Public Participation in the Implementation of the PEISS (PD 1586) during the State of National Public Health Emergency.
EMB MC 2020-31	Guidelines on the Five (5)-year Validity of ECC pursuant to DAO 2003-30.
EMB MC 2021-05	Documentary Requirements for Minor Amendment (Non-Technical) of ECC under the PEISS.

99. The PEISS has six main sequential stages comprising of screening, scoping, EIA study and report preparation, EIA review and evaluation, decision-making, and post-ECC monitoring, validation, and evaluation/audit. A summary flowchart of this EIA process is presented in **Figure 3.1.1**.

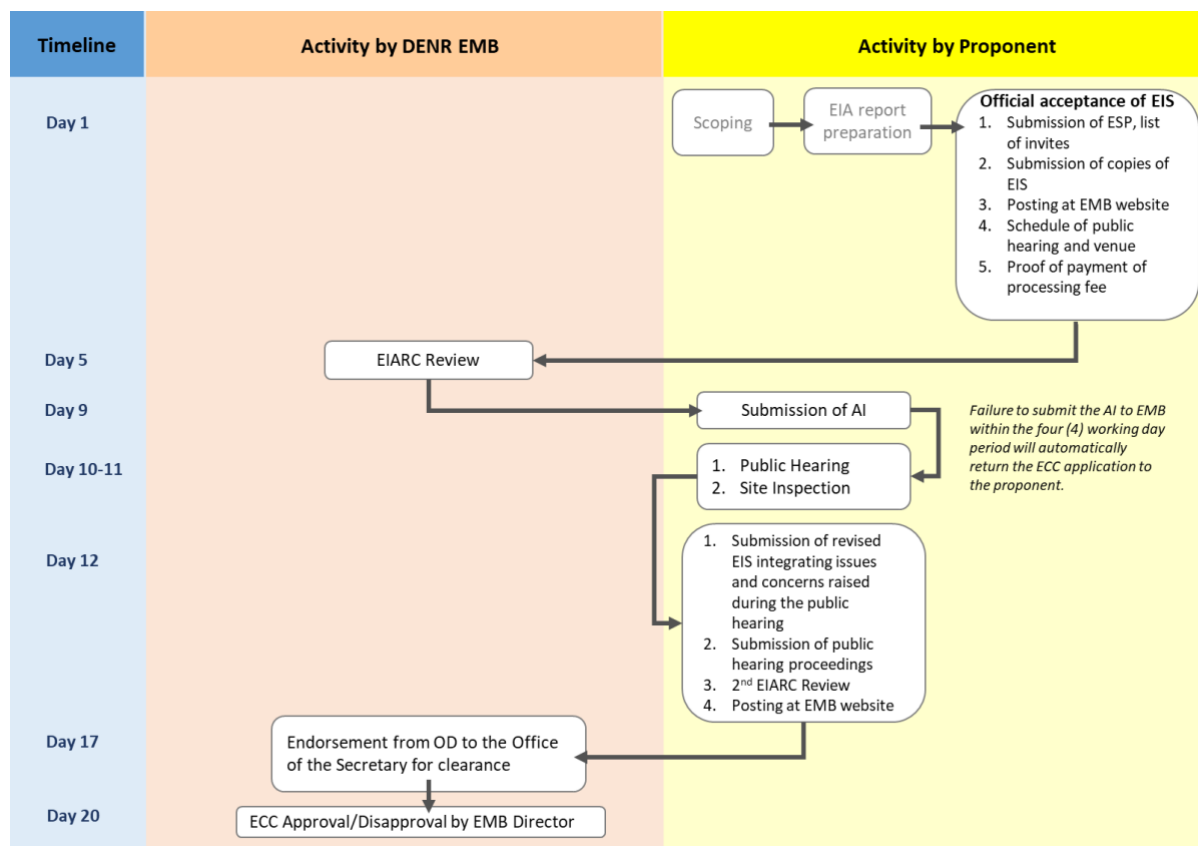


Source: DENR-EMB (2007). EMB MC 2007-002.

Figure 3.1.1 Summary Flowchart of EIA Process

100. In 2019, the DENR-EMB issued DAO 2019-16, Streamlining the Environmental Impact Assessment Process and Requirements for Projects under the Build Build Build Program, to streamline the EIA process and ECC applications of projects under the BBB Program of the Philippine government which the NSCR Project (and subsequently the SBT Section) is a part of. DAO 2019-16 aims “to ensure

optimum economic development without compromising the environment.” **Figure 3.1.2** shows the decision-making process flow for the ECC applications of projects under the BBB Program.



Note: ESP = Executive Summary for the Public; AI = additional information; EIARC = Environmental Impact Assessment Review Committee; OD = Office of the Director

Source: DENR (2019). DAO 2019-16.

Figure 3.1.2 ECC Application Process for Projects under the BBB Program

3.1.1 Project Categorization and ECC Application

101. Based on EMB MC 2014-005 or the Revised Guidelines for Coverage Screening and Standardized Requirements under the PEISS, there are four categories for proposed projects or undertakings. Category A which are classified as environmentally critical projects (ECPs), Category B which are not classified as ECP under Category A but are deemed to significantly affect the quality of environment, Category C which are not under Category A and B that directly enhance the quality of the environment, and Category D that are deemed unlikely to cause adverse impact. Among these, Categories A and B are required to secure an ECC prior to implementation.

102. All new railway systems are categorized as Category A projects which have a high potential for significant negative environmental impacts. Furthermore, DAO 2003-30 allows for the amendment of issued ECCs in case of proposed modifications to projects. **Annex C-1** shows the Decision Chart for the Determination of Requirements for Project Modification provided in Annex B of EMB MC 2014-005. The SBT Section is a modification to the NSCR Project that was issued an ECC amendment twice. The first amendment was granted on July 2, 2020 and the second amendment was granted on August 31, 2021.

3.1.2 Scope of the Supplemental EIA Report for the SBT Section

103. The terms of reference of an EIA in the Philippines is provided in a document called the Technical Scoping Checklist (TSC). Each ECC application required to submit an EIS or EPRMP has a specific TSC, signed by the EIA Review Committee Members, DENR-EMB, the project proponent, and the EIA preparer. While there is no specific TSC for the SBT Section, the study largely followed the outline for EIA Reports for proposed (new) single projects provided in DENR Memorandum Circular 2010-14 (DMC 2010-14), except for a few modified and additional sections as agreed with DOTr. **Table 3.1.2** compares the generally prescribed outline by DENR-EMB and the actual outline applied to the Supplemental EIA Study for the SBT Section.

Table 3.1.2 Comparison of EIA Report Outlines

Annotated Outline for EIA Reports for Proposed (New) Single Projects based on DMC 2010-14 ^a	Applied Outline to the Supplemental EIA Report as agreed with DOTr ^b
Executive Summary 1. Project Description 2. Analysis of Key Environmental Impacts 3. Environmental/Ecological Risk Assessment 4. Impacts Management Plan 5. Social Development Plan (SDP) and IEC Implementation 6. Environmental Compliance Monitoring* 7. Emergency Response Policy and Generic Guidelines 8. Abandonment/ Decommissioning/ Rehabilitation Policies and Generic Guidelines 9. Institutional Plan for EMP Implementation	Executive Summary 1. Introduction 2. Project Description 3. Legal and Institutional Framework For EIA 4. Environmental Baseline Conditions 5. Prediction and Assessment of Environmental Impacts 6. Environmental Risk Management and Emergency Response Programs 7. Environmental Management Plan 8. Environmental Compliance Monitoring 9. Public Consultation Documentation 10. Conclusions and Recommendations 11. References Annexes

Notes:

^a DMC 2010-14 amends the outline provided in the RPM for DAO 2003-30 (EMB MC 2007-002).

^b Primary baseline environmental studies included in the supplemental EIA report are Soil Quality and Contamination (The Land), Terrestrial Ecology (The Land), Surface Water Quality Assessment (The Water), Ambient Air and Noise Quality (The Air), and Vibration Assessment. Other studies were undertaken through review and analysis of secondary information.

Source: DENR (2010). Annex 1-A, DAO 2010-14.

3.1.3 Public Participation, Public Consultation, and Information Disclosure

104. Public participation guidelines under the PEISS are provided in DAO 2017-15. Additional guidelines are provided in DAO 2019-16 for BBB Projects (such as the SBT Section), and in EMB MC 2020-30 given the national public health emergency brought about by the COVID-19 pandemic during the conduct of the study. DAO 2017-15 requires public participation throughout all stages of the EIA process, following these principles:

- Public participation should be initiated early and sustained at the various stages of the EIA process;
- Public participation should be well planned and should involve the stakeholders in the assessment, management, and monitoring of environmental impacts; and
- Public disclosure of all necessary relevant information should be timely, especially to the stakeholders who are made to understand and appreciate the specific purpose and context of their participation for each stage of the process.

105. The entire EIA process involves public participation from social preparation prior to scoping to impact management, and to monitoring during project implementation. **Table 3.1.3** outlines the timeline for the various activities with public involvement in the PEISS for BBB Projects.

Table 3.1.3 Outline of Public Participation Activities under the PEISS for BBB Projects

Timeline	EIA Step	Activity	Objective	Responsible Party	Coverage
c/o Proponent	Scoping	Social Preparation/ IEC Meetings ^a	To identify stakeholders and prepare for issues in the public scoping proper	Proponent	Required for PEIS/EIS-based applications for new or modification proposals
		Initial Perception Survey	To collect the public's initial opinion on a project and gain perspective on its preliminary social impacts		
		Public consultation with the community (Public Scoping)	To gather issues of community sectors that need to be addressed by the EIA study	Proponent	Required for PEIS/EIS-based applications for new or modification proposals
c/o Proponent	EIA Study and Report Preparation	Baseline field survey	To integrate local and indigenous knowledge into the EIA study	Proponent	Required for PEIS, EIS, PEPRMP, and EPRMP-based projects
		Socioeconomic survey			
10 th working day from submission of Draft EIS Report to EMB (for BBB projects only) ^b	Public Hearing	Public consultation with community	To facilitate efficient exchange of information and views among an IA, the EMB, NGAs, LGUs and other stakeholders on environmental impact assessment, management and monitoring for a project applying for an ECC	DENR-EMB Proponent	• Required for PEIS/EIS-based applications for new or modification proposals • Site visit is optional for PEPRMP, EPRMP-based projects
Project Implementation	Monitoring, Validation, and Evaluation/Audit	Monitoring activities	To ensure that a project complies with the ECC conditions, EMP, and EMoP of the EIS.	Proponent MMT/TPA DENR-EMB	Project-specific MMT/TPA is required for PEIS and Group I (ECPs) EIS-based projects

Note:

^a Minimum requirement for PEIS/EIS-based applications for new projects and projects for modification/ expansion.

^b Public hearing proceedings are submitted within 2 working days after the Public Hearing.

Source: DENR-EMB (2007). EMB MC 2007-002; DENR (2019). DAO 2019-16.

106. The conduct of Information, Education and Communication (IEC) meetings for LGUs with jurisdiction over the project area is required at the minimum by the DENR-EMB for PEIS/EIS-based applications for new proposals or projects for modification/expansion. IEC meetings that were conducted for the SBT Section are presented in **Chapter 9**.

107. Planned stakeholder engagement activities and the grievance redress mechanism (GRM) for the NSCR Project are also implemented for the SBT Section in accordance with DAO 2017-15. The DOTr is to establish the GRM for the Project to:

- Receive and facilitate the resolution of aggrieved stakeholder concerns and grievances about physical and economic displacement and other project impacts with particular attention to

- impacts on vulnerable groups;
- Resolve aggrieved stakeholder concerns and grievances which cannot be settled through collective platforms such as stakeholder consultations due to the complexity of the concerns or grievances and/or due to the absence of such platform at the time when a cause for grievances occurs; and
- Address aggrieved stakeholder concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the country's judicial or administrative remedies commensurate to risks and adverse impacts of the Project.

108. Guidelines for the conduct of public participation activities during the state of National Public Health Emergency are based on EMB MC 2020-30.

3.1.4 Compliance Monitoring and Institutional Arrangements

109. Projects with ECCs are required by the DAO 2003-30 to conduct monitoring of compliance to the ECC conditions and the approved EMP through a Multi-partite Monitoring Team (MMT) or a Third-Party Auditor (TPA), and through self-monitoring of the project proponent. The MMT is an independent entity composed of project stakeholders tasked to assist the DENR-EMB in monitoring environmental impacts and compliance with the PEISS and other environmental laws of the country. The MMT is required to submit a Compliance Monitoring and Validation Report (CMVR) semi-annually to the DENR-EMB. The project proponent is also required to submit a Compliance Monitoring Report (CMR) to the designated DENR-EMB office on a semi-annual basis, and a Self-Monitoring Report (SMR) on a quarterly basis. Upon completion of the DENR-EMB's evaluation, SMRs are considered as public documents. Subject to the applicable rules and regulations including guarantee of the confidentiality of specific business information, access of the document by the general public are allowed.

110. Alternatively, a TPA may be engaged in lieu of the MMT as approved by the DENR-EMB. The option to engage a TPA was stipulated in the NSCR Project ECC. The engagement of a TPA to conduct compliance monitoring for the NSCR Project was approved by the DENR-EMB Central Office last November 6, 2018. The same scheme is applied to the SBT Section. Pursuant to DAO 2003-30, the TPA shall be a qualified environmental or Environmental Management System (EMS) auditor. The proponent shall submit to EMB a copy of audit findings and shall be held accountable for the veracity of the report. Furthermore, the proponent with its TPA shall submit to EMB an audit plan prior to conduct of audit which shall cover all aspects of environment (land, air, water, and people module) as stated in the Environmental Management and Monitoring Plan (EMMoP) of the environmental impact study. On April 15, 2021, DENR-EMB gave DOTr the approval to implement the submitted Audit Management Plan and required the submission of an audit report on every conduct of the audit. Relevant laws, guidelines, standards, and other documentary references adopted for the compliance monitoring of the environmental and social activities committed by DOTr in the EIA of the SBT Section are provided in **Table 3.4.1**.

111. **Table 3.1.4** summarizes the monitoring, validation and evaluation/ audit schemes showing the roles and responsibilities of the Proponent, the TPA, and the DENR-EMB.

Table 3.1.4 Monitoring, Validation, and Evaluation/Audit Schemes

Monitoring Aspects		Frequency/Timing		
		Proponent Self-Monitoring	MMT/ TPA Validation of Proponent's Performance	DENR-EMB Evaluation/Audit
Compliance Reporting	ECC	Semi-annual in CMR	Semi-annual in CMVR or Audit Report ^b	Semi-annual in CER ^c

Monitoring Aspects		Frequency/Timing		
		Proponent Self-Monitoring	MMT/ TPA Validation of Proponent's Performance	DENR-EMB Evaluation/Audit
	EMPa	Semi-annual in CMR	Semi-annual in CMVR or Audit Report ^b	Semi-annual in CER ³
	Environmental Standards (under specific environmental laws)	Detailed report in Quarterly SMR; Summary of compliance in semi-annual CMR	Semi-annual in CMVR or Audit Report ^b	Semi-annual in CER ^c
Field Validation		-	Semi-annual	Semi-annual, or whenever there are complaints, exceedance of standards, suspicious data ^d
Effectiveness of Environmental Management Measures	Sampling and measurement	Monthly/ continuous as committed in the EMoP within the EMP	Only in cases of complaints/ exceedance of standards/ suspicious data ^d	As the need arises in coordination with MMT/TPA ⁴
	Trend analysis / Cumulative Performance Report ^e	2nd semi-annual CMR; 4th quarter SMR	2nd semi-annual CMVR	2nd semi-annual CER

Note:

^a The EMP is composed of the Impacts Management Plan (IMP), the Social Development Plan (SDP), Information Education and Communication (IEC) Plan,

^b Instead of CMVR that has the Proponent's CMR/SMR as an attachment, the TPA submits an Audit report to the Proponent (Project Management Office) for submission to DENR-EMB.

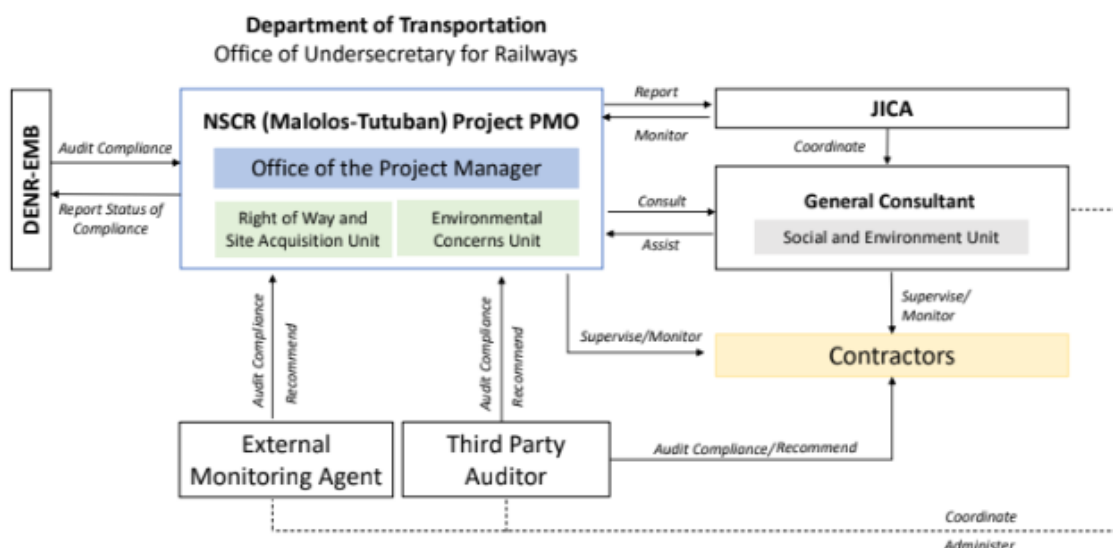
^c CER is prepared by the EMB Case Handler/staff and attached to the Proponent's CMR/SMR and MMT's CMVR

^d The composite EMB Team (if a project has no MMT) conducts validation, or if the Proponent has an existing MMT, the EMB personnel undertake validation as a member of the MMT. Should a composite team be needed to address a mix of issues within the respective mandate of the EMB divisions/units, the EMB composite team joins the particular MMT validation activity so that there is only one integrated group validating the issues.

^e Trend Analysis is undertaken on key significant environmental parameters in relation to standards while Cumulative Performance Report is done on applicable key significant impacts and measures.

Source: DENR-EMB (2007). EMB MC 2007-002.

112. Furthermore, institutional arrangements necessary for the implementation of environmental management measures are required in accordance with DAO 2003-30. The institutional structure for EMP implementation is shown in **Figure 3.1.3**.



Source: Department of Transportation (2021). [Institutional plan for EMP implementation] [Chart]. Unpublished.

Figure 3.1.3 Institutional Structure for EMP Implementation

113. The Department of Transportation creates the Project Management Office (PMO) for the overall NSCR Project that serves as the primary entity responsible for the environmental management of the Project including the implementation of EMP and EMoP.

114. Currently, the PMO designates qualified personnel to form its Environmental Concerns Unit including but not limited to a DENR-accredited Pollution Control Officer (PCO) competent in pollution control and environmental management and an environment officer responsible for the conduct of routine monitoring of project activities. The PMO is also assisted by the Social and Environmental Unit of the General Consultant. Each Project Contractor has an operational EU composed of PCOs with required 40-hr training.

115. The EMP, along with other relevant information in this Supplemental EIA Report, will be included in the specifications for Contractors to ensure that the EMP is implemented by the Contractors of the project to appreciate and understand the requirements of the Project in terms of its environmental safeguards and to ensure full compliance of the Contractors with their complete and proper implementation. Various documents to be provided by the Contractors are subject to the review and approval of the DOTr. Contractors are also required to submit a Construction Environmental Management and Monitoring Plan (CEMMP) prior to construction activities.

3.2 JICA GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

116. As a matter of policy, JICA, as an implementing agency for Japanese official development assistance (ODA), adheres to the need to conduct environmental and social considerations for all forms of assistance – from technical cooperation to loan and grant aid projects. To complement this, under the JICA Guidelines for Environmental and Social Considerations (April 2010), seven important principles are recognized:

- Projects must address a wide range of environmental and social impacts;
- Measures for environmental and social considerations must be implemented from an early stage to a monitoring stage;

- Ensure accountability when implementing cooperation projects;
- Ensure stakeholder participation in decision-making processes;
- Appropriate disclosure of information;
- Enhance organizational capacity of proponents; and
- Promptness in project implementation.

117. Projects are screened, scoped, and categorized (Category A, B, C, and F1) after proper information disclosure based on, among others, the project scale, nature, and degree of impacts on the natural and social environments, the site or location, and the mitigation measures required. EIA is mandatory for projects whose environmental category is “A”, and an EIA Report must be disclosed to the public through JICA’s website at least 120 days before the project proponent and JICA agrees to implement the project.

118. Proponents of projects, such as the governmental body that implements the Project, bear responsibility for the environmental and social considerations (ESC). JICA is accountable for the ESC of projects it supports, and to this end, JICA confirms the implementation of the ESC by project proponents through environmental review and supervision of monitoring.

3.2.1 Scope of EIA Report for Category A Projects

119. The JICA Guidelines for Environmental and Social Considerations (April 2010) provides that projects classified as Category A should cover the following items:

- Executive summary;
- Policy, legal, and administrative framework;
- Project description;
- Baseline data;
- Environmental impacts;
- Analysis of alternatives;
- Environmental Management Plan; and,
- Consultation.

120. The scope and level of detail of the EIA is determined based on the anticipated potential impacts of a project. JICA requires that the information integrated in the EIA report is relevant to decisions about project site, design, operation, or mitigation measures applied and is sourced from accurate and reliable data. Similar to the PEISS, the impact assessment required by JICA predicts and assesses a project’s likely positive and negative impacts in quantitative terms, to the extent possible. It is necessary that any negative environmental impacts that cannot be mitigated are identified and opportunities for environmental enhancement are explored. The EIA also identifies and estimates where there are essential data gaps and uncertainties associated with the predictions produced in the report.

3.2.2 Public Participation and Consultation

121. As provided in Part 2.4 of the JICA Guidelines for Environmental and Social Considerations (April 2010), consultation with local stakeholders aims to take into consideration the environmental and social factors that are most suitable to local scenarios, and to reach an appropriate consensus for matters of discussion. To facilitate a broad and open discourse, project proponents are highly encouraged to publicize in advance the details of the public consultation, with particular attention to directly affected people.

122. In the case of Category A projects such as the NSCR Project, JICA encourages discussions between DOTr and the local stakeholders with regards to their understanding of development needs,

the likely adverse impacts on the environment and the community, and the analysis of alternatives at an early project stage. Consultations with stakeholders, such as local residents, are highly advised to be held during the preparation of the EIA report after sufficient information has been disclosed to the public. All stakeholder consultations must be well-documented as the EIA should include a record of consultation meetings (date, venue, participants, procedures, opinions of major local stakeholders and responses to them, and other items), including consultations for obtaining the informed views of the affected people, local NGOs, and regulatory agencies.

3.2.3 Compliance Monitoring and Institutional Arrangements

123. JICA confirms compliance to the principles and procedures as contained in the Guidelines by thorough Environmental Review of environmental reports and ensures that all project impacts on the natural and social environments are identified and proper mitigating measures are discussed, and monitoring is supervised. JICA further confirms that projects should conform to the environmental laws and standards of host countries or other international financial organizations (such as World Bank Group (WBG) Safeguard Policies) when appropriate – if the standards set by the host country differ from international standards, project proponents are advised to adopt the standards that better serve the purpose of attaining a higher level of the ESC. The independent Advisory Committee for Environmental and Social Considerations was established by JICA to provide expert advice on preparatory surveys, environmental review, and monitoring of projects under consideration. If the ESC is not appropriately undertaken or substantial compliance to establish environmental laws and standards is not met after its review, JICA may opt to suspend its assistance in accordance with the written agreement between JICA and DOTr as the project proponent.

124. The following environmental and social considerations are required by JICA for the monitoring of intended projects:

- After the project commencement, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. Appropriate measures are then taken based on the results of such monitoring.
- In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.
- Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.
- When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.
- JICA discloses the results of the monitoring conducted by project proponents, etc. as the proponent on its website to the extent that they are made public by project proponents, etc. When third parties request further information, JICA discloses it, subject to approval by the project proponent.

125. Furthermore, institutional framework for measures regarding environmental and social considerations is required. JICA conducts environmental and social surveys at the EIA level for Category A projects and prepares drafts of monitoring plans including institutional arrangements for environmental and social considerations.

3.3 COMPARISON OF THE PHILIPPINE EIS SYSTEM AND JICA GUIDELINES

126. **Table 3.3.1** presents the comparison of the requirements of the PEISS and the JICA Guidelines for Environmental and Social Considerations (2010). Recommended countermeasures have also been provided to address the gaps that have been identified.

Table 3.3.1 Gap Analysis of the JICA Environmental and Social Guidelines (2010) and the Philippines EIS System and other Philippine Environmental Laws

Aspect	JICA Environmental and Social Guidelines (2010)	Relevant Regulations in the Philippines	Main Gap	Counter measures for Filling Gaps
EIA	JICA supports and examines appropriate environmental and social considerations undertaken by project proponents, etc. to avoid or minimize development projects' impacts on the environment and local communities and to prevent the occurrence of unacceptable adverse impacts.	The Philippine EIS System requires project proponents to incorporate environmental and social considerations in the planning and decision-making process of projects. By integrating and addressing all possible environmental and social concerns, adverse impacts of proposed activities are considerably reduced, as the project siting, design, alternatives, and its corresponding environmental management and monitoring plans are thoroughly reviewed by the proponent, the DENR, and the public. (DAO 2003-30)	No gap identified	Not applicable
Compliance with National Legislations and International Treaties	- Projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries. Those governments' policies and plans on the environment and local communities are also considered. - Projects do not deviate significantly from the WBG Safeguard Policies, and refer as a benchmark to the standards of international financial organizations, to internationally recognized standards or international standards, treaties and declarations, etc. and to the good practices, etc. of developed nations including Japan, when appropriate (Sec.2/2.6/2, 3).	- The release of the ECC following the EIA process allows the project to proceed to the next stage of project planning, which is the acquisition of approvals from other government agencies and LGUs, after which the project can start implementation. Environmental and social issues raised by these entities must be considered during the conduct of the EIA. The subsequent EIA findings provide guidance and recommendations as a basis for their decision-making process. - During the Scoping stage of the EIA process, the EIA Review Committee (EIARC) recommends or evaluates nationally or internationally acceptable methods for quantitative assessments. (DAO 2003-30) - The EIA process covers projects in ECAs, which includes sensitive areas described in international treaties and agreements to which the Philippines has committed participation. (DAO 2003-30)	No gap identified	Not applicable
Impacts to be Assessed	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety as well as the natural environment, e.g., air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including transboundary or global scale impacts. These also include social impacts including migration of populations and involuntary resettlement, a local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructure and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural	- The country's statutory framework requiring EIA for all projects that affect environmental quality is embodied in PD 1151 of 1977. - Under the EIA process, the proponent assesses the direct and indirect impacts of a project on biophysical and human environments, ensuring that these impacts are addressed by appropriate environmental protection and enhancement measures (DAO 2003-30).	No gap in environment items and contents. However, standards on soil contamination and vibration are yet to be established.	International standards of WBG-International Finance Corporation (IFC) and developed countries' standards (Dutch Intervention

Aspect	JICA Environmental and Social Guidelines (2010)	Relevant Regulations in the Philippines	Main Gap	Counter measures for Filling Gaps
	heritage, local conflicts of interest, infectious diseases such as HIV/AIDS and working conditions including occupational safety. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process. • In addition to direct and immediate impacts of projects, derivative, secondary and cumulative impacts as well as impacts associated with indivisible projects are also assessed with regard to environmental and social considerations, so far as it is rational. Project impacts throughout the life cycle are also considered. • If the scale of uncertainty in impact prediction is considered to be large, project proponents should provide environmental and social considerations that include preventive measures as much as possible.			Values (2013), United States Federal Transit Administration (US FTA) standards), Japanese Noise Guideline values) are referred to in order to evaluate these items.
Alternatives	Environmental impacts must be assessed and examined from the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	Project alternatives are required to be discussed in the EIS along with criteria used to determine options for facility siting, development design, process/technology selection, resource utilization, and how decisions on the preferred options were made	No gap identified	Not applicable
EMP	• Impact examination must include an analysis of environmental and social costs and benefits in the most quantitative terms possible as well as a qualitative analysis. These must be conducted in close harmony with economic, financial, institutional, social, and technical analysis of projects. • The findings of the examination must include alternatives and mitigation measures and be recorded as separate documents or include mitigation of potential adverse impacts to the level of no significant harm to third parties and the polluter pays principle. • The EMP also provides workers with safe and healthy working conditions and prevents accidents, injuries, and diseases. • Establish preventive and emergency preparedness and response measures to avoid and minimize adverse impacts and risks on health and safety of local communities.	• The EIA process requires the preparation of an impact mitigation plan, an IEC framework, a social development program proposal, an environmental monitoring plan (with multi-sectoral public participation for EIS-based projects) and the corresponding institutional and financial requirements/arrangements. • The formulated EMP and corresponding costs and benefits of proposed actions are inputted into the Feasibility Study as a basis for decision making of the Proponent on its final project option, siting, and design. • The prescribed outline for EIA reports may include an Environmental Risk Assessment, which deals with the further analysis of hazards identified in the EIA. The probability of occurrence of accidents and their magnitude are assessed in order to recommend preventive and emergency protocols to significantly reduce, if not eliminate the identified risks.	No gap identified	Not applicable
Consultation	• Project proponents, etc. consult with local stakeholders through means that induce broad public participation to a reasonable extent in order to take into consideration environmental and social factors	• DAO 2017-15 mandates public participation for the entire EIA process from social preparation prior to scoping to impact management and monitoring during project implementation/abandonment.	No gap identified	Not applicable

Aspect	JICA Environmental and Social Guidelines (2010)	Relevant Regulations in the Philippines	Main Gap	Counter measures for Filling Gaps
	which are most suitable to local situations and reach an appropriate consensus. • Project proponents, etc. publicize in advance that they plan to consult with local stakeholders with particular attention to directly affected people in order to have meaningful meetings. • In the case of Category A projects, project proponents, etc. are encouraged to consult with local stakeholders regarding their understanding of development needs, the likely adverse impacts on the environment and the society and the analysis of alternatives at an early stage of the project, and they are assisted as needed. • Consultations with relevant stakeholders such as local residents should take place, if necessary, throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when a draft report is being prepared (Appendix 2).	• The IEC serves as the basis for preliminary identification of stakeholders and related issues in preparation for proper scoping. The conduct of the EIA study engages local stakeholders who may serve as local expert sources, aides/guides, and resource persons for primary data collection to optimize the access to indigenous knowledge of the environment.		
Information Disclosure	• In principle, project proponents, etc. disclose information about environmental and social considerations of their projects. • JICA encourages project proponents, etc. to disclose and present information about environmental and social considerations to local stakeholders (Sec.2/2.1/1, 6). • Project proponents, etc. in the preparation of documents in an official or a widely used language and in a form understandable to local people (2.1/1, 6,7). • For Category A projects, JICA publishes the status of host countries' submission of major documents on environmental and social considerations on its website. Prior to its environmental review, JICA also discloses EIA reports and environmental permit certifications 120 days prior to concluding agreement documents. JICA discloses a translated version of EIA reports, subject to approval by project proponents, etc.	• DAO 2017-15 mandates public participation for the entire EIA process from social preparation prior to scoping to impact management and monitoring during project implementation/abandonment. This includes the conduct of a Public Hearing (PH) which is mandatory for projects requiring EIS, PEIS, PEPRMP, and EIS-based EPRMP. Before the PH, relevant documents must be opened to the public. • Guidelines on public participation under the Philippine EIS System also requires the submission of an EIS Summary for the Public (ESP) in English and Filipino, along with supporting documentation, for the general public's understanding. This document, the Notice of PH, and the draft EIS Report are publicly posted in the EMB website. (DAO 2017-15) • The EMB ensures that the procedures and requirements for public participation from scoping to public hearing are complied with. Major documents submitted by the project proponents throughout the ECC application are published on the EMB website for public disclosure.	No gap identified	Not applicable
Monitoring and Disclosure	• JICA confirms with project proponents, etc. the results of monitoring the items that have significant environmental impacts. This is done in order to confirm that project proponents, etc. are undertaking environmental and social considerations for projects that fall under Categories A, B and FI.	• The proponents with issued ECCs are primarily responsible for monitoring their projects. They are required to submit two kinds of monitoring reports, the CMR on a semi-annual basis and the SMR on a quarterly basis to the concerned EMB RO.	No gap identified	Not applicable

Aspect	JICA Environmental and Social Guidelines (2010)	Relevant Regulations in the Philippines	Main Gap	Counter measures for Filling Gaps
	- The information necessary for JICA's confirmation on monitoring must be provided by project proponents, etc. via appropriate means including in writing. When necessary, JICA may also conduct its own investigations. - JICA discloses the results of monitoring conducted by project proponents, etc. on its website to the extent that they are made public to project proponents, etc. (Sec.3/3.2/3.2.2/1, 7).	- Upon completion of the DENR-EMB's evaluation, SMRs are considered as public documents. Subject to the applicable rules and regulations including guarantee of the confidentiality of specific business information, access of the document by the general public are allowed. - For ECPs, the MMT are representative of various stakeholder groups who lead the practice of local vigilance to the project's performance. - Major features of the MMT are the followings: (i) providing appropriate checks and balances in monitoring of project implementation; (ii) validating the proponent's performance; (iii) recommending courses of action to the EMB through the CMVR. - The EMB-DENR remains to be the primary actor for the overall evaluation of the proponents' monitoring and the MMTs' validation.		
Site Selection	- Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances for the conservation of the nature or cultural heritages (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas. - JICA defines "natural habitats" as land and water areas (including sea area) (1) where the ecosystems' bio-logical communities are formed largely by native plant and animal species, and (2) where human activity has not essentially modified the area's primary ecological functions. Furthermore, all natural habitats have important biological, social, economic, and existence value.	- Protected areas under the National Integrated Protected Areas System (NIPAS) of the Philippines through Republic Act No. (RA) 7586 are safeguarded with strictly enforced national and local policies to ensure their preservation. - For project sites proposed outside protected areas declared under the NIPAS, the Wildlife Resources Conservation and Protection Act ensures that all designated and critical habitats are protected by the DENR-EMB in coordination with local government units and other concerned groups from any form of exploitation or destruction which may be detrimental to the survival of the threatened species dependent therein. For such purpose, the secretary may acquire, by purchase, donation or expropriation, lands, or interests therein, including the acquisition of usufruct, establishment of easements or other undertakings appropriate in protecting the critical habitat (RA 9147).	No gap identified.	Not applicable

3.4 ENVIRONMENTAL LAWS AND REGULATIONS

3.4.1 Environmental Guidelines and Standards

127. **Table 3.4.1** lists the environmental guidelines¹ and standards² applied to the Project. In the absence of national environmental standards, internationally recognized standards may be used. If national environmental standards differ from international standards, JICA requires the more stringent standards to be adopted and monitored for environmental compliance. Compliance to the listed environmental standards are monitored by DENR, EMB and/or JICA.

128. On the physical quality of soil, the Philippine government has no legal standards for the regulation, monitoring and management of pollution, contamination and risks for its various uses other than agricultural use. Although major environmental laws related to soil contamination due to solid waste, hazardous waste and substances as well as toxic chemicals are covered by RA 9003, RA 6969 and PD 856. Thus, international standards including Dutch Intervention Values (DIVs) (2013) and United States (US) Environmental Protection Agency (EPA) Regional Screening Levels (RSLs) (2020) are adopted for monitoring.

129. In terms of noise management, although a national standard is available, international standards are also adopted including the WBG-IFC Environmental, Health and Safety (EHS) Guidelines on Noise Management (2007) and the Japanese Standards for the Regulation of Noise Generated by Specific Construction Work (1998) and Noise Guideline Values for New Project and Large-Scale Modification of the Conventional Railway (1995).

130. In the absence of a national vibration standard, the US FTA Transit NVIA Manual (Report 0123) (2018) is adopted.

Table 3.4.1 Environmental Standards Applied to the Project

Study Item	Environmental Standard
Soil Quality ^a (Fertility)	Bureau of Soils and Water Management (BSWM) ^b Soil Fertility Rating (n.d.)
Soil Contamination (Toxic Chemicals, Hazardous Substances and Waste)	DAO 2013-22, Revised Procedures and Standards for the Management of Hazardous Wastes (2013)
	Dutch Intervention Values (DIVs) (2013)
	United States Environmental Protection Agency Regional Screening Levels (USEPA RSLs) (2020)
Soil Contamination (Solid Waste)	DAO 2001-34, IRR of RA 9003, Ecological Solid Waste Management Act (2001)
Terrestrial Ecology	DAO 2017-11, Updated National List of Threatened Philippine Plants and Their Categories (2017)
	DAO 2019-09, Updated National List of Threatened Philippine Fauna and Their Categories (2019)
Surface Water Quality	DAO 2016-08, Water Quality Guidelines and General Effluent Standards (2016)
	DAO 2021-19, Updated Water Quality Guidelines (WQG) and General Effluent Standards (GEF) for Selected Parameters (2021)
Ambient Air Quality	DAO 2000-81, Ambient Air Quality and Emission Standards (2000)

¹ Guidelines refer to official recommendation or guidance to protect human beings or receptor against adverse effects of pollutants.

² Standards refer to allowable limits or quantities of specific pollutants that may contaminate the environment and deemed harmful to humans.

Study Item	Environmental Standard
	DAO 2020-14, Establishing the Breakpoints for Particulate Matter 2.5 (PM2.5) Air Quality Index (AQI) Amending Section 5(a) of DAO 2013-13 (2020)
Noise	National Pollution Control Commission (NPCC) Memorandum Circular No. (MC) 002 Series of 1980 (NPCC 1980-002): Section 78. The Ambient Quality and Emission Standards for Noise (Environmental Quality Standards for Noise in General Areas) (1980)
	NPCC 1980-002: Section 78. The Ambient Quality and Emission Standards for Noise (Noise Standards for Construction Activities) (1980)
	Japan (Environmental Agency) Noise Guideline Values for New Project and Large-Scale Modification of the Conventional Railway in Japan (1995)
	Japan (Ministry of Environment) Standards for the Regulation of Noise Generated by Specific Construction Work (1998)
	World Bank Group/ International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (WBG EHS Guidelines) on Noise Management (2007)
Vibration	US FTA Transit Noise and Vibration Impact Assessment Manual (Report 0123) (FTA Manual) (2018)

Note:

^a As noted in Environmental Management of the Philippines (Pedrosa, 2016), the physical quality of soils used for agricultural purposes is managed by the Department of Agriculture (DA) while the mandated agency for the setting of standards and monitoring of soil quality for purposes other than agricultural use is not explicitly identified in different environmental laws. The closest national law/s that respond to soil fertility decline is RA 10068 amended by RA 11511. BSWM website (<http://bswm.da.gov.ph/why-bswm/>) noted that RA 10068 is an act that promotes organic production systems to maintain long-term soil fertility, promote the healthy use of soil and minimize all forms of pollution.

^b BSWM is a DA attached agency primarily mandated to ensure effective soil, land, and water resources utilization by undertaking projects and research on soil conservation, irrigation, rainmaking, and other related (agricultural) activities.

3.4.1.1 Soil Quality

(1) Soil Fertility

131. The BSWM provides a standard soil fertility rating for certain parameters such as levels of pH, organic matter, primary nutrients (Kjeldahl nitrogen, phosphorus and potassium). **Table 3.4.2** presents the soil evaluation criteria standards.

Table 3.4.2 Soil Fertility Evaluation Criteria Standards

Parameter	Adequate (Favorable)	Marginal (Moderately Unfavorable)	Deficient (Unfavorable)
pH ^a	5.5-8.5	5.0-5.5	<5.0, >8.5
Organic matter (%)	1-8, (>3 ^b)	-	<1, >8 (<3 ^a)
Total Kjeldahl Nitrogen (mg/kg)	-	-	-
Available Phosphorus (mg/kg)	>10 (>20 ^b)	6-10 6-20 ^b	<6
Exchangeable Potassium (cmol/Kg)	>0.25	0.15 – 0.25	<0.15

Note:

^a For deep-rooting crops a further subdivision could be made according to the nutrient level in the subsoil (30 to 60cm or 30 to 90cm).

^b For limits applicable for dryland crops.

Source: BSWM (n.d.). BSWM Regional Soils Laboratory (RSL) Handbook.

(2) Soil Contamination

132. Due to the absence of Philippine standards, the Dutch Intervention Values (DIVs) (2013) for soil remediation and the US EPA Regional Screening Levels (RSLs) (2020) were adopted to assess soil contamination in the SBT Section. The soil guideline values are presented in **Table 3.4.3**. The DIVs provide guideline values above which serious detrimental effects to the environment are expected based on studies of the Netherlands' National Institute for Public Health and Environmental Protection on the human and ecotoxicological effects of soil contaminants. These values mainly provide reference for the regulation of soil clean-up as part of a multifunctional remediation approach. On the other hand, the USEPA Regional Screening Levels (RSLs) are internationally accepted guidelines which sets forth chemical-specific screening levels which are based on human health risk. These are used to assess for potential human health and safety risks associated with possible exposure of human receptors to potentially impacted soil. The RSLs consider the various types of pathways by which man can be exposed such as ingestion, inhalation, and dermal contact. The USEPA RSLs present values with target cancer risk of 1×10^{-6} and a target hazard quotient of 0.1 was used in the assessment. Both guidelines were used as reference for the baseline assessment for soil contamination.

133. Procedural guidelines that are followed for the handling and management of hazardous wastes during the construction, operation, and decommissioning and abandonment of the SBT Section are provided in DENR Administrative Order 2013-22 (DAO 2013-22), Revised Procedures and Standards for the Management of Hazardous Wastes. The DAO 2013-22 is the revised procedures and standards for the management of hazardous wastes (revising DAO 2004-36). The procedural manual provides a comprehensive documentation on the legal and technical requirements of hazardous waste management to strengthen RA 6969, Toxic Substances, Hazardous and Nuclear Wastes Control Act, enacted to control and manage import, manufacture, process, distribution, use, transport, treatment, and disposal of toxic substances and hazardous and nuclear wastes in the country. Wastes are considered hazardous if they are listed under the Classification of Prescribed Hazardous Wastes under the DAO 2013-22 or exhibit any of the four characteristics, namely: ignitable, corrosive, reactive, or toxic based on Toxicity Characteristic Leaching Procedure (TCLP). In the case that contamination is encountered during the development or operation works, these values are used as basis for the monitoring of hazardous waste management. **Table 3.4.4** presents the screening criteria for TCLP metals. Materials which exceed the screening criteria are considered hazardous.

Table 3.4.3 Soil Remediation Intervention Values and Screening Levels

Parameters	Dutch Intervention Value (mg/kg)	US EPA Regional Screening Levels (mg/kg)
		Industrial Soil
Arsenic, total	76	no given value
Arsenic, inorganic	no given value	3.0
Barium	no given value	22,000
Copper	190	4,700
Zinc	720	35,000
Cadmium	13	98
Chromium, Hexavalent	78	6.3
Chromium, Trivalent	180	180,000
Iron	no given value	82,000
Lead	530	800
Magnesium	no given value	no given value
Manganese	no given value	2,600
Mercury, elemental	no given value	4.6

Parameters	Dutch Intervention Value (mg/kg)	US EPA Regional Screening Levels (mg/kg)
		Industrial Soil
Mercury, inorganic	36	no given value
Mercury, organic	4	no given value
Selenium	no given value	580
Nickel	100	2200
Cyanide, total	no given value	15
Cyanide (pH≥5)	50	no given value
Cyanide (free)	20	15
Fluoride	500	4,700
Polychlorinated Biphenyls (PCB) *	1	no given value
Oil and Grease	no given value	no given value
Mineral oil	5,000	350,000
Benzene, mg/kg	1.1	5.1
Toluene, mg/kg	32	4700
Ethylbenzene, mg/kg	110	25
Xylenes, Total, mg/kg	17	250
PCBs, Aroclor 1016, µg/kg	no given value	5.1
PCBs, Aroclor 1221, µg/kg	no given value	0.83
PCBs, Aroclor 1232, µg/kg	no given value	0.72
PCBs, Aroclor 1242, µg/kg	no given value	0.95
PCBs, Aroclor 1248, µg/kg	no given value	0.94
PCBs, Aroclor 1254, µg/kg	no given value	0.97
PCBs, Aroclor 1260, µg/kg	no given value	0.99
PCBs, Aroclor 1262, µg/kg	no given value	no given value
PCBs, Aroclor 1268, µg/kg	no given value	no given value

Note: 1) Ecotoxicological HC50-values (hazardous concentration 50% that is to say concentration at which 50% of the species and processes in an ecosystem are completely protected) in mg/kg soil/sediment (dry weight). The HC50-values are given for standard soil (10% organic substance and 25% clay).

Source: Rijkswaterstaat Environment. (2013). Soil Remediation Circular. Dutch Intervention Values for Soil Remediation;
US EPA (2020). Regional Screening Levels (RSLs) for Industrial Soil.

Table 3.4.4 TCLP Screening Criteria (DAO 2013-22)

Parameters	Screening Level, mg/L
Arsenic (As)	1
Barium (Ba)	70
Chromium (Cr)	5
Lead (Pb)	1
Mercury (Hg)	0.1
Selenium (Se)	1

Source: DENR (2013), DAO 2013-22.

3.4.1.2 Terrestrial Ecology

(1) Protected Areas

1) National Integrated Protected Areas System

134. The National Integrated Protected Areas System (NIPAS) Act of 1992 (RA 7586) and its IRR (DAO1992-25) as amended by DAO 2008-26, along with RA 11038 or the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2018 provides the legal framework for the establishment and management of protected areas (PAs) in the Philippines. A protected area (PA) may be categorized into the following classifications based on RA 11038, depending on its nature and characteristics:

- Strict nature reserve – refers to an area possessing some outstanding ecosystem, features, and species of flora and fauna of national scientific importance that should be maintained to protect and preserve nature in its undisturbed state and to preserve ecologically representative examples of the natural environment to ensure their availability for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state;
- Natural park – refers to a relatively large area not materially altered by human activity where extractive resource uses are not allowed and is maintained to protect outstanding natural and scenic areas of national or international significance for scientific, educational, and recreational use;
- Natural monument – refers to a relatively small area focused on the protection of small features to protect or preserve nationally significant natural features on account of their special interest or unique characteristics;
- Wildlife sanctuary – refer to an area which assures the natural conditions necessary to protect nationally significant species, groups of species, biotic communities or physical features of the environment which may require specific human manipulations or their perpetuation;
- Protected landscapes and seascapes – refer to areas of national significance which are characterized by the harmonious interaction of man and land and water while providing opportunities for public enjoyment through recreation, tourism, and other economic activities;
- Resource reserves – refer to an extensive, relatively isolated, and uninhabited area which is difficult to access and is designated to protect the natural resources of the area for future use and prevent or contain development activities that could affect the resources, pending the establishment of sustainable resource utilization goals which are based upon appropriate information and planning; and
- Natural biotic areas – refer to an area set aside to allow the way of life of societies living in harmony with the environment to adapt to modern technology at their pace

135. PAs in the Philippines are managed by the Protected Area Management Board (PAMB). All proposed activities within a PA (e.g., research, development, conservation, etc.) are required to be approved by the PAMB.

2) Locally Designated Protected Areas

136. The Local Government Code of the Philippines or RA 7160 allows LGUs (municipality or city) to pass legislations which they foresee as beneficial and needed by the community, including those related to environmental protection and conservation. The LGUs are given the local autonomy to pass laws (as long as aligned with national law/s) for implementation in their area of jurisdiction, including

the declaration of certain lands owned by the state as protected. RA5752 encourages every municipality or city to establish, develop, and maintain a permanent forest, tree parks, or watershed within public land owned by such municipality or city. It is recommended that the aggregate size of such area be equivalent to at least 2% of the entire size of the municipality or city. PAs declared by LGUs are usually managed by the Municipal Environmental and Natural Resource Office (MENRO) under the office of the mayor, therefore all activities (e.g., research, development, conservation, etc.) within the PA will require the approval of the mayor prior to implementation.

3) Key Biodiversity Area and Important Bird Area

137. Key Biodiversity Area (KBAs) represent the most important sites for biodiversity conservation worldwide, and are identified nationally using a Global Standard from the International Union for the Conservation of Nature (IUCN). Important Bird Areas (IBAs) are a subset of KBA. KBAs in the Philippines were determined by the DENR in 2006 using data from the IBAs Program, the 2004 IUCN Red List, as well as data from published literature, experts and scientists, and museum collections. Some KBAs (either wholly or partially) are included in declared PAs thus, these KBAs or part thereof have formal declaration of protection. However, most KBAs are without any formal declaration of protection in the Philippines (as part of NIPAS, E-NIPAS or LGU proclamation). Hence, development (as long as required permits are secured and aligned with CLUP) could be established in these areas.

(2) National List of Threatened Philippine Flora and Fauna

138. DAO 2017-11 and DAO 2019-09, also known as the National List of Threatened Philippine Plants and National List of Threatened Philippine Fauna, respectively, provide the latest available information on the conservation status and extinction risk of vegetation and wildlife species along with their categories. The IUCN Red List of Threatened Species on the other hand, provides information on the global extinction risk status of animal, fungus, and plant species, along with their range, population size, habitat and ecology, use and/or trade, threats, and recommended conservation actions.

139. DAO 2017-11, DAO 2019-09, and the IUCN Red List of Threatened Species serve as reference for the identification of the conservation status of species in the baseline survey for terrestrial ecology. Succeeding inventories for monitoring purposes of terrestrial vegetation and wildlife will be based on the same references.

Table 3.4.5 Definitions of the Conservation Status of Flora and Fauna

Category	Description
Critically Endangered Species (CR)	Species, subspecies, varieties, or other infraspecific categories that is facing extremely high risk of extinction in the wild in the immediate future. Presumed extinct species upon rediscovery of a population of such a group are automatically categorized as Critically Endangered. Species listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are considered under the category of Critically Endangered.
Endangered Species (EN)	Species, subspecies, varieties, or forma that is not Critically Endangered whose survival in the wild is unlikely if the causal factors continue operating. Species listed under CITES Appendix II are considered under the category of Endangered
Vulnerable Species (VU)	Species, subspecies, varieties, formae or other infraspecific categories of plants that is neither Critically Endangered nor Endangered but is under threat from adverse factors throughout its range and is likely to be moved to the Endangered category in the future. Species listed under CITES Appendix III are considered under the Vulnerable category
Other Threatened Species (OTS)	Species, subspecies, varieties, or other infraspecies that is not Critically Endangered, Endangered nor Vulnerable but is under threat from adverse factors, such as over collection throughout its range and is likely to be moved to the vulnerable category in the near future; also includes species that have the tendency to become threatened due to predation, destruction of habitats, or other similar causes, new species, and species with insufficient scientific information; such species may be included in the threatened species list by the DENR Secretary upon the recommendation of the Philippine Red List Committee for Wild Fauna and endorsement of the National Wildlife Management Committee

Category	Description
Other Wildlife Species	All other species of flora and fauna native to the Philippines but not listed in DAO 2017-11 and DAO 2019-09; these species are considered non-threatened. Exotic species not listed in any CITES Appendices are considered as Other Wildlife Species

Source: DENR (2017). DAO 2017-11; DENR (2019). DAO 2019-19.

Table 3.4.6 The IUCN Red List Species Classification

Category	Description
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of a taxon's risk of extinction based on its distribution and/or population status
Least Concern (LC)	The taxon does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened after evaluation against the Red List criteria
Near Threatened (NT)	The taxon does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future after evaluation against the Red List criteria
Vulnerable (VU)	Best available evidence indicates that the taxon meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild
Endangered (EN)	Best available evidence indicates that the taxon meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild
Critically Endangered (CR)	Best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild;
Extinct in the Wild (EW)	The taxon is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range; the taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual
Extinct (EX)	There is no reasonable doubt that the last individual has died; a taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual

Source: IUCN (2021). *The IUCN Red List of Threatened Species* (Version 2021-1). Retrieved June 30, 2021 from <https://www.iucnredlist.org/>.

(3) Applicable Guidelines

140. DAO 2003-30 Annex 2-7a outlines the PEISS requirements. Furthermore, the project complies with JICA Guidelines (2010) which conforms with World Bank safeguard policy. International Finance Corporation (IFC), a division of World Bank, produces the Impact Assessment Advice for the World Bank. Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources (June 2019) and Guidance Note 1 Assessment and Management of Environmental and Social Risks and Impacts (June 2021) have been used to develop the methodology and the terrestrial ecology will be assessed in relation to the biodiversity values emphasized in the IFC PS6.

3.4.1.3 Surface Water and Effluent Quality

141. DENR Administrative Order 2016-08 (DAO 2016-08) or the Water Quality Guidelines and Effluent Standards of 2016 provides the guidelines for the classification of water bodies in the Philippines, as well as the Water Quality Guidelines (WQG) and General Effluent Standards (GES) of the country. The WQG are applicable to all water bodies in the country, with specific WQG provided for freshwater, marine water, and groundwater. The guideline values were used as reference in the baseline assessment and also serves as basis for the monitoring requirements of DENR-EMB. The GES on the other hand specifies the “legal restriction or limitation on quantities, rates, and/or concentrations or any combination thereof, of physical, chemical, or biological parameters of effluent which a person or point source is allowed to discharge into a body of water or land.” The GES is applicable to all industry categories.

142. The applicable WQG and GES for a waterbody is determined based on its waterbody classification assigned by the DENR-EMB. The criteria used to classify freshwater are presented in **Table 3.4.7**. The applicable WQG and GES for unclassified waterbodies is determined based on its beneficial use as evaluated by the DENR-EMB.

143. **Table 3.4.8** provides the Class C WQG used in the assessment of the two creeks in the vicinity of the SBT Section. South Antipolo Canal and Antipolo Creek have not been classified by the DENR-EMB but both drain to a Class C waterbody (i.e. Pasig River) and therefore can be assessed using the Class C WQG as confirmed with the DENR-EMB through a phone consultation last December 2020. The Class C GES is used to monitor compliance of the wastewater discharges from the SBT Section (**Table 3.4.9**).

144. Updated WQG and GES values for Copper, Fecal Coliform, and Phosphate, along with other select parameters are provided in DENR Administrative Order 2021-19 (DAO 2021-19) or the Updated Water Quality Guidelines and General Effluent Standards for Selected Parameters. The order also clarifies that discharges from any point source are at all times meet the GES set forth in Table 9 of DAO 2016-08 (**Table 3.4.9**) to maintain the required water quality per water body classification.

Table 3.4.7 Water Body Classification and Usage of Freshwater

Classification	Intended Beneficial Use
Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest PNSDW
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment (coagulation, sedimentation, filtration, and disinfection) to meet the latest PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, etc.)
Class C	1) Fishery Water for the propagation and growth of fish and other aquatic resources 2) Recreational Water Class II – for boating, fishing, or similar activities 3) For agriculture, irrigation, and livestock watering
Class D	Navigable waters

Source: DENR (2016). DAO 2016-08.

Table 3.4.8 Surface Water Quality Guidelines

Parameter	DENR Guidelines (DAO 2016-08 ^b / DAO 2021-19 ^c)			
	Class A	Class B	Class C	Class D
Color	50 TCU	50 TCU	75 TCU	150 TCU
Temperature ^a	26-30°C	26-30°C	25-31°C	25-32°C
pH (Range)	6.5-8.5	6.5-8.5	6.5-9.0	6.0-9.0
Dissolved Oxygen (DO)	5 mg/L	5 mg/L	5 mg/L	2mg/L
Conductivity	-	-	-	-
Biochemical Oxygen Demand (BOD)	3	5 mg/L	7 mg/L	15 mg/L
Total Suspended Solids (TSS)	50 mg/L	65 mg/L	80 mg/L	110 mg/L
Surfactants (MBAS)	0.2 mg/L	0.3 mg/L	1.5 mg/L	3 mg/L
Oil and Grease (Petroleum Ether Extracts)	1 mg/L	1 mg/L	2 mg/L	5 mg/L
Nitrate as NO ₃ -N	7 mg/L	7 mg/L	7 mg/L	15 mg/L

Parameter	DENR Guidelines (DAO 2016-08 ^b / DAO 2021-19 ^c)			
	Class A	Class B	Class C	Class D
Phosphate as Phosphorus (Total, Reactive)	0.025 mg/L	0.025 mg/L	0.025 mg/L	0.05 mg/L
Phenolic Substances and Phenols	<0.001 mg/L	<0.001 mg/L	0.05 mg/L	0.5 mg/L
Total Coliforms	-	-	-	-
Fecal Coliforms	50 MPN/100mL	100 MPN/100mL	200 MPN/100mL	400 MPN/100mL
Chloride	250	250	350 mg/L	400 mg/L
Copper as Dissolved Copper (2016) / Copper as Total Copper (2021)	0.2 mg/L	0.2 mg/L	0.02 mg/L / 0.2 mg/L	0.4 mg/L
Arsenic (As)	0.01 mg/L	0.01 mg/L	0.02 mg/L	0.04 mg/L
Cadmium (Cd)	0.003 mg/L	0.003 mg/L	0.005 mg/L	0.01 mg/L
Chromium (Hexavalent)	0.01 mg/L	0.01 mg/L	0.01 mg/L	0.02 mg/L
Cyanide (CN ⁻)	0.07 mg/L	0.07 mg/L	0.1 mg/L	0.2 mg/L
Lead (Pb)	0.01 mg/L	0.01 mg/L	0.05 mg/L	0.1 mg/L
Total Mercury (Hg)	0.001 mg/L	0.001 mg/L	0.002 mg/L	0.004 mg/L
Organophosphate as Malathion	1 µg/L	1 µg/L	3 µg/L	8 µg/L

Note:

^a Samples are taken from 9:00 AM to 4:00 PM.

^b The natural background concentration as determined by EMB prevails if the concentration is higher than the WQG; provided that the maximum increase is only up to 10 percent and that it does not cause any risk to human health and the environment.

^c DAO 2021-19 only covers the updating of WQG and/or GES for Copper, Fecal Coliform, and Phosphate.

Source: DENR (2016). DAO 2016-08; DENR (2021). DAO 2021-19.

Table 3.4.9 General Effluent Standards

Parameter	DENR Standards (DAO 2016-08 / DAO 2021-19 ^a)			
	Class A	Class B	Class C	Class D
Color	100 TCU	100 TCU	150 TCU	300 TCU
Temperature	3 °C change	3 °C change	3 °C change	3 °C change
pH (Range)	6.0-9.0	6.0-9.0	6.0-9.5	5.5-9.5
Dissolved Oxygen (DO)	-	-	-	-
Biochemical Oxygen Demand (BOD)	20 mg/L	30 mg/L	50 mg/L	120 mg/L
Total Suspended Solids (TSS)	70 mg/L	85 mg/L	100 mg/L	150 mg/L
Surfactants (MBAS)	2 mg/L	3 mg/L	15 mg/L	30 mg/L
Oil and Grease (Petroleum Ether Extracts)	5 mg/L	5 mg/L	5 mg/L	15 mg/L
Nitrate as Nitrogen	14 mg/L	14 mg/L	14 mg/L	30 mg/L
Phosphate as Phosphorus (Total, Reactive)	1 mg/L	1.5 mg/L	4 mg/L	10 mg/L
Phenolic Substances and Phenols	0.01 mg/L	0.01 mg/L	0.5 mg/L	5 mg/L
Total Coliforms	3,000 MPN/100mL	3,000 MPN/100mL	10,000 MPN/100mL	15,000 MPN/100mL
Fecal Coliforms	100 MPN/100mL	200 MPN/100mL	400 MPN/100mL	800 MPN/100mL

Parameter	DENR Standards (DAO 2016-08 / DAO 2021-19 ^a)			
	Class A	Class B	Class C	Class D
Chloride	350 mg/L	350 mg/L	450 mg/L	500 mg/L
Copper as Dissolved Copper (2016)/ Copper as Total Copper (2021)	0.04 mg/L	0.04 mg/L	0.04 mg/L	0.08 mg/L
Arsenic (As)	0.02 mg/L	0.02 mg/L	0.04 mg/L	0.08 mg/L
Cadmium (Cd)	0.006 mg/L	0.006 mg/L	0.01 mg/L	0.02 mg/L
Chromium (Hexavalent)	0.02 mg/L	0.02 mg/L	0.02 mg/L	0.04 mg/L
Cyanide (CN-)	0.14 mg/L	0.14 mg/L	0.2 mg/L	0.4 mg/L
Lead (Pb)	0.02 mg/L	0.02 mg/L	0.1 mg/L	0.2 mg/L
Total Mercury (Hg)	0.002 mg/L	0.002 mg/L	0.004 mg/L	0.008 mg/L
Organophosphate as Malathion	1 µg/L	1 µg/L	3 µg/L	6 µg/L

Note: ^a DAO 2021-19 only covers the updating of WQG and/or GES for Copper, Fecal Coliform, and Phosphate.

Source: DENR (2016). DAO 2016-08; DENR (2021). DAO 2021-19.

3.4.1.4 Ambient Air Quality

145. **Table 3.4.10** shows the ambient air quality national standards that were used for the assessment. DAO 2000-81, otherwise known as the IRR of the Clean Air Act of 1999 (RA 8749), establishes the national ambient air quality standards for total suspended particulate (TSP), particulate matter (PM₁₀), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃) and lead (Pb). The provisional national ambient air quality guideline for PM_{2.5} values is provided in DAO 2020-14. The air quality standards are used as reference for the baseline assessment and also serve as basis for the compliance monitoring for air quality.

Table 3.4.10 National Ambient Air Quality Standards

Parameter	NAAQS for Source Specific Air Pollutants from Industrial Sources/ Operations (DAO 2000-81)		NAAQGV (Short Term) (DAO 2000-81 and DAO 2020-14)	
	Averaging Time	Standard	Averaging Time	Guideline Values
TSP	1 Hour	340	24 Hours	230 µg/NCM
PM ₁₀	1 Hour	300	24 Hours	150 µg/NCM
PM _{2.5} ^a	1 Hour	200	24 Hours	35 µg/NCM
SO ₂	1 Hour	260	24 Hours	180 µg/NCM
NO ₂	1 Hour	260	24 Hours	150 µg/NCM
CO	-	-	1 Hour	35 mg/NCM or 30 ppm
O ₃	-	-	1 Hour	140 µg/NCM or 0.07 ppm
P _b ^b	30 minutes	-	24 Hours	1.5 µg/NCM

Note:

^a Standard value used for PM_{2.5} is based on DAO 2020-14.

^b Evaluation of this guideline (1.5 µg/Ncm) is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

Source: DENR (2000). DAO 2000-81; DENR (2020). DAO 2020-14.

146. The air quality indices that were used to classify existing air quality conditions as specified in DAO 2000-81 and DAO 2020-14 are presented in **Table 3.4.11**.

Table 3.4.11 Air Quality Indices

Type / Classification	TSP, µg/Ncm (24-hour average)	PM ₁₀ , µg/Ncm (24-hour average)	SO ₂ , ppm ^a (24-hour average)	NO ₂ , ppm ^a (1-hour average)	PM _{2.5} , µg/Ncm (24-hour average)	O ₃ , ppm ^a (1-hour average)
Good	0 to 80	0 to 54	0.00 to 0.034 (0 to 88.8)	No prescribed index	0 to 25	No prescribed index
Fair	81 to 230	55 to 154	0.35 to 0.144 (91.4 to 376.2)	No prescribed index	25.1 to 35	No prescribed index
Unhealthy for sensitive groups	231 to 349	155 to 254	0.145 to 0.244 (378.8 to 627.4)	No prescribed index	35.1 to 45	0.125 to 0.164 (246.25 to 323.08)
Very unhealthy	350 to 599	255 to 354	0.255 to 0.304 (587.8 to 794.2)	No prescribed index	45.1 to 55	0.165 to 0.204 (325.05 to 401.88)
Acutely unhealthy	600 to 899	355 to 424	0.305 to 0.604 (796.8 to 1,577.9)	0.65 to 1.24 (1,220.5 to 2,328.3)	55.1 to 90	0.205 to 0.404 (403.85 to 795.88)
Emergency	900 and above	425 to 504	0.605 to 0.804 (1,580.5 to 2,100.3)	1.25 to 1.64 (2,347.0 to 3,079.3)	Above 91	0.405 to 0.504 (797.85 to 992.88)

Notes: ^a Values in parenthesis are expressed in units of µg/Ncm, conversion factor for SO₂: 1 ppm = 2,612.4 µg/Ncm, for NO₂: 1 ppm = 1,877.6 µg/Ncm, for O₃: 1 ppm = 1,970 µg/Ncm.

Source: DENR (2000). DAO 2000-81; DENR (2020). DAO 2020-14.

3.4.1.5 Noise Level

147. Pursuant to PD 984, otherwise known as the National Pollution Decree of 1976, and its IRR that specified the noise control regulations and defined the environmental quality standards for noise in general areas, the National Pollution Control Commission (NPCC), now abolished but with functions integrated into the EMB, developed the NPCC MC 1980-002 (1980), the primary ambient noise standard in the country adopted by the DENR/ EMB that has not been amended nor modified since 1980. Section 75 (b) stipulates those activities resulting in emission of noise levels greater than the ambient noise standards or a level that could cause adverse effect on the public are not allowed to be undertaken. Section 78 provides correction factors for areas facing roads and noise standards for construction activities. However, although maximum allowable noise levels for general areas are set forth in the available national standard, NPCC 1980 does not explicitly prescribe an averaging period for the maximum allowable noise, nor the location of measurement. On construction noise, NPCC 1980 is limited to a distance of 30 meters from the noise source. In addition, the standard is only applicable to operation of fixed commercial or industrial facilities and not to operational noise from passenger rail infrastructure.

148. As NPCC 1980 does not reference criteria relevant to the operation of the Project and does not set out a methodology for how a rail noise assessment should be undertaken, international good practices outlined in the WBG-IFC EHS Guidelines on Noise Management and Japan Environmental Quality Standards for Noise have been used to develop the project noise criteria, assessment methodology and mitigation measures where required. **Table 3.4.12** presents the national and international noise criteria, standards and/or guidelines.

Table 3.4.12 Comparison of National and International Environmental Noise Standards

Receptor in General Areas	Ambient Noise Levels (dBA) – Philippine Noise Standards 1980 ^a			Noise Levels (dBA) – WBG EHS Guidelines 2007 ^{b c}		Noise Levels (dBA) – Japan Guidelines	
	Daytime (9am-6 pm)	Morning (5am-9am) and Evening (6pm-10pm)	Nighttime (10pm-5am)	Daytime (7am-10pm)	Nighttime (10pm-7am)	Daytime (6am-10pm)	Nighttime (10pm-6am)
Class AA: A section of contiguous area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals, and special house for the aged	50	45	40	55	45	50	40
Class A: A section of contiguous area which is primarily used for residential area	55	50	45			55	45
Class B: A section of contiguous area which is primarily a commercial area	65	60	55	70	70	60	50
Class C: A section of contiguous area reserved as light industrial area	70	65	60				
Class D: A section which is primarily reserved, zoned or used as heavy industrial area	75	70	65				

Notes:

^a For areas directly facing a public transportation route or an urban traffic artery, the foregoing standards plus a correction factor equivalent to the following apply: (i) areas directly facing a four-lane road: +5 dBA; (ii) areas directly fronting or facing a four-lane wider road: +10 dBA

^b Guideline values are for noise levels measured out of doors.

^c Acceptable indoor noise levels for residential, institutional, and educational settings refer to WB-EHS (2007). Noise impacts should not exceed the levels presented, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Source: NPCC (1980). *The Ambient Quality and Emission Standards for Noise* (NPCC MC 1980-002); World Bank Group-International Finance Corporation (2007). *Noise Level Guidelines* (WBG EHS Guidelines 2007); Government of Japan Ministry of the Environment (1998). *Environmental Quality Standards for Noise* (Environment Agency Notification No. 64).

(1) WBG EHS Guidelines

149. The WBG EHS Guidelines provide a source of noise prevention and mitigation measures that should be applied where predicted or measured noise impacts from project operations exceed the applicable Noise Level Guidelines (Table 3) at the nearest sensitive receptors. The recommended noise level guidelines is that noise impacts should not exceed the levels presented in **Table 3.4.12**, nor result in a maximum increase in background levels of 3 dB at the nearest receiver location off-site. The guidelines recommend noise monitoring prior to the project to establish the existing background noise levels. These noise level guidelines provide a measurable criterion for design. The recommended external noise criteria are based on measured ambient background levels and World Health Organization (WHO) guideline noise values.

150. The WHO provides noise guideline values for community according to specific environments, critical health effects and length of exposure (**Table 3.4.13**). Exceedance to the equivalent sound levels for the specified time duration may cause adverse health effects. For impulsive sounds (e.g., breaking,

percussive pile driving) to avoid acute hearing impairment, sound pressure level should be below 110 dBA.

Table 3.4.13 Guidelines for Community Noise in Specific Environments (WHO, 1999)

Environment	Critical Health Effect	L _{Aeq} , dBA	Duration, hours
Outdoor living area	Serious annoyance	55	16
	Moderate annoyance	50	16
Dwelling, indoors	Speech intelligibility & moderate annoyance	35	16
Inside bedrooms	Sleep disturbance	30	8
School classrooms	Speech intelligibility	35	During class
School, playground	Annoyance	55	During playtime
Industrial, commercial shopping and traffic areas	Hearing impairment	70	24

Source: WHO (1999). Guidelines for Community Noise.

151. The sound levels at adjacent receptors are monitored to ensure that threshold levels for community noise are not exceeded and that generated noise during construction does not cause adverse impacts to the community.

(2) Japanese Guidelines

152. While NPCC MC 1980-002 was developed as a guidance tool for general and commercial noise, with provisions for highway noise and construction. It does not provide specific guidance for railway noise. Conversely, the Japanese Guidelines provides a specific methodology for assessing noise impacts of a transit project.

Table 3.4.14 Japan Noise Guideline Values for New Project and Large-Scale Modification

Project	One Hour L _{Aeq} (dBA) ^a	
	Day 7:00 - 22:00	Night 22:00 - 07:00
New project	60	55
large-scale modification	Improving the noise level situation from that before the improvement.	

Note: ^a The guideline values are used to further reduce the noise in areas where the residential environments should be protected, such as exclusive residential area. The assessment point is the horizontal distance 12.5 m from near track centerline.

Source: Government of Japan Environmental Agency (1995) Noise Guideline Values for New Project and Large-Scale Modification of the Conventional Railway in Japan.

153. If a noise problem arises due to special circumstances, such as the prior existence of a school, hospital, or other facility that requires particular quietness, or a facility in extremely close proximity to the railroad tracks, measures should be taken as necessary.

3.4.1.6 Vibration Level

154. Since the Philippines currently has no standards for vibration, the vibration criteria and generalized assessment procedures in the FTA Manual have been adopted to assess the potential project impacts from vibration. The same criteria will also be used in monitoring vibration levels unless otherwise a more stringent standard applicable to the project becomes available.

(1) Standards for Construction

155. There are two types of impacts related to construction vibrations in the FTA Manual including (1) human annoyance and (2) building damage. The same vibration criteria for general assessment can be applied for the evaluation of annoyance or interference with vibration-sensitive activities. These annoyances can occur when construction vibration rises above the threshold of human perception over extended periods. Often, the primary concern regarding construction vibration is its potential damage effects. Damages to buildings can be cosmetic or structural.

156. Historical structures which are fragile are commonly vulnerable to damages caused by ground vibration; normal buildings which are not fragile would not experience cosmetic damages at reasonable distances. The distances can considerably vary depending on soil composition and subsurface conditions. Further, buildings have different responses to vibration generated by construction equipment. The FTA's construction vibration criteria are presented in **Table 3.4.15**.

Table 3.4.15 FTA Construction Vibration Damage Criteria

Building Category	Peak Particle Velocity (PPV) (in/s)	Approximate Lv ^a (VdB)
i. Reinforced concrete, steel, or timber (no plaster)	0.5	102
ii. Engineered concrete and masonry (no plaster)	0.3	98
iii. Non-engineered timber and masonry buildings	0.2	94
iv. Buildings extremely susceptible to vibration damage	0.12	90

Note: ^a root mean square velocity in decibels, VdB

Source: US FTA (2018). *US FTA Transit Noise and Vibration Impact Assessment Manual* (Report 0123).

(2) Standards for Operation

157. Railway operations have the potential to induce high vibration levels because the rolling contact between rigid steel rails and wheels creates vibratory motions that are transmitted into the track support system. The magnitude of vibration is highly dependent on the smoothness of wheels and rails as well as the suspension system of the vehicle. The vibration energy of track structures in contact with the ground generates vibration, which is propagated through different soil and rock strata and into the foundation of nearby structures. Buildings, structures, and their inhabitants are the receivers. The focus of this study is to determine if vibration would cause disruption or annoyance to people inside buildings and whether vibration interferes their activities based on the FTA Manual.

158. Ground vibration can be described in terms of displacement, velocity, or acceleration. However, human responses by monitoring instruments and other objects are most accurately described with velocity. Therefore, the FTA Manual recommends the use of the velocity level to assess vibration impacts from transit projects.

159. Vibration amplitude is the magnitude of the motion of the system under study and is usually expressed as either peak particle velocity (PPV) or the root mean square (RMS) velocity. The PPV is the maximum instantaneous peak of the vibration signal. It is considered as the most appropriate parameter for the evaluation of the potential to cause building damages. On the other hand, the RMS is the average of the squared amplitude of the signal and is typically used to assess human responses to vibration. According to the FTA Manual (2018), the RMS amplitude is always less than the PPV and is always positive. PPV and RMS velocities can be expressed in inches per second.

160. **Table 3.4.16** shows the vibration criteria in evaluating ground-borne vibration impacts associated with train traffic at nearby receptors. The vibration criteria are based on Table 6-3 and Table 6-4 of the US FTA (2018), which specifies the indoor ground-borne vibration (GBV) impact criteria for general

assessment and those for special buildings. The FTA criteria are based on the RMS vertical vibration velocity in terms of decibel units (VdB) relative to one (1) micro inch per second. The limits are also absolute levels and do not increase relative to the existing ambient vibration conditions. Hence, the assessment in comparison with the FTA criteria does not require background ambient vibration levels.

Table 3.4.16 FTA Ground-Borne Vibration Impact Criteria

Receptor Land Use		RMS Vibration Levels (VdB)		
Category	Description	Frequent Events ^a	Occasional Events ^b	Infrequent Events ^c
1	Building where low vibration is essential for interior operations	65 ^d	65 ^d	65
2	Residences and buildings where people normally sleep	72	75	80
3	Daytime institutional and office use including schools, churches, and other institutions	75	78	83
Specific Buildings	TV/ Recording Studios/ Concert Halls	65	65	65
	Auditoriums/Theaters	72	80	80

Notes:

^a Defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.

^b Defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have many operations.

^c Defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.

^d This standard limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a Detailed Vibration Analysis must be performed.

Source: US FTA (2018). *US FTA Transit Noise and Vibration Impact Assessment Manual* (Report 0123).

3.4.2 Other Environment-Related Laws And Regulations

161. Other major national environment-related laws and regulations relevant to infrastructure projects are listed in **Table 3.4.17**. The PEISS states obligations to strictly comply with environmental laws, rules, regulations and standards, which have been established by the Philippine government.

Table 3.4.17 Other Environment-Related Laws and Regulations

Items	Laws and Regulations on Environmental Quality and Natural Environment
Biodiversity	RA 7586 (1992), National Integrated Protected Areas System (NIPAS) Act
	RA 9147 (2001), Wildlife Resources Conservation and Protection Act
	Executive Order No. (EO) 247, Prescribing Guidelines and Establishing a Regulatory Framework for the Prospecting of Biological and Genetic Resources, Their By-products and Derivatives for Scientific Purposes and for Other Purposes
	DAO 2004-15, Establishing the List of Terrestrial Threatened Species and Their Categories and the List of Other Wildlife Species Pursuant to RA 9147
	DAO 2007-24, Establishing the National List of Threatened Plants and Their Categories and the List of Other Wildlife Species
	RA 11038 (2018), Expanded National Integrated Protected Areas System Act
	DAO 2019-05, IRR of RA 7586, as Amended by RA 11038
Forestry	PD 705 (1975), Forestry Reform Code
	PD 953 (1976), Requiring the Planting of Trees in Certain Places and Penalizing the Unauthorized Cutting, Destruction, Damaging and Injury of Certain Trees, Plants, and Vegetation
	EO 193 Series of 2015, Expanding the Coverage of the National Greening Program (NGP)
Tree Cutting	RA. 8048 (1995), Coconut Preservation Act

Items	Laws and Regulations on Environmental Quality and Natural Environment
	DENR Memorandum pursuant to Presidential Decree 953 (2009), Guidelines and Procedures on the Planting, Maintenance, and Removal of Trees in Urban Areas and in Areas Affected by Government Infrastructure Projects
	DENR MC (DMC) No. 2011-01, Guidelines, and Procedures in the implementation of the National Greening Program
	RA 10593 (2012), An Act Amending Certain Sections of RA 8048
	PCA Administrative Order (AO) No. 2018-03, Revised IRR of RA 8048
	DENR Memorandum Order (DMO) No. 2012-02, Uniform Replacement Ratio for Cut or Relocated Trees
	Forest Management Bureau (FMB) Technical Bulletin No.3 (2014), Measurement Standards, and Procedures in the conduct of inventory for standing trees
	DAO 20 s. 2016, IRR of EO 193
	DAO 2018-16, Guidelines in the Processing and Issuance of Permits on the Removal and Relocation of Trees Affected by DPWH Projects
	DAO 2020-06, Amending Certain Provisions and Expanding the Coverage of DAO. 2018-16
Soil (Fertility)	RA 10068 (2010), Organic Agriculture Act
	RA 11151(2020), An Act Amending RA 10068
Pollution Control (Water)	PD 1067 (1976), Water Code
	RA 9275 (2004), Clean Water Act
	DAO 2005-10, IRR of the Clean Water Act
	DOH AO 2017-0010, Philippine National Standards for Drinking Water (PNSDW)
Pollution Control (Air)	RA 8749 (1999), Clean Air Act
Pollution Control (Waste) (including Spoil Disposal)	PD 856 (1975), Code of Sanitation of the Philippines
	PD 825 (1975), Providing Penalty for Improper Disposal of Garbage and Other Forms of Uncleanliness and for Other Purposes
	RA 6969 (1990), Toxic Substances, Hazardous and Nuclear Wastes Control Act
	DAO 1994-28, Interim Guidelines for the Importation of Recyclable Materials Containing Hazardous Substances
	DAO 1997-28, Amending Annex A of DAO 1994-28
	DAO 1998-49 Technical Guidelines for Municipal Solid Waste Disposal
	RA 9003 (2000), Ecological Solid Waste Management Act
	DAO 2001-34, IRR of RA 9003
	DAO 2006-10, Guidelines on the Categorized Final Disposal Facilities
	MMDA Regulation No. 002 Series of 2011: Adopting a Revise Schedule of Administrative Fees, Charges, Restoration and Maintenance Deposits, Fines and Penalties on Road Digging/Excavations and Restorations in Metropolitan Manila
Vulnerable Groups	DAO 2013-22, IRR of RA 6969
	RA 9710 (2009), Magna Carta of Women
	Batas Pambansa 344 (1982), Accessibility Law
	RA 4846 (1966), Cultural Properties Preservation and Protection Act

Items	Laws and Regulations on Environmental Quality and Natural Environment
Historical/ Cultural Heritage	RA 6541 (1972), the National Building Code of the Philippines (NBCP)
	PD 374 (1974) amending certain sections of RA 4849
	RA 8492 (1998), An Act Establishing a National Museum System Providing for its Permanent Home and for Other Purposes, Otherwise Known as the "National Museum Act of 1998"
	RA 10086 (2010), Strengthening Peoples' Nationalism through Philippine History by Changing the Nomenclature of the National Historical Institute into the National Historical Commission of the Philippines (NHCP), Strengthening its Powers and Functions, and for Other Purposes
	RA 10066 (2010), National Cultural Heritage Act of 2009, Providing for the Protection and Conservation of the National Cultural Heritage, Strengthening the National Commission for Culture and Arts (NCCA) and its Affiliated Cultural Agencies and for Other Purposes
	NHCP Standards and Guidelines in Maintaining Historic Sites and Structures (2010)
	NHCP Guidelines on the Identification, Classification and Recognition of Historic Sites and Structures in the Philippines (2011)
	NHCP Universal Guidelines of the Restoration and Preservation of Monuments and Historic Sites
	NHCP Process of Architectural Restoration
	NHCP Techniques involved in the Restoration of Historic Structures
	PD 1096 (1977), Adopting a NBCP Thereby Revising RA 6541
Archaeological Sites	RA 4846 (1966), Cultural Properties and Preservation Act
	PD 1151 (1977), Philippine Environmental Policy
	PD 1586 (1978), PEISS
	PP 2146 (1981), Proclaiming Certain Areas and Types of Projects as Environmentally Critical and within the Scope of the EIS System Established under PD 1586
	RA 8492 (1998), An Act Establishing a National Museum, Providing for its Permanent Home and for Other Purposes
	EMB MC 2007-002, RPM for DAO 2003-30, IRR of PD 1586 (2007)
	RA 10066 (2010), National Cultural Heritage Act 2009, Outlining the Definitions and Protections Afforded to Cultural Property
	National Museum (NM) Office Order 2018-126, Permit to Conduct Land Archeological Research Exploration and Excavation, Outlining the Procedures to Carry Out Excavations.
	RA 11333 (2019), An Act Strengthening the National Museum of the Philippines (NMP) Repealing for the Purpose RA 8492
Climate Change and DRR	EMB MC 2011-005 EIA Technical Guidelines Incorporating DRR and CCA Concerns
Occupational Health and Safety	RA 11058 (2018), Strengthening Compliance with Occupational Safety and Health (OSH) Standards and Providing Penalties for Violations
	DOLE Department Order No. (DO) 198-18, IRR of RA 11058
	RA 9514 (2008) Fire Code of the Philippines and its IRR (i.e. 2013 Fire Safety Enforcement Manual of the Bureau of Fire Protection)
	DOLE DO 13 Series of 1998 Guidelines Governing Occupational Safety and Health in the Construction Industry (1998)

3.5 INTERNATIONAL ENVIRONMENTAL TREATIES AND AGREEMENTS

162. **Table 3.5.1** provides a list of environmental treaties and international agreements that the Philippines has ratified.

Table 3.5.1 Ratified International Treaties and Agreements in the Philippines

Category	Name of Treaty	Date/Year of Ratification
Biodiversity	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973	November 1981
	Convention on Biological Diversity, 1992	October 1993
	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), 1983	February 1994
	Convention on Wetlands of International Importance (Ramsar Convention), 1971	November 1994
	Cartagena Protocol on Biosafety, 2000 (to the Convention on Biological Diversity)	October 2006
	Nagoya Protocol on Access to Genetic Resources & the Fair & Equitable Sharing of Benefits Arising from their Utilization-Supplementary Agreement to the Convention of Biological Diversity	September 2015
Climate Change	Montreal Protocol on Substances that Deplete the Ozone Layer, 1987	July 1991
	Vienna Convention for the Protection of the Ozone Layer, 1985	July 1991
	London Amendment (to the Montreal Protocol), 1990	August 1993
	United Nations (UN) Convention to Combat Desertification, 1994	February 2000
	UN Framework Convention on Climate Change, 1994	November 2003
	Kyoto Protocol to the UN Convention on Climate Change, 1998	November 2003
	Minamata Convention	October 2013 (ongoing ratification)
	Doha Amendment (to the Kyoto Protocol), 2012	February 2016
	Paris Agreement Adopted in the 21st Session of the Conference of Parties to the UN Framework Convention on Climate Change, 2015	December 2017 RP Accession
Pollution	Basel Convention on the Control of Transboundary Movements of Hazardous wastes and their Disposal, 1992	October 1993
	Stockholm Convention on Persistent Organic Pollutants 2001	May 2004
	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemical and Pesticides in International Trade, 2004	July 2006
Historical/ Cultural Heritage	UNESCO Convention Concerning the Protection of the World Cultural and National Heritage, 1972	May 1985
	The Venice Charter: International Charter for the Conservation and Restoration of Monuments and Sites, 1964	May 1964
	The Washington Charter: Charter on the Conservation of Historic Towns and Urban Areas, 1987	October 1987
	The Nara Document on Authenticity, 1994	November 1994
Forestry	International Tropical Timber Agreement, 1994	November 1983
Social	Convention on the Elimination of all Forms of Discrimination against Women, 1979	1981
	International Convention on the Elimination of all forms of racial discrimination, 1965	September 1967
	International Covenant on Civil and Political Rights, 1976	1986
	International Covenant on Economic, Social and Cultural Rights, 1976	June 1974
	Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, 1987	June 1986

Category	Name of Treaty	Date/Year of Ratification
	Convention on the Rights of the Child, 1990	July 1990
	International Convention on the Protection of the Rights of all migrant Workers and members of their families, 1996	July 1995
	International Convention for Protection of All Persons from Enforced Disappearance, 2010	December 2010
	Convention on the Rights of Persons with Disabilities, 2008	April 2008
	UN 2030 Agenda for Sustainable Development and the Sustainable Development Goals	September 2015

3.6 NATIONAL STRATEGIES AND PLANS ON ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

163. **Table 3.6.1** lists the national-level action plans and strategies (including systems) on various natural resources components and environmental management which impact on projects and activities. These are implemented by national government agencies and instrumentalities in coordination with appropriate stakeholders and partners, which reflects the cross-sectoral approach to environmental management concerns.

Table 3.6.1 National Strategies and Plans Relevant to Environmental and Social Considerations

Category	Name
Biodiversity	National Biodiversity Strategy and Action Plan (NBSAO) 2015-2028
	Philippine Biodiversity Conservation Priorities 2002
	National Wetland Action Plan for Philippines 2011-2016
	Philippine Plant Conservation Strategy and Action Plan 2005
Pollution	DAO 2007-22, Guidelines on the Requirements for Continuous Emission Monitoring System
	DAO 2000-82, Integrated Air Quality Improvement Framework-Air Quality Control Action Plan
	Adopt an Estero/Water body Program 2010
	DAO's Implementing Sec. 5 of RA 9275 on the Designation of Certain Areas as Water Quality Management Areas
	Integrated Persistent Organic Pollutants Management Project
	Adoption of a National Strategy for the Management of POP's Contaminated Sites in the Philippines, EMB Memorandum February 2016
	National Solid Waste Management Framework 2004
Social	Philippine Development Plan (PDP) 2017-2022
	Philippine Environmental Partnership Program
	Government Poverty Reduction Programs and Plans
	Philippine Plan for Gender Responsive Development Plan 1995-2025
	National Plan of Action for Children 2017-2022
	22 Point Platform and Policy Pronouncements on Labor and Employment 2010
	Philippine Labor and Employment Plan (LEP) 2017-2022
Climate Change	Second National Communication Plan on Climate Change
	Philippine Energy Plan 2009-2030
	Philippine Strategy on Climate Change Adaptation 2010-2022

Category	Name
	National Framework Strategy on Climate Change 2010-2022
	Philippine Development Plan 2017-2022
	National Climate Change Action Plan 2011-2028

3.7 PERMITS, CLEARANCES, AND APPROVALS TO BE OBTAINED FOR PROJECT IMPLEMENTATION

164. **Table 3.7.1** summarizes the permits required for the project, the endorsing authorities, the required documents that need to be secured prior to project implementation. The procedures for tree cutting, spoil disposal and historic preservation during construction (including archaeological discovery) are also discussed.

Table 3.7.1 Permits Required for the Project

Permit	Authority	Laws and Regulations	Required Documents	Responsible Party	Timeline
Permit for a Project to Construct Structure over Water Body	DPWH	• PD 1067 • DAO 2005-10 • DPWH DO 179 Series of 2015, Dec. 3.2015 "Design Guideline, Criteria and Standards, 2015 Edition"	• Letter request (attach requirements below) • Vicinity map • Cross-section of structure(s) with cross-section of the river at the location of the structure showing the minimum water level, the maximum flood level without the structure(s) and the maximum flood level with structure(s) • Plan showing the extent of the maximum flooded area without structure(s) and the maximum flooded area with the structure(s) • Schemes and details of provisions for passage of watercrafts • Construction schedule	DOTr/ Contractor	Secure prior to construction
Wastewater Discharge Permit	EMB-Regional Office	• RA 9275 • DAO 2016-08	• Letter request, attaching requirements below and supporting documents • Application form including sources of water and wastewater generation, product information and vicinity map	DOTr/ Contractor	Secure prior to construction of wastewater treatment facility
Tree Cutting Permit, Chainsaw Registration	DENR-Regional Office Philippine Coconut Authority (PCA)	• Memorandum from DENR Secretary (November 27, 2009) "Guidelines and Procedures on the Planting, Maintenance and Removal of Trees in Urban Areas and in Areas Affected by Government Infrastructure Projects." • DENR Memorandum Order No. (DMO) 2012-2 (November 5, 2012) "Uniform Replacement Ratio for cut or Relocated Trees" • DAO 2020-06, "Amending Certain Provisions and Expanding the Coverage of DENR Administrative Order No. 2018-16 or the "Guidelines in the Processing and Issuance	• Letter request, attaching requirements below • Original copy of barangay/city mayor's clearance/barangay certification re: interposing no objection to the removal of trees • Proof of land ownership • Geotagged photos • Layout plan/site development plan indicating location of existing tree(s) • Transplanting site of trees within the area • Copy of the ECC • Copy of the results of public consultations during EIS • Brief/summary of description of the project • Perspective plan (soft landscape plan)	DOTr/ Contractor	Secure prior to site clearing

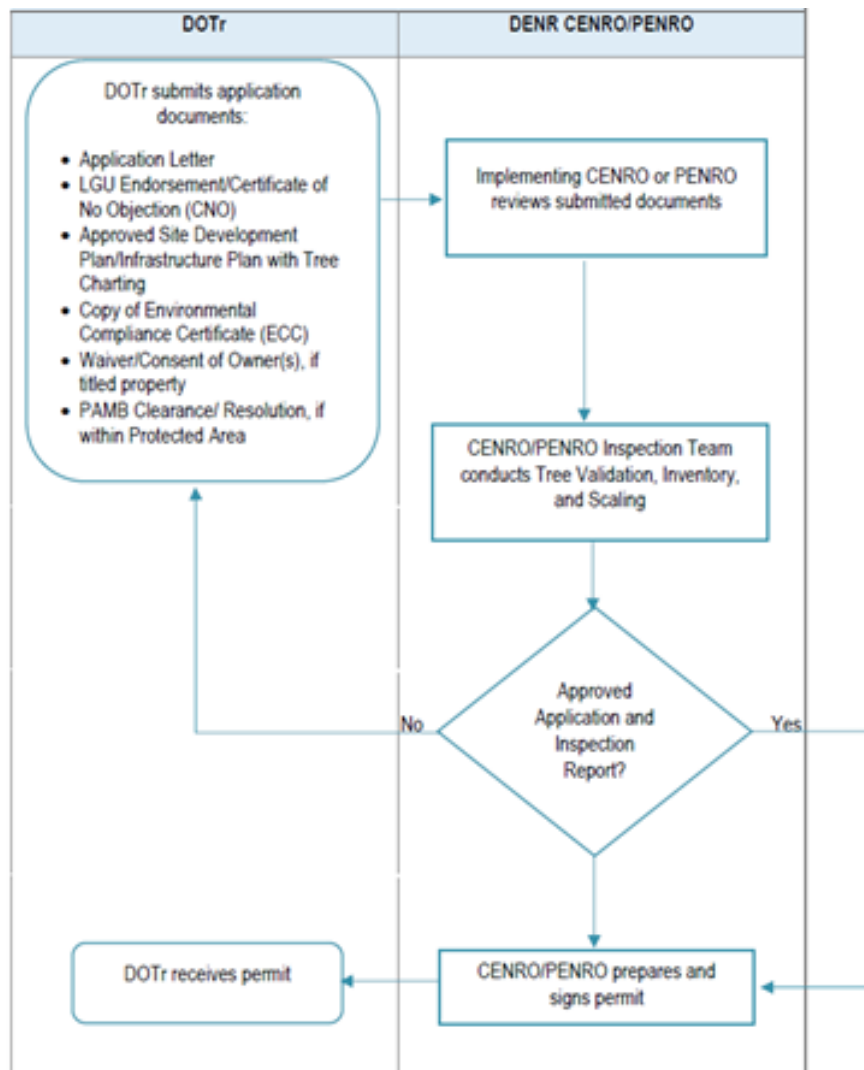
Permit	Authority	Laws and Regulations	Required Documents	Responsible Party	Timeline
		- of Permits on the Removal and Relocation of Trees Affected by DPWH Projects" - DENR Administrative Order 2018-16, "Guidelines in the Processing and Issuance of Permits on the Removal and Relocation of Trees Affected by DPWH Projects" - PCA Administrative Order No. 3, series of 2018, "Revised IRR of RA 8048, otherwise known as the Coconut Preservation Act"	- Cutting/balling/IEC plan - Recommendation report from the Forestry Utilization Section (FUS) personnel in the form of a memorandum		
Permit to Operate for Generator/ Sub-station (Air Pollution Source Installation (APSI))	EMB-Regional Office	- RA 8749 - DAO 2000-81	- Letter request, attaching requirements below and supporting documents - General information - Raw materials and product information - List of the APSI, etc.	DOTr/Contractor	Secure prior to operation of the APSI
Collection of Solid Wastes	LGU	- RA 9003 - DAO 2001-34	Waste collectors are usually accredited by the LGU where they operate their business	Solid wastes collectors (to be required by DOTr to present their accreditation)	Secure prior to collection of solid wastes
Hazardous Waste Generator ID No.	EMB-Regional Office	- RA 6969 - DAO 2013-22	Registration online, ECC	DOTr	Secured prior to construction
Hazardous Wastes Transport Record (Manifest System)	EMB-Regional Office	- RA 6969 - DAO 2013-22	Manifest system for transport and disposal of prescribed hazardous wastes, the transport permit	DOTr	Secure prior to transport/disposal of hazardous wastes
ECC for Batching Plants/Construction Work Areas/Temporary Facilities/Spoil Disposal Area	EMB Regional Office	- PD 1152 - PD 1586 - DAO 03-30 - EMB MC 2007-002 (RPM of DAO 03-30) - EMB MC 2011-005	Initial environmental examination checklist (online application)	DOTr/ Contractor	Secure prior to operation of batching plants/construction work areas/ temporary facilities

Permit	Authority	Laws and Regulations	Required Documents	Responsible Party	Timeline
Pollution Control Officer (PCO) Accreditation	EMB Regional Office	• LOI 588 • PD 1586 • EO 192 • RA 9275 • DAO 2014-02 • DAO 2018-07	• Letter of request • Application form • Basic qualifications and minimum competency requirements as contained in Sec. 6 of DAO 2014-02	DOTr/ Contractor	Secure during pre-construction
LGU Permit	LGU	• RA 7160 • AO 270 (1992)	• Application form • Property title • Tax declaration • Examples of permits: building permits and barangay clearance	DOTr/ Contractor	Secure prior to construction
Clearance/Endorsement on Built Heritage Concerns	Tripartite (NCCA-NHCP-NMP) Technical Working Council (TWC) on built heritage issues and concerns through NCCA chairman on behalf of the board of commissioners	• RA 10066	• Protection plan (the procedure for historic structures/buildings during construction) • Conservation plan	DOTr/PNR	Secure prior to construction
Traffic clearance and excavation permit	MMDA	• MMDA Regulation No. 11-002	• Application form • Detailed plan with vicinity/location plan • Program of works or bill of quantities • Contract or notice of award • Traffic management plan and/or re-routing plan.	DOTr/ Contractor	Secure prior to construction

165. All projects that require cutting of trees must secure a tree cutting permit from the DENR and the Philippine Coconut Authority (PCA). The issuances and guidelines in obtaining a tree cutting permit are presented earlier in **Table 3.7.1**.

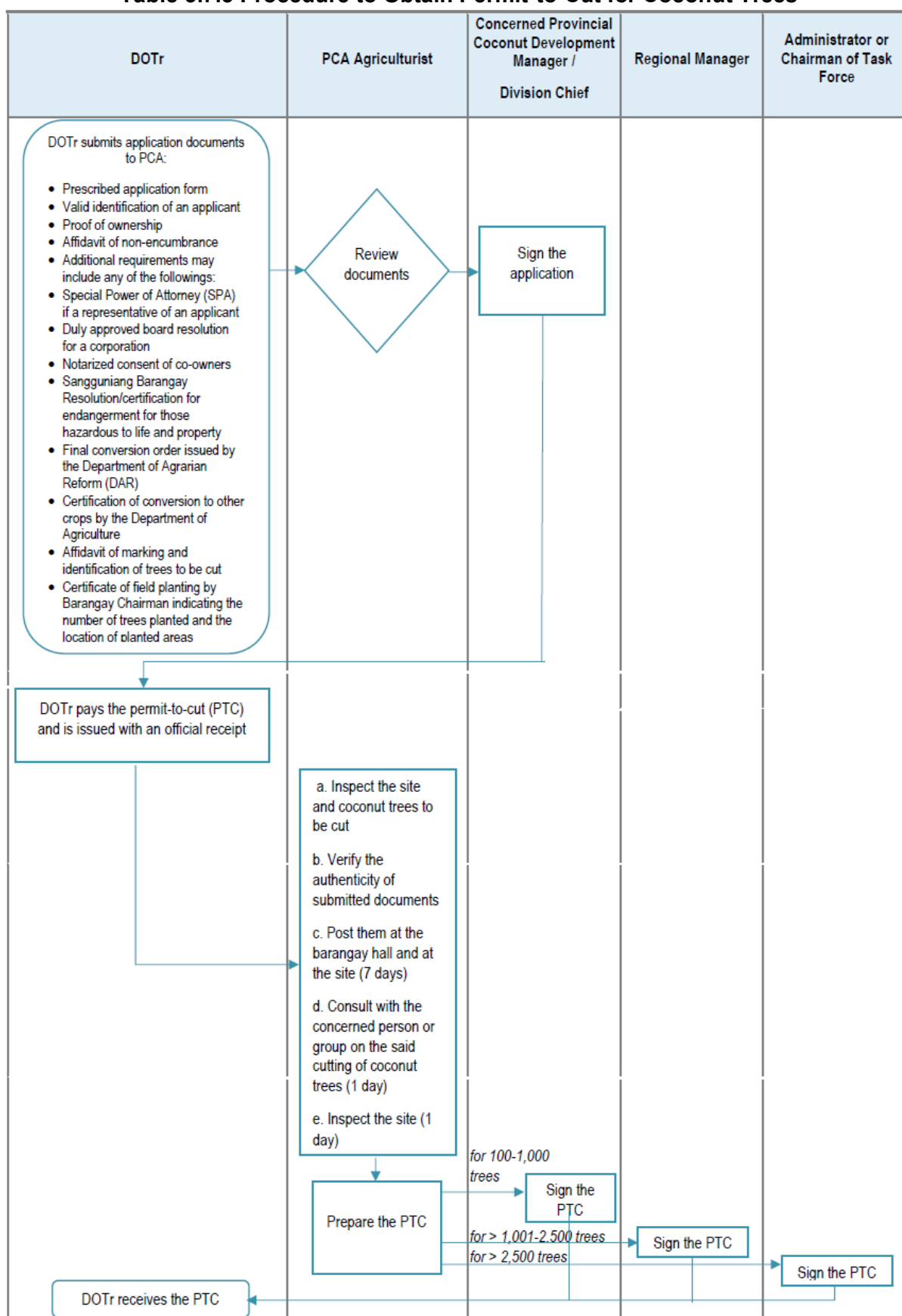
166. The application procedures for the issuance of a tree cutting permit are shown in **Table 3.7.2** and **Table 3.7.3**. The responsible agency for the approval of the tree cutting permit is the concerned DENR Community Environment and Natural Resources Office (CENRO) or Implementing Provincial Environment and Natural Resources Office (PENRO). As prescribed, the process of tree cutting permit application takes about three days. Once issued, a tree cutting permit is usually valid for 60 days after its issuance. The proponent can claim to extend its validity through justification on the reason for extending its validity. If coconut trees are affected, tree cutting guidelines of the PCA, pursuant to Republic Act No. 10593, are applied. The use of DENR-registered chainsaws in cutting the coconut trees as mandated by RA 9175 (Chainsaw Act of 2002) also applies.

Table 3.7.2 DENR Procedure to Obtain Tree Cutting Permits



Source: DENR (2020). *Issuance of Tree Cutting and/or Earth-Balling Permit for DPWH Projects* (DENR Citizen's Charter Process No. RO-F-05).

Table 3.7.3 Procedure to Obtain Permit-to-Cut for Coconut Trees



Source: PCA (2017). *PCA Quality Management System Manual* (Resolution No. 151-2017).

3.7.1 Spoil Disposal

167. The acquisition of relevant permits and clearances for the Spoil Disposal Area to be used for the excess soils from excavation and earthworks is expected to be borne by the Contractor in accordance with the target timeline with the management and supervision of DOTr and its GC.

168. Prior the operation and use of a spoil disposal area, the permits and clearances provided in **Table 3.7.4** are needed to be secured from respective government offices.

Table 3.7.4 Permits and Procedure Related to Spoil Disposal Area

Permits and Clearances	Procedure	Issuing Office/ Authority
ECC for the spoil disposal area/site	Upon the finalization of the location and size of the spoil disposal area to be used, securing of ECC are undertaken. Based on EMB MC 2007-002, use of land for spoil disposal area (classified under reclamation and other land restoration projects) with ≥ 5 has but < 25 has is categorized as "B" and is required to prepare an EIS under the concerned DENR-EMB Regional Office.	DENR-EMB
Accreditation of Solid Waste Collectors	The DOTR, through the Contractor, requires the private hauler to submit The contractor for solid waste collection is required to submit proof of accreditation of solid waste collectors issued by the LGU.	LGU
Hazardous Waste Generator ID (if the soil is found to be contaminated based on analytical testing and classified as hazardous waste per DAO 2013-22)	Prior the disposal of the spoils to be generated, it is important to have it tested for its toxicity. If the result of the laboratory test shows that the soil is contaminated, then these are characterized, and must comply with the limits provided in DAO 2013-22 or the IRR of RA No. 6969. If soils are categorized as hazardous waste, then transport and disposal must comply with the requirements of RA No. 6969 (i.e., soils must be disposed to an accredited TSD facility by an accredited hazardous waste transporter). The TSD facility, depending on their treatment process, may have an existing discharge permit. The Contractor and its proponent apply for a Hazardous Waste Generator ID for all the present chemical and its estimated amount to be generated. Non-impacted/contaminated soils which are non-hazardous may be disposed of to the target spoil disposal area	DENR-EMB
Hazardous Wastes Transport Record (Manifest System) (if the soil is found to be contaminated based on analytical testing and classified as hazardous waste per DAO 2013-22)	If soils are categorized as hazardous waste, then transport and disposal must comply with the requirements of RA 6969. A waste generator whose hazardous wastes are transported outside the waste generator's premises is required to comply with the Hazardous Waste Manifest System. The Hazardous Waste Manifest System refers to the online tracking and database system for real-time tracking of the wastes from the point of generation to the point of ultimate treatment, storage or disposal, and for timely and easy access of hazardous waste management information. The transporter must secure an approved Manifest Form to convey the hazardous waste from the waste generator's premises to the designated TSD facility.	DENR-EMB
Traffic clearance and excavation permit	All excavation activities to be done within Metro Manila are secured with permission and permit first with the MMDA. Further, the hauling of spoil towards its chosen disposal area may cause traffic congestion during its operation. With this, the Contractor, in coordination with the proponent, secures a Traffic Clearance and Excavation Permit from their Traffic Engineering Center and provide requirements such as, but not limited to, the detailed plan with vicinity/location plan, program of works or bill of quantities, contract or notice of award, and traffic management plan and/or re-routing plan.	MMDA

3.7.2 Historical/Cultural Heritage

3.7.2.1 Laws and Guidelines Relevant to Historical/Cultural Heritage

169. The country's cultural heritage, its property and histories, and the ethnicity of local communities are protected through Republic Act 10066 (RA 10066) or the National Cultural Heritage Act of 2009, Republic Act 4846 or the Cultural Properties Preservation and Protection Act, Presidential Decree No. 374, Amending Certain Sections of Republic Act 4846, and Republic Act 10086, Strengthening Peoples' Nationalism through Philippine History Act. All cultural properties of the country deemed important to cultural heritage are registered in the Philippine Registry of Cultural Property. Cultural properties are defined in RA 10066 as "all products of human creativity by which a people and a nation reveal their identity, including churches, mosques, and other places of religious worship, schools, and natural history specimens and sites, whether public or privately-owned, movable or immovable, and tangible or intangible.

170. Based on RA 10066, cultural properties can be categorized into Grade I level (declared as World Heritage Sites, National Cultural Treasures, National Historical Landmarks, National Historical Shrines and Historical Monuments), Grade II level (declared as Important Cultural Properties (ICC)), Grade III (all other cultural property in the PRECUP not declared as Grade I or II but are presumed ICC or possess characteristics of an ICC), and Uncategorized Property (undeclared property not presumed ICC but contains characteristics but will qualify them as such shall be registered in the PRECUP).

171. At the national level, the NHCP, in collaboration with other cultural agencies, declares historic sites and structures in the country based on their demonstrable historical significance, age (at least 50 years old), and authenticity (70.0 %) in accordance with NHCP Guideline on the Identification, Classification, and Recognition of Historic Sites and Structures in the Philippines (2011) under the National Cultural Heritage Act of 2009 or RA 10066 (2009).

172. Marked structures or structures with historical markers are presumed ICC unless declared by NHCP. Works of national artists are also presumed ICC unless declared by NCCA. Structures with historical markers and works of national artists both fall under Grade III Category. At the local level, LGUs are mandated to maintain an inventory of cultural properties under their jurisdiction and the NCCA is furnished a copy of the same. Local important cultural properties are declared by the Sanggunian due to their significance to local culture and history.

173. The JICA Guidelines also requires the assessment of potential project impacts to cultural heritage. Projects must be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of cultural heritage and should not cause significant adverse impacts on designated conservation areas.

3.7.2.2 Responsible Authorities

174. The national cultural agencies such as NHCP, NMP and NCCA are responsible for the protection of archaeological and cultural resources in the country. The NMP is the designated agency to preserve and protect the important cultural properties such as artefacts, historical sites, and archaeological sites. The NHCP and NMP were designated as lead agencies in declaring heritage zones that are culturally significant to the country. By virtue of RA 11333, some regulatory functions of the NMP were transferred to NCCA (Section 30) as provided by RA 4846 and RA 10066. Collaboration and coordination between and among these agencies are expected for historic and cultural concerns.

3.7.2.3 Preservation of Historic Structures

175. In case that historic structures are present in a project site, the endorsement of the Philippines' cultural agencies in relation to the preservation of historic structures is necessary prior to project

implementation to ensure that proposed project activities conform with acceptable cultural and historical standards and procedures. In the absence of a standard procedure, the DOTr developed the Procedure for Historic Structures/Buildings Preservation during Construction for the NSCR Calamba Ex Project in 2019 (**Annex C-2**). Upon official approval of the NMP, this procedure also applies for the NSCR Project including SBT Section. The reference law and guidelines in the preparation of the procedure include RA 10066, RA 10086, RA 6541, RA 8492 and NHCP Guidelines (i.e., NHCP Guidelines on the Identification, Classification and Recognition of Historic Sites and Structures in the Philippines, NHCP Universal Guidelines of the Restoration and Preservation of Monuments and Historic Sites, NHCP Process of Architectural Restoration, NHCP Techniques involved in the Restoration of Historic Structures, NHCP Standards and Guidelines in Maintaining Historic Sites and Structures).

3.7.2.4 Heritage Accidental Finds

176. RA 10066 was enacted for the protection and conservation of the country's national cultural heritage. If an archaeological site is discovered in project sites which have already received clearance, all earth-moving activities are required to cease immediately, subject to an assessment by the NMP. As stated in Section 33 of the IRR of RA 10066, when the presence of any cultural or historical property the NMP or NHCP immediately suspends all activities that affect the site. The procedure for Historic Structures/Buildings Preservation during Construction developed in 2019 for the NSCR Calamba Ex Project by DOTr also outlines the chance-find procedures as well as the heritage accidental find procedure (**Annex C-2**).

3.8 HEALTH AND SAFETY PROTOCOLS RELATED TO COVID-19

177. Throughout the conduct of field activities for the environmental baseline surveys, the Health and Safety Protocols for Public Consultations and Ground Surveys in the Context of COVID-19 of the PNR and DOTr (June 2020) (**Annex C-3**) was implemented to ensure the safety of PAPs and activity organizers given the COVID-19 pandemic.

178. DOTr also developed the Unified COVID-19 Health and Safety Protocols for Railway Lines (20 May 2021) (**Annex C-4**). This protocol is currently being implemented to promote, develop and regulate a dependable and coordinated network of transportation without sacrificing the health and safety of railway sector personnel within the premises of all stations and depot offices of existing railway system and all on-going railway projects.

179. National legislations and guidelines (**Table 3.8.1**), movement restrictions imposed by national and local governments and key international recommendations of the Centers for Disease Control and Prevention (CDC), WHO, and IFC in response to COVID-19 were considered in the development of the DOTr protocols. The consideration of local and international standards ensures that project activities are conducted in line with the country implementation of preventive and control measures against the COVID-19 pandemic declared by the WHO as a public health of international concern in January 2020.

Table 3.8.1 National Legislation and Guidelines on COVID-19 (as of November 2021)

No.	Legislation/ Guideline	Content
1	Presidential Proclamation 922 Issued on March 8, 2020	Declaring a state of public health emergency throughout the Philippines due to COVID-19
2	Presidential Proclamation 929 Issued on March 16, 2020	Declaring a state of calamity throughout the Philippines due to COVID-19
3	DOH AO 2020-0015 Issued on April 27, 2020	Setting the Guidelines on the Risk- Based Standards for COVID-19 Mitigations; applicable to public consultations and ground surveys.

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No.	Legislation/ Guideline	Content
4	EO 112 Series of 2020 Issued on April 30, 2020 by the President of the Philippines	- Imposing an ECQ in high risk geographic areas of the Philippines and General Community Quarantine (GCC) in the rest of the country from May 01 to 15, 2020 - Section 3 – Confirmed and adopted the “Omnibus Guidelines on the Implementation of Community Quarantine in the Philippines”
5	DTI and DOLE Interim Guidelines on the Workplace Prevention and Control of COVID- 19 Issued on April 30, 2020	Assistance to private institutions in developing the minimum health protocols and standards to operate during the COVID-19 pandemic; applicable to public consultations and ground surveys
6	DOH Department Memorandum 2020-0220 Issued on May 11, 2020	Interim Guidelines on the Return-to-Work; applicable to public consultations and ground surveys
7	Omnibus Guidelines on the Implementation of Community Quarantine in the Philippines (IATF) Issued on May 15, 2020	Guidelines for the areas placed under quarantine including restrictions on the organization of mass gathering and movement, including suspension of public transportation
8	DPWH DO 39 S. 2020, Return-to-work Guidelines and Workplace Standard Protocol Issued on May 19, 2020	Types of projects that may be implemented, and guidelines for the return to work
9	EO 168 Series of 2014 Issued on May 26, 2014 by the President of the Philippines	E.O Creating the Inter-Agency Task Force (IATF) for the management of emerging infectious diseases in the Philippines
10	DOTr Guidelines on Public Transportation under GCQ Issued on May 29, 2020	- Stringent sanitary measures are to be strictly enforced. - Phase 1 (covering June 1 to 21) Phase 2 (covering June 22 to 30) - Authorized transportation modes differ in Phase 1 and Phase 2
11	EMB MC 2020-30 Issued on July 29, 2020	Interim Guidelines on Public Participation in the Implementation of the Philippine Environmental Impact Statement System (PD 1586) During the State of the National Public Health Emergency
12	RA 11494 “Bayanihan to Recover as One Act” Approved on September 11, 2020	Providing for COVID-19 Response and Recovery Interventions and Providing Mechanisms to Accelerate the Recovery and Bolster the Resiliency of the Philippine Economy, Providing Funds Therefor, and for other purposes
13	Omnibus Guidelines on the Implementation of Community Quarantine in the Philippines with Amendments/updates as of January 14, 2021	- Amended Omnibus Guidelines to harmonize and codify existing guidelines of the IATF and member - agencies pertaining to community quarantine which are applied to all regions, provinces, cities, municipalities and barangays placed under community quarantine - Under GCQ and MECQ public transportation are allowed to operate at such capacity and following the protocols as provided for by the DOTr
14	Omnibus Guidelines on the Implementation of Community Quarantine in the Philippines with Amendments/updates as of April 15, 2021	- Amended Omnibus Guidelines to harmonize and codify existing guidelines of the IATF and member - agencies pertaining to community quarantine which are applied to all regions, provinces, cities, municipalities and barangays placed under community quarantine - Prohibitions/Limitations on Mass and Public Gatherings under the Different Community Quarantines (i.e. gatherings under ECQ, MECQ & GCQ are prohibited while allowed in MGCQ up to 50% of seating or venue capacity)
15	DILG MC 2021-050, Issued on May 5, 2021	Directives on the Roles of Local Chief Executives in the Implementation of Minimum Public Health Standards Especially on the Prohibition Against Public or Mass Gatherings
16	IATF Resolution 131 Series of 2021, August 5, 2021	Inclusion of contractors, subcontractors, and consultants of the DOTr for the construction of BBB flagship infrastructure projects
17	Guidelines on the Implementation of Alert Levels System for COVID-19 Response in Pilot Areas, October 13, 2021	New Community Quarantine Classifications for dealing with COVID-19 covering entire cities, municipalities and/or regions; aimed to manage and minimize the risk of the disease through System Indicators, Triggers and Thresholds determined by the IATF to specify the public health and social measures to be taken in relation to the COVID-19 response, as may be updated based on new scientific knowledge, information about the effectiveness of control measures in the country and overseas, and its application.

4 ENVIRONMENTAL BASELINE CONDITIONS

4.1 OVERVIEW OF BASELINE SURVEYS

180. Environmental baseline assessment was undertaken as part of the Supplemental Environmental Impact Assessment (EIA) Report for the SBT Section. Baseline surveys were conducted for environmental aspects most likely to be impacted by project construction and operation including soil quality and contamination, terrestrial vegetation and wildlife, surface water quality, ambient air quality, noise and vibration (**Table 4.1.1**). All sampling activities were done during the wet season. For environmental baseline assessment that requires seasonal variation analysis, secondary data were used as reference. Prior to the conduct of sampling activities, a field reconnaissance was conducted from October 27-28, 2020 to assess the suitability and accessibility of the proposed sampling sites and to capture aerial images and photos of the study area (**Plate 4.1.1**). An additional field reconnaissance was conducted for the soil quality and contamination assessment last November 3, 2020. Socio-economic baseline information are also covered but studies on land acquisition, displacement, relocation, and livelihood programs for the direct project-affected persons (PAPs) of the SBT Section are detailed in the Resettlement Action Plan (RAP) for the Project.

Table 4.1.1 Summary of Environmental Baseline Surveys

Study Area	Survey Method	Number of Sampling Sites	Sampling Dates
Soil quality and contamination	Composite sampling	2	November 11, 2020
Terrestrial vegetation	Transect survey	2	October 30, 2020
Terrestrial wildlife	Transect survey	2	October 28, and November 4-5 and 9, 2020
Surface water quality	Grab sampling	2	October 30, 2020
Ambient air quality	24-hour and 1-hour sampling	2	November 17-19, 2020
Noise	24-hour and 1-hour sampling	3	November 4-6, 2020 March 22-23, 2021
Vibration	24-hour sampling	2	November 17-19, 2020

Note: analyzed parameters for each study area are presented in their respective sections below

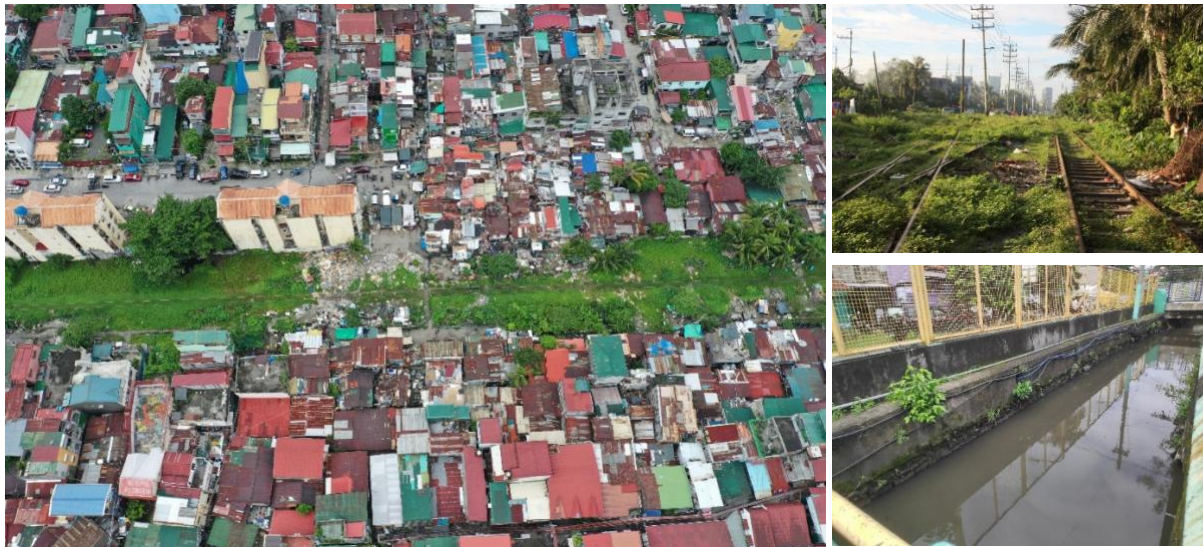


Plate 4.1.1 Drone Captured Image and Photos taken during the Field Reconnaissance: Left Photo (SB section); Upper Right Photo (SBT Fauna 1 Transect); Lower Right Photo (SBT WQ2)

181. The SBT Section will be directly traversing 21 barangays in the district of Tondo and additional 6 barangays located within 100 m from both edge of the existing right-of-way (ROW) of the Philippine National Railways (PNR) and adjacent private lots. Manila is the capital city of the country, bounded on the west by the Manila Bay, Navotas City; Caloocan City on the north; Quezon City, San Juan City, and Mandaluyong City on the east; and Makati City and Pasay City on the south. Manila is a densely populated area and is classified as a highly urbanized city. Land uses along the SBT Section alignment include high density residential areas, medium to high intensity commercial areas, general institution zones (Manila Comprehensive Land Use Plan (CLUP), 2018).

4.2 THE LAND

4.2.1 Soil Quality and Contamination

182. The soil quality and contamination assessment were conducted to establish baseline soil conditions along the SBT Section. The specific objectives of this assessment are to:

- assess the baseline conditions of the project site with regards to soil quality and soil contamination associated with the current and historical use of the site and its vicinity;
- identify the presence or absence of contaminated soils on site;
- determine contamination pathways the Project may affect;
- identify potential impacts of the Project to the surrounding soil; and
- develop prevention and/or mitigation measures for the identified impacts to the surrounding and excavated soil.

4.2.1.1 Scope of Study

(1) Study Area

183. The soil quality and soil contamination assessment covered the existing PNR ROW, which will be utilized by the Project, and the impact zones. Based on a review of historical land use data, the study area and impact zones used to be mixed residential, commercial, and institutional areas. Its current land use is mixed medium- to high-density residential-commercial areas with some institutional zones and open spaces based on the 2005-2020 Manila City Comprehensive Land Use Plan and Zoning Ordinance (MCLUPZO). Earliest available satellite images from 2001 show the study area occupied by residential establishments.

4.2.1.2 Survey Methodology

(1) Preliminary Site Assessment

184. A preliminary site assessment (PSA) was conducted on October 27, 2020 and November 3, 2020 in accordance with the American Society for Testing and Materials (ASTM) E-1527 and the Guidelines for Site Characterization provided in Memorandum Circular No. 2017-003 (MC 2017-003) by DENR-EMB in order to identify potential sampling sites for the soil quality and soil contamination assessment. The following were also conducted as part of the PSA:

- review of all relevant environmental documents such as historical land uses within the study area with focus on potentially contaminating activities, historical satellite/aerial images, previous environmental investigation reports, and geotechnical investigation reports;
- identification of visually observable contaminated soils within the project alignment and within 500-m radius of the alignment;
- identification of potential sources of contamination within the project alignment and within 500-m radius of the alignment; and,
- identification of potential sensitive receptors within the project alignment and within 500-m radius of the alignment.

(2) Soil Sampling

185. Two composite samples were collected from each sampling site – one from the surface (0.0 m to 0.1 meters below ground surface (m bgs) and one from the subsurface (0.40 m to 0.50 m bgs). Prior to digging the first borehole, and between subsequent boreholes, boring and sampling equipment were decontaminated to prevent potential cross-contamination between soil samples. The decontamination

procedure involved washing the equipment with a phosphate-free detergent, followed by several rinses with distilled water.

186. Surface soil samples were collected using a clean stainless-steel hand trowel. Subsurface samples were collected using a 100-millimeter (mm) diameter hand auger which was used to bore into the subsurface soil until 0.50 m bgs. This tool consists of a short cylindrical container with cutting flange (auger bucket) attached to a rod and operated by hand. It is typically used to bore shallow holes and obtain samples of soil and other relatively unconsolidated near-surface materials. Most of the soil is discharged into the bucket as the auger moves downward providing a collectable sample at a measurable depth. Soil samples were collected from the auger bucket upon retrieval of the equipment from the borehole.

187. As indicated in MC 2017-003, the soil samples were classified according to the Unified Soil Classification System (USCS) and described by soil type, color, grain size, accessory constituents, plasticity, moisture content, chemical/hydrocarbon staining and odors. A field headspace screening measurement was performed using a calibrated Photo-Ionization Detector (PID) to detect potential organic vapors within the soil samples as detailed in US EPA SW-846 Test Method 3815¹.

188. The collected samples were placed and mixed in a food-grade low density polyethylene (LDPE) lockable bag. Each homogenized composite sample comprised of multiple grab samples collected within an area of 10 m² at each sampling site (Plate 4.2.3 and Plate 4.2.4).

189. Subsequent to homogenization of the soil samples in the LDPE bag, composite soil samples were extracted into pre-labelled laboratory-supplied soil jars, sealed, and placed in a cooler filled with ice to chill the samples to less than 6°C to preserve the integrity and quality of the soil samples prior to delivery to the laboratory for analysis. Each soil sample was recorded in accordance with standard sample chain-of-custody (CoC) protocol.

190. The parameters analyzed for this study and the corresponding reference methods for sample preparation and analysis are presented in **Table 4.2.1**. Based on the potential sources of contamination within a 500-m radius from the alignment, chemicals of potential concern (COPCs) identified during the PSA include total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, total xylenes (BTEX), mineral oil, free cyanides, polychlorinated biphenyls (PCBs), and heavy metals. These COPCs are commonly associated with petroleum products and industrial processes. USEPA and other standard methods were adopted for the analysis of the identified COPCs.

Table 4.2.1 Soil Quality and Soil Contamination Parameters

Parameter	Test Method
pH	USEPA Method 9045D Soil and Waste pH
Total Kjeldahl Nitrogen	4500-N C Nitrogen
Exchangeable Potassium	USEPA 6010B Inductively Coupled Plasma Method
Available Phosphorus	Colorimetric Method
Total Metals: Arsenic (As), Barium (Ba), Copper (Cu), Zinc (Zn), Cadmium (Cd), Chromium (Cr), Lead (Pb), Selenium (Se), Nickel (Ni), Iron (Fe), and Manganese (Mn)	USEPA 6010B Inductively Coupled Plasma-Atomic Emission Spectrometry
Total Metals: Mercury (Hg)	USEPA 7471A Cold-Vapor Atomic Absorption (CVAA)
Polychlorinated Biphenyls (PCBs)	USEPA Method 8082 PCBs by Gas Chromatography
Free Cyanides	USEPA Method 9016
Total Petroleum Hydrocarbons (TPH) C ₆ -C ₉ hydrocarbon range	USEPA 8260B Volatile Organic Compounds by Gas Chromatography / Mass Spectrometry (GC/MS)
TPH C ₁₀ -C ₃₆ hydrocarbon range	USEPA Method 8015C by Gas Chromatography

¹ The local reference guidance used, EMB MC 2017-003, provides guidelines for persistent organic pollutants (POPs) contaminated sites. This, however, does not consider volatile organic pollutants. As such, internationally accepted guidelines from US EPA for site characterization was used.

Parameter	Test Method
Benzene, Toluene, Ethylbenzene, total Xylenes (BTEX)	USEPA 8260B Volatile Organic Compounds by Gas Chromatography / Mass Spectrometry (GC/MS)
Toxicity Characteristic Leaching Procedure (TCLP) Metals: As, Ba, Cr, Pb, Hg, and Se	SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure

191. Majority of the contaminant concentrations in shallow soils, i.e., above the groundwater table, except for volatile constituents typically associated with petroleum hydrocarbons, are generally not affected by seasonal variations particularly by varying ambient temperatures hence further seasonal sampling and testing are no longer recommended.

4.2.1.3 Sampling Site

192. The selection of the sampling sites was based on the potential sources of contamination outside the alignment which were assessed to have the potential to impact the soils and groundwater beneath the site. Identified sampling stations were labelled as SS01 and SS02 and are presented in **Table 4.2.2** and **Figure 4.2.1**. Soil sampling was conducted on November 11, 2020.

Table 4.2.2 Soil Quality and Soil Contamination Assessment Sampling Sites

Station Name	Sample Collected	Location	Coordinates	Weather	Description
SS01	SS01-Surface	Along Hermosa St. cor. Dagupan St. Extension (Barangay 186) City of Manila	14°37'56.96"N, 120°58'34.44"E	Sunny	located near Amigo Gas Station along Hermosa Street. The gas station has been operating for approxi.8 years. Also located within 200 m from this location are Centroil Gas Station and Oliva Engineering and Machine Works which are more than 10 years old. Residential areas are located in close proximity within the ROW (see Figure 4.2.3).
	SS01-0.50 m				
SS02	SS02-Surface	Along Old Antipolo St. cor. Jose Abad Santos Avenue (Barangay 218) City of Manila	14°37'23.25"N, 120°58'38.20"E	Cloudy	Near Caltex Gas Station and Motolite Battery Store including Taiyang Trading which sells automotive batteries, tires, and other auto supply. The gas station and the battery store are approx..20 years old. Approx. 10 years ago, informal settlers occupied this area. During the fieldwork, homeless people were observed residing inside the ROW using makeshift materials. A Meralco Substation was also observed within 200 m from this location (see Figure 4.2.4).
	SS01-0.50 m				

4.2.1.4 Data Assessment

193. Soil analytical results were compared to local guidelines and screening levels including Bureau of Soils and Water Management (BSWM) Soil Fertility Rating and DAO 2013-22, Revised Procedures and Standards for the Management of Hazardous Wastes.

194. In the absence of local guidelines for some parameters, the following international protective guidelines were used: Dutch Intervention Values (DIVs) from the Soil Remediation Circular 2013 of the Dutch Ministry of Infrastructure and the Environment and 2020 Regional Screening Level by the United States Environmental Protection Agency (USEPA).

195. The DIVs mainly provide reference for the regulation of soil clean-up as part of a multifunctional remediation approach while the USEPA RSLs are chemical-specific screening levels based on human health risk associated with possible exposure to potentially impacted soil. Details of the guidelines and screening levels used for the soil quality and contamination assessment are presented in **Sections 3.4.1** and **3.4.2**.

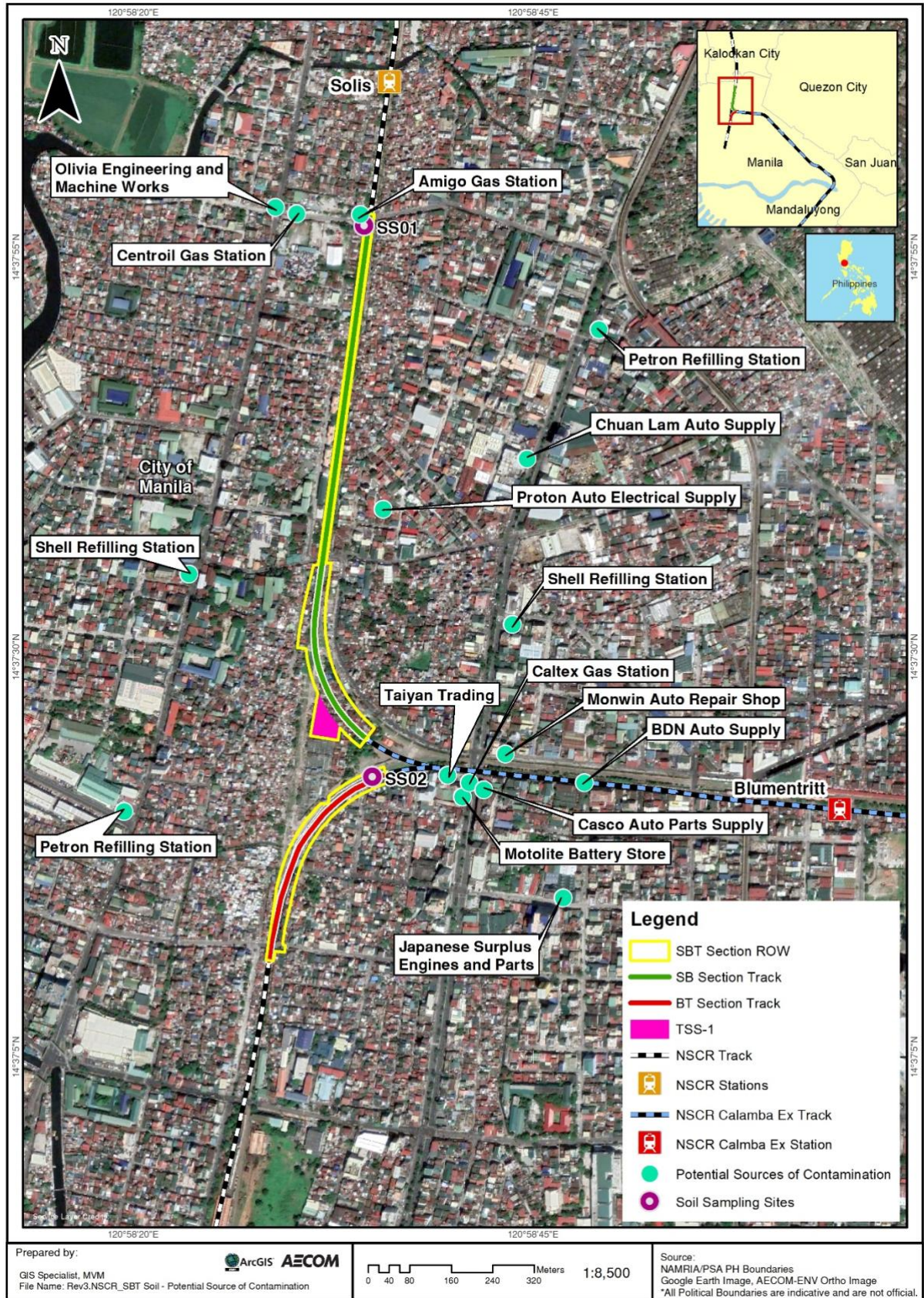


Figure 4.2.1 Potential Sources of Contamination along the SBT Section

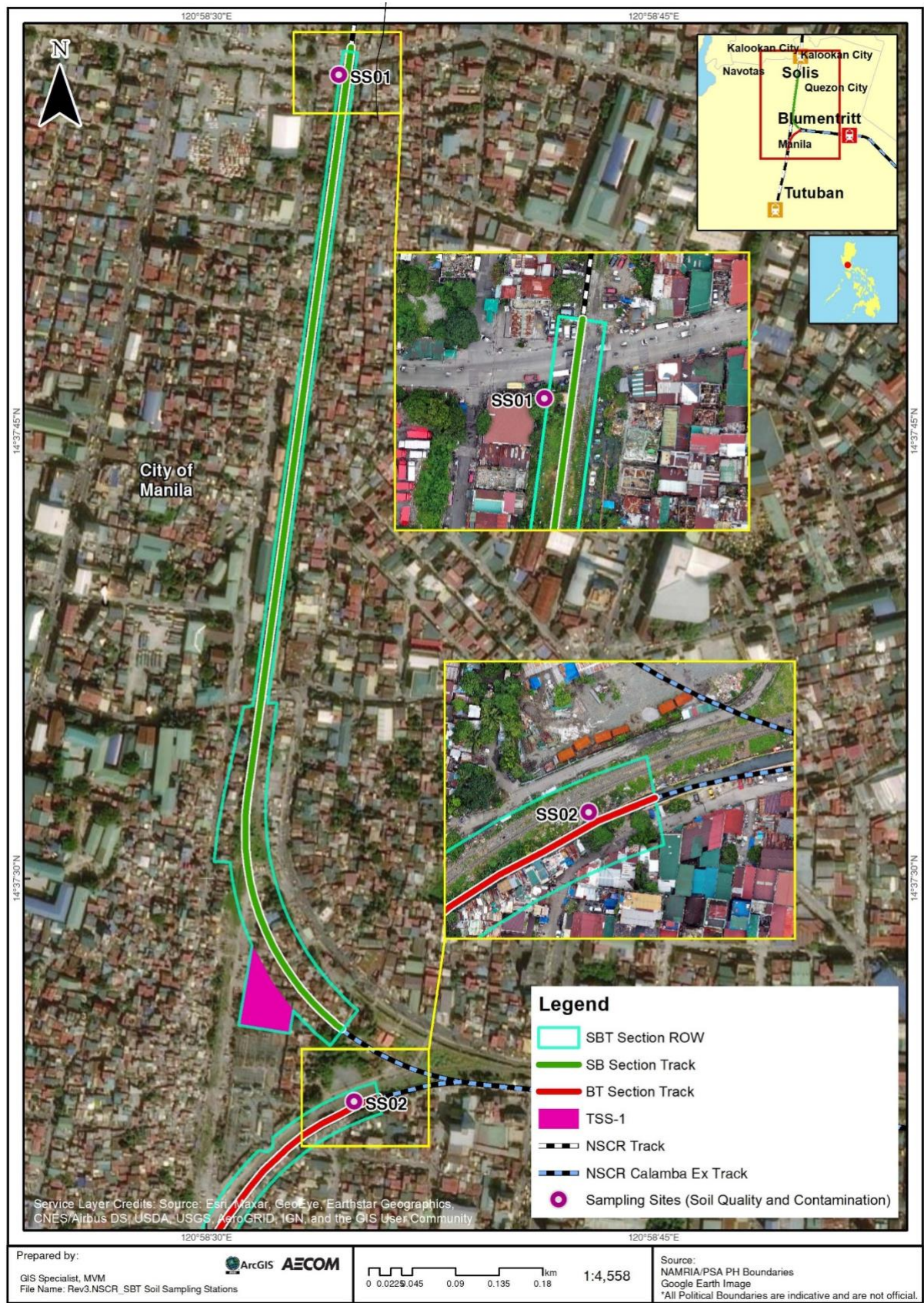


Figure 4.2.2 Soil Quality and Soil Contamination Assessment Sampling Sites

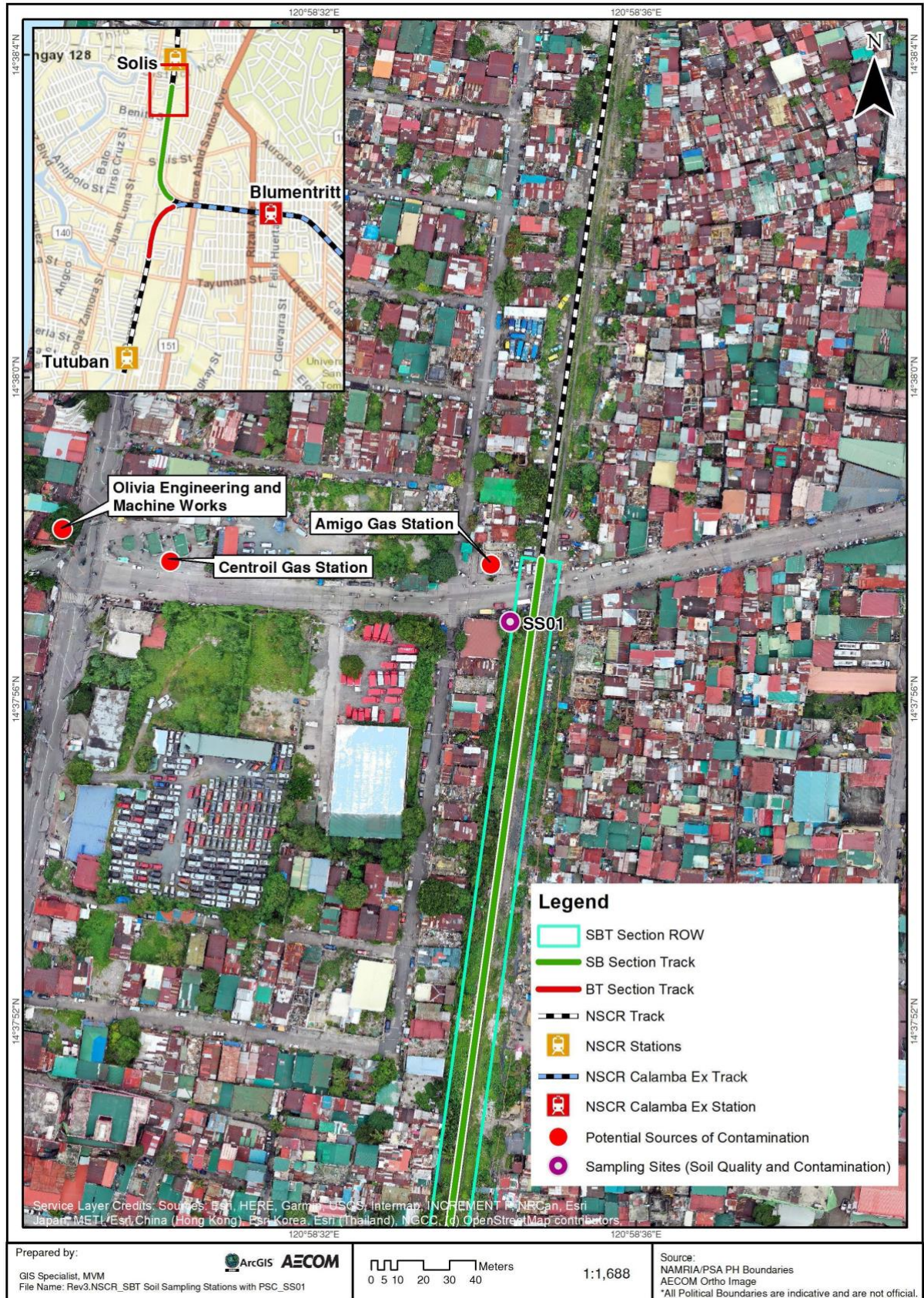


Figure 4.2.3 Sampling Sites and Potential Sources of Contamination in the Vicinity of SS01

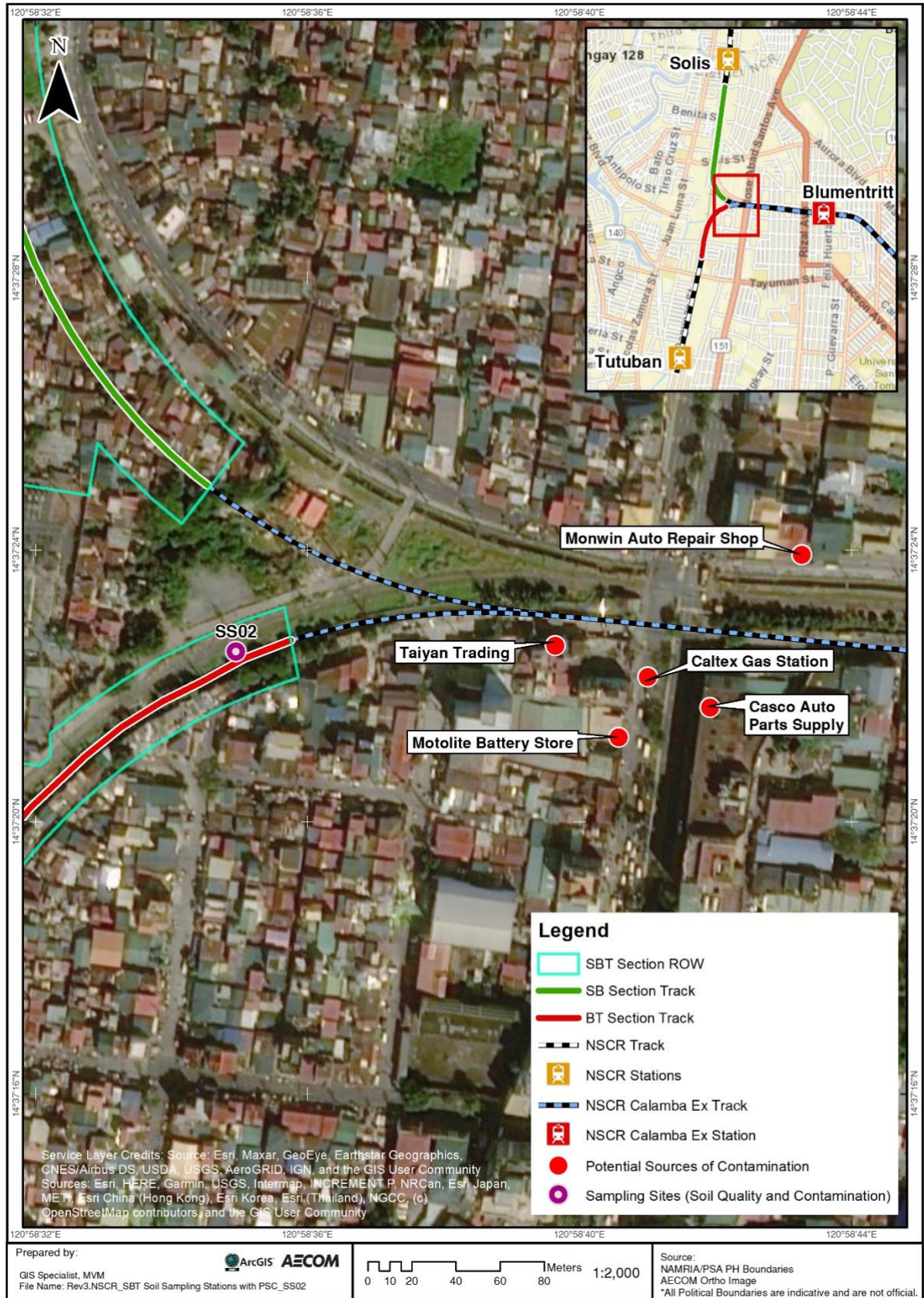
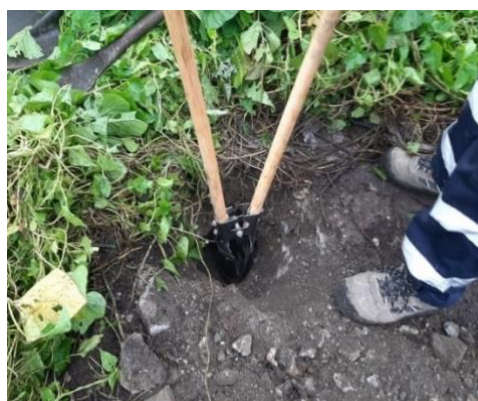


Figure 4.2.4 Sampling Sites and Potential Sources of Contamination in the Vicinity of SS02



Soil Sampling at SS01



Soil Sampling at SS02



Grab Sampling at SS01



Grab Sampling at SS02

Figure 4.2.5 Grab Sampling

4.2.1.5 Survey Results

(1) Soil Quality

196. The SBT Section is underlain by quaternary alluvium based on available geologic maps from the Mines and Geosciences Bureau (MGB). Quaternary alluvium refers to recent heterogeneous mixtures of gravels, sands, silts, and clays with varying degrees of consolidation. Such deposits are influenced by the provenance of sediments. Deposits within the Manila Coastal Zone show characteristics of sediments from alluvial and marine environments.

197. **Table 4.2.3** presents the laboratory results for the parameters analyzed for the soil quality assessment. The laboratory certificates of analyses are attached as **Annex D-1**. No hydrocarbon staining was observed nor odor noted in all soil samples. The PID readings at 0 ppm did not indicate the presence of any volatile organic compounds in all soil samples. Surface samples from SS01 were identified to be very soft, brown, low plasticity clayey silt while samples from 0.50 m bgs depth were soft, dark green, low to medium plasticity sandy clay. Surface samples from SS02 were identified to be soft, dark brown, low plasticity sandy silt while samples from 0.50 m bgs depth were gray gravelly sand.

198. Soil pH is “adequate” as per BSWM standards (**Table 4.2.3**). Surface soils were slightly alkaline while soils at 0.50 m bgs depth were moderately alkaline. Alkaline soils generally have reduced phosphorus and micronutrient availability. Exchangeable potassium (K) levels were low while phosphorus (P) detected in the soil samples were of adequate concentrations. Based on these results, surface soils and soils at 0.50 m bgs are deemed not suitable for agricultural purposes. Potassium not supplied in adequate amounts stunts plant growth and reduces yield. K is an essential nutrient for plant growth as it helps regulate the rate of photosynthesis, exchange of water vapor, oxygen and carbon dioxide, among others.

Table 4.2.3 Results of Soil Analysis Pertaining to Soil Fertility

Parameter	Sampling Station				High/Adequate Values (BSWM)
	SS01 (Surface)	SS01 (0.50 m)	SS02 (Surface)	SS02 (0.50 m)	
Soil Type	Clayey silt	Sandy clay	Sandy silt	Gravelly sand	-
pH	7.64	8.02	7.60	8.11	5.5 – 8.5
Ammonia as Nitrogen, mg/kg	10.60	2.00	4.00	2.10	-
Potassium (exchangeable), mg/kg	0.01	0.03	0.01	0.03	>0.25
Nitrate as Nitrogen, mg/kg	5.77	2.09	1.72	11.3	-
Nitrite, mg/kg	< 0.5	1.90	< 0.5	< 0.5	-
Phosphorus, mg/kg	407	88	401	147	> 10
Total Kjeldahl Nitrogen, mg/kg	2110	1279	3167	464	-

Note: “-” - no specified value in the Soil Fertility Rating (BSWM), * - did not meet/ exceeded the screening criteria
highlight – parameters with exceedance/s with respect to Soil Fertility Rating (BSWM)

(2) Soil Contamination

199. **Table 4.2.4** presents the laboratory results for the parameters analyzed for the soil contamination assessment. The laboratory certificates of analyses are attached as **Annex D-1**.

200. TPH and other heavy metal concentrations did not exceed any of the adopted screening criteria. BTEX and PCBs were below laboratory’s reporting limits; hence no exceedances were noted on all analyzed soil samples. As such, human health and ecological risks are assessed to be low. TCLP concentrations did not exceed local hazardous waste standards provided in DAO 2013-22, hence excavated soils for disposal will be classified as non-hazardous waste.

201. Arsenic was detected in all analyzed soil samples from SS01 and SS02 with concentrations ranging from 10.1 mg/kg to 13.0 mg/kg (**Table 4.2.4**), which exceed the United States Environmental

Protection Agency Regional Screening Level (USEPA RSL) of 3.0 mg/kg. No potential sources of arsenic were identified within the vicinity of the sampling locations and none of the observed anthropogenic activities could potentially cause arsenic impacts in the soil, thus the potential for historical spillage of substances containing arsenic in the sampling locations is assessed to be low. Based on this, the detected concentrations may likely be attributed to naturally occurring background concentrations as arsenic is generally present in all soils in concentrations ranging from 0.1 to 40.0 mg/kg². According to a study conducted by Pfeiffer et al. (1990), plant samples in polluted areas of Metro Manila were reported to have arsenic levels ranging from 0.1 mg/kg to 17.9 mg/kg, with 50.0% of all samples having concentrations higher than 3.0 mg/kg. This could be verified by further soil sampling and testing or laboratory analysis. Exposure to arsenic may cause adverse health effects such as skin lesions, cancer, and pulmonary and cardiovascular diseases. Further assessment is needed to evaluate the actual risk associated with detected arsenic concentrations in soil. It is recommended that site-specific screening levels be generated considering various factors such as exposure duration.

Table 4.2.4 Results of Soil Analysis Pertaining to Soil Contamination

Parameter	Sampling Station				Dutch IV (2013)	USEPA RSL (2020)	EMB DAO 2013-22
	SS01 (Surface)	SS01 (0.50 m)	SS02 (Surface)	SS02 (0.50 m)			
Soil type	Clayey silt	Sandy clay	Sandy Silt	Gravelly sand			
pH	7.64	8.02	7.60	8.11	-	-	-
TPH C ₆ -C ₉ , mg/kg	< 35.2	< 28.7	< 32.4	< 25.3	-	-	-
TPH C ₁₀ -C ₁₄ , mg/kg	< 25.0	< 25.0	< 25.0	< 25.0	-	-	-
TPH C ₁₅ -C ₂₈ , mg/kg	46.4	112	77.3	99.1	-	-	-
TPH C ₂₉ -C ₃₆ , mg/kg	204	220	134	< 100	-	-	-
Benzene, mg/kg	< 0.264	< 0.215	< 0.243	< 0.190	1.1	5.1	-
Toluene, mg/kg	< 0.308	< 0.251	< 0.283	< 0.221	32	4700	-
Ethylbenzene, mg/kg	< 0.246	< 0.201	< 0.227	< 0.177	110	25	-
Xylenes, Total, mg/kg	< 0.765	< 0.623	< 0.704	< 0.550	17	250	-
Arsenic (As), mg/kg	13.0	10.1	11.5	10.2	76	3	-
Barium (Ba), mg/kg	73.4	205	104	83.0	-	22000	-
Copper (Cu), mg/kg	109	85.9	255	72.5	190	4700	-
Zinc (Zn), mg/kg	629	849	771	500	720	35000	-
Cadmium (Cd), mg/kg	1.08	1.67	1.87	1.13	13	98	-
Chromium (Cr), mg/kg	14.7	19.6	25.8	13.2	-	-	-
Lead (Pb), mg/kg	84.7	152	220	91.1	530	800	-
Selenium (Se), mg/kg	< 1.56	< 1.09	< 1.21	< 0.942	-	580	-
Nickel (Ni), mg/kg	15.6	17.1	18.8	10.8	100	2200	-
Iron (Fe), mg/kg	13400	26400	21400	16100	-	82000	-
Manganese (Mn), mg/kg	400	631	403	344	-	2600	-
Mercury (Hg), mg/kg	0.244	0.815	0.232	0.155	36	4.6	-
Mineral Oil, mg/kg	< 10	12	11	12	5000	350K	-
Cyanides, free, mg/kg	< 1.00	< 0.689	< 0.783	< 0.633	20	15	-
PCBs, Aroclor 1016, µg/kg	< 100	< 70	< 77	< 63	-	5.1	-
PCBs, Aroclor 1221, µg/kg	< 100	< 70	< 77	< 63	-	0.83	-
PCBs, Aroclor 1232, µg/kg	< 100	< 70	< 77	< 63	-	0.72	-
PCBs, Aroclor 1242, µg/kg	< 100	< 70	< 77	< 63	-	0.95	-
PCBs, Aroclor 1248, µg/kg	< 100	< 70	< 77	< 63	-	0.94	-
PCBs, Aroclor 1254, µg/kg	< 100	< 70	< 77	< 63	-	0.97	-
PCBs, Aroclor 1260, µg/kg	< 100	< 70	< 77	< 63	-	0.99	-
PCBs, Aroclor 1262, µg/kg	< 100	< 70	< 77	< 63	-	-	-
PCBs, Aroclor 1268, µg/kg	< 100	< 70	< 77	< 63	-	-	-
TCLP Arsenic (As), mg/L	< 1.00	< 1.00	< 1.00	< 1.00	-	-	1

² Washington State Department of Health (1999). Hazards of Short-Term Exposure to Arsenic Contaminated Soil. Retrieved from <https://www.doh.wa.gov/portals/1/Documents/Pubs/334-284.pdf>

Parameter	Sampling Station				Dutch IV (2013)	USEPA RSL (2020)	EMB DAO 2013-22
	SS01 (Surface)	SS01 (0.50 m)	SS02 (Surface)	SS02 (0.50 m)			
TCLP Barium (Ba), mg/L	0.183	0.938	0.343	0.291	-	-	70
TCLP Chromium (Cr), mg/L	< 0.500	< 0.500	< 0.500	< 0.500	-	-	5
TCLP Lead (Pb), mg/L	< 0.500	< 0.500	< 0.500	< 0.500	-	-	1
TCLP Selenium (Se), mg/L	< 1.00	< 1.00	< 1.00	< 1.00	-	-	1
TCLP Mercury (Hg), mg/L	< 0.00250	< 0.00250	< 0.00250	< 0.00250	-	-	0.1

Note: “-” :no specified value in the screening criteria, * : did not meet/exceeded the screening criteria,
<: below laboratory’s reporting limits, highlight: parameters exceeding the screening criteria

(3) Existing Potential Sources of Pollution and Sensitive Receptors

202. Visually observable contaminated soils were not found within the SBT Section/Project ROW and within a 500-m radius from the project alignment. Potential sources of contamination were also not identified within the Project ROW. However, outside the Project ROW or within the 500-m radius from the project site, 16 potential sources of contamination were identified including petroleum refilling stations, auto repair and shops, and factories (**Figure 4.2.1**).

203. Identified potential sensitive receptors within the project alignment and within 500-m radius include customers, workers and visitors of the commercial establishments, employees, patients, and visitors of hospitals (i.e., Tondo Hospital), employees, students, and visitors of institutional establishments (i.e., schools, chapels) along with residents inhabiting in the residential areas and informal settlers.

4.2.2 Protected Areas

204. Protected Areas (PAs) in the Philippines are defined by the Department of Environment and Natural Resources – Biodiversity Management Bureau (DENR-BMB) under the National Integrated Protected Areas System (NIPAS) act of 1992 (Republic Act 7586) and as amended by DENR Administrative Order 2008-26, along with Republic Act 11038 or the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2018.

205. Depending on the characteristics and nature of a PA, it may be categorized into strict nature reserve, natural park, natural monument, wildlife sanctuary, protected landscapes and seascapes, resource reserves, and natural biotic areas). A PA is managed by the Protected Area Management Board (PAMB) thus, all proposed activities (research, development, conservation, et cetera) therein are required to be approved by the PAMB first.

206. An area may also be declared as protected through a proclamation by the LGU (municipality or city). RA 7160 (Local Government Code of the Philippines) allows LGUs covering their area/s of jurisdiction to pass legislations which they foresee as beneficial and needed by the community including those related to environmental protection and conservation as long as aligned with national law/s. The LGUs are given the autonomy to pass laws for implementation in their area of jurisdiction, as long as they are aligned with national law/s. This could include declaration of certain lands owned by the state as protected.

207. Specifically, RA 5752, encourages every municipality or city to establish, develop, and maintain permanent forest, tree parks or watershed within public land owned by such municipality or city. It is recommended that the aggregate size of such area be equivalent to at least 2% of the entire size of the municipality or city. LGU declared PAs are usually managed by the Municipal Environmental and Natural Resource Office (MENRO) which is directly under the office of the mayor. All proposed activities (research, development, conservation, etc) therein are required to be approved by the mayor first.

208. The protected areas within the AOI are detailed below and summarized in **Table 4.2.5** and **Figure 4.2.6**. Of the five protected areas, one Natural Park is also classified internationally as a Ramsar site, and the other three are designated as national parks at the national level, and one is declared by the LGU as permanent forest park.

4.2.2.1 International Protected Areas

(1) Las Piñas–Parañaque Critical Habitat and Ecotourism Area

209. Las Piñas–Parañaque Critical Habitat and Ecotourism Area is the only Protected Areas (PAs) identified in the AOI for Birds that could be classified as a Natural Habitat. It is one of the few (although revegetated) mangrove patches remaining in the entire Manila Bay. Located in Las Pinas City, it is approximately 15.5 km south-southwest from the SBT Section ROW. Under E-NIPAS, it is categorized as a Natural Park and Wildlife Sanctuary (Critical Habitat/Eco-tourism area) and was designated as such in 2007.

210. Additionally, LPPCHEA was also designated as a Ramsar site (Ramsar Convention under UNESCO) in 2013 recognizing the habitat as one of international importance. The area is also protected by Republic Act 9147 (Wildlife Resources Conservation and Protection Act) and Republic Act 8550 (The Fisheries Code of 1998). These laws provide protection to critical habitat areas and prohibit the conversion of mangrove areas into fishponds. LPPCHEA has a vegetation assemblage (i.e., mangrove forest) that is adapted to saline, flooded, and nutrient deficient habitat. LPPCHEA typifies the vegetation assemblage that used to cover the entire Manila Bay (from Bataan, Pampanga, Bulacan, Cavite, and the NCR) until the early 1900s. However, from a vast mangrove forest, what remains now are scattered minute patches that are usually interspersed with fishponds and salt pans.

211. There are eight recorded mangrove species in the LPPCHEA with api-api (*Avicennia marina*) as the most speciose. At least 123 birds (82 resident breeders and 41 migratory species) have been recorded in the LPCHEA. Also, this PA is a congregatory area for migratory wetland birds.

4.2.2.2 Nationally Protected Areas

(1) Arroceros Forest Park

212. The nearest PA (LGU proclaimed) is the Arroceros Forest Park (AFP) located approximately 3.20 km south-southeast from the ROW. The AFP is a small parcel of land (around 2.2 has) along the south bank of Pasig River considered as an “urban forest” consisting mainly of exotic or introduced tree species (some are surmised to have been there since 1950’s) and various ornamental plants.

213. The area used to be a Chinese trading settlement during the early Spanish settlement period and it became a military garrison during the American occupation. After WWII, the barracks were converted into the main office of the Department of Education (DepEd). In 1993, as the main office of the DepEd was transferred, The AFP was established through a MOA between the LGU and Winner Foundation (private environmental group). This move was undertaken by the environmental group to retain the area as a green space for Manila City. To date, it is considered as an important feature of the city as the only nature park in the area. Categorized as “permanent forest park” in the year 2020, it is protected by a City Ordinance (Manila City Ordinance No. 8607) against cutting of trees, dumping waste products and any form of excavation. Based on various on-line sources and pictures, approximately 80% of plants in the AFP are exotic or introduced. Also, recorded therein are 10 bird species including the Philippine pied fantail and most likely the Philippine woodpecker. The area has undergone tremendous transformation due to various human activities which have extensively modified the primary ecological functions and species composition. This is clearly shown by the dominance of exotic or introduced plants together with the presence of various man-made structures such as tiled pathways, concrete roads, fishponds, a bridge, and riverside walk.

(2) Luneta Park

214. The Luneta National Park (LNP) or Rizal Park is PA that is located within the AOI for Birds. It is located approximately 4.20 km south-southeast from the ROW. It was declared a PA through Proclamation 234, s. 1955 and categorized under E-NIPAS as a Natural Park (Historical Distinction).

215. LNP was declared as such since it has great historical significance to the country (it is the place where Jose Rizal, the national hero of the Philippines, was executed and where his remains lie), rather than due to biodiversity, the presence of endemic and/or threatened species, the congregation of migratory wetland birds, or as a unique habitat associated with key evolutionary processes. The species of plants in the park are mostly comprised of exotics or introductions and it has been subjected to various modifications thereby losing the original ecological settings in the area.

(3) Manila Bay Beach Resort

216. The Manila Bay Beach Resort is a PA located approximately 6 km south-southwest from the ROW. This PA was declared through Proclamation 41, s., 1954 (Reserving for National Park Purposes to be known as “Manila Bay Beach Resort” a certain parcel of the public domain situated in the cities of Manila and Pasay and the Municipality of Parañaque, Island of Luzon) in 1954 and was signed by President Ramon Magsaysay. Despite this protection, successive governments have allowed the area to be developed. The entirety of this PA is currently comprised of built-up areas with limited to no vegetation at all. This site is screened out of the sites within the AOI of the project.

217. In view of the built up nature of this PA could neither be described as a Natural Habitat nor a Critical Habitat. Instead, it is a Modified Habitat (like the SBT Section) with low ecological value.

(4) The Ninoy Aquino Parks and Wildlife Center

218. The Ninoy Aquino Parks and Wildlife Center (NAPWC) is a PA located in the District of Diliman in Quezon City. It is 7.60 km north-northeast from the ROW. The declarations involved in its protection are Proclamation 42, s. 1954, Proclamation 723, s. 2004, and the E-NIPAS Act. Confiscated wildlife from illegal traders and rescued wildlife from nearby provinces were temporarily housed in the park. NAPWC is currently under the management and administration of the DENR and is home to BMB and the Wildlife Rescue Center.

219. The area has an estimated 3,000 tree individuals with the park being a popular spot for tree planting activities of government agencies. However, species of plants in the area are mostly introduced. The Wildlife Rescue Center aims to rescue, rehabilitate, and release endemic and indigenous wild animals. Any wildlife unfit for release are kept and retained in the park showcase area to promote conservation and public awareness of the current state of Philippine wildlife. As such, majority of the wildlife species are currently kept in cages with most of the wildlife being introduced and not originally from the National Capital Region (NCR).

(5) Las Piñas–Parañaque Critical Habitat and Ecotourism Area

220. The details of the Piñas–Parañaque Critical Habitat and Ecotourism Area are described above under **International Protected Areas**.

Table 4.2.5 Protected Areas in the vicinity of the Project Site (In accordance to the distance from the project site)

Key	Name	Declaration (law)	Category (NIPAS)	Area (ha)	Description	Habitat Type (IFC P6)	Approx. distance from project site
1	Arroceros Forest Park	Manila City Ordinance No. 8607, 2020	Permanent forest park (Not NIPAS)	2.14	A small parcel of land around two hectares along the southbank of Pasig River considered as an "urban forest" consisting of different trees species and various ornamental plants. It is considered as an important feature of the City of Manila as the city's only nature park.	Modified	3.20 km
2	Luneta National Park	Proclamation 234 s. 1955)	Natural Park (Historical Distinction)	16.04	A parcel of land situated in the District of Ermita, City of Manila. Species of plants are mainly comprised of introduced species. Similarly, wildlife in the area are mainly resident breeders but non-endemic. However, it remains as one of the few green spaces in the NCR. It was established to honor one of the country's national heroes.	Modified	4.20 km
3	Manila Bay Beach Resort	Proclamation 41 s. 1954)	Natural Park (Historical Distinction)	464.66	Parcel of land situated in the cities of Manila, Pasay, and Paranaque. The area is currently built up	Modified	6.00 km
4	Ninoy Aquino Parks and Wildlife Center	Proclamation 723 s. 2004/ Proclamation 42 s. 1954/ E-NIPAS	Protected Landscape	23.85	A parcel of land situated in the District of Diliman, Quezon City. This park was previously used as a repository for confiscated wildlife species from illegal traders and rescued wildlife species from nearby provinces. It is also a popular spot for tree planting activities of government agencies. Majority of the wildlife species currently being kept (i.e. in cages) in the park are introduced and species that originally are not from the NCR. The species of plants in the park are also mostly introduced.	Modified	7.60 km
5	Las Piñas-Parañaque Critical Habitat and Ecotourism Area (LPPCHEA)	E-NIPAS (RA-11038), 2007	Natural Park and Wildlife Sanctuary (Critical Habitat/ Eco-tourism Area)	181.61	A coastal wetland in Manila Bay situated within the metropolis of Manila, comprising two interconnected, mangrove-covered islands, shallow lagoons, and coastline. Few of the last remaining patches of mangrove in Manila Bay. Provides wetland habitat for wetland birds (both migratory and resident breeders)	Natural Critical	15.50 km

Note: Habitat Type defined in IFC Performance Standard 6 GN35-GN52. Critical Habitat is defined in GN53-GN92

4.2.2.3 Key Biodiversity Area and Important Bird Area

221. Key Biodiversity Area (KBAs) represent the most important sites for biodiversity conservation worldwide and are identified nationally using a Global Standard from the International Union for the

Conservation of Nature (IUCN). Important Bird Areas (IBAs) are a subset of KBA. KBAs in the Philippines were determined by the DENR in 2006 using data from the IBAs Program, the 2004 IUCN Red List, as well as data from published literature, experts and scientists, and museum collections. Some KBAs (either wholly or partially) are included in declared PAs thus, these KBAs or part thereof have formal declaration of protection. However, most KBAs are without any formal declaration of protection in the Philippines (as part of NIPAS, E-NIPAS or LGU proclamation). Hence, development (as long as required permits are secured and aligned with CLUP) could be established in these areas. These KBAs (without formal declaration of protection as part of NIPAS, E-NIPAS or LGU proclamation) have no management plan, no organized managing structure, and no monitoring activities put in-place.

222. Manila Bay with area of 96,332ha located cross widely in Bataan, Pampanga, Bulacan and NCR is a congregatory area for resident and migratory wetland birds and recognized as a KBA under DENR, Haribon Foundation, and Birdlife International through the Philippine Biodiversity Conservation Priority-setting Program as well as recognized as an IBA (PH010) by BirdLife International (2022). Manila Bay is the only KBA/IBA within the AOI for this study (located about 7.7 km north-northwest from the ROW) The whole stretch of this KBA/IBA along Manila Bay is comprised of extensive intertidal (mudflats and sand flats). Monthly bird counts in 1979 to 1982 recorded 32,000 individuals of wetland birds. Thus, it is an important wetland habitat for various species of resident breeding and migratory water birds.

223. Although the project is not located within Manila Bay KBA the project is within important global migratory routes such as the East Asian–Australasian Flyway. Birdlife describes the route thus;

224. To take a cautionary approach an assessment of the indirect impact on the Manila Bay KBA by the effect of the railway on migratory birds moving between locations will be made in Chapter 5.

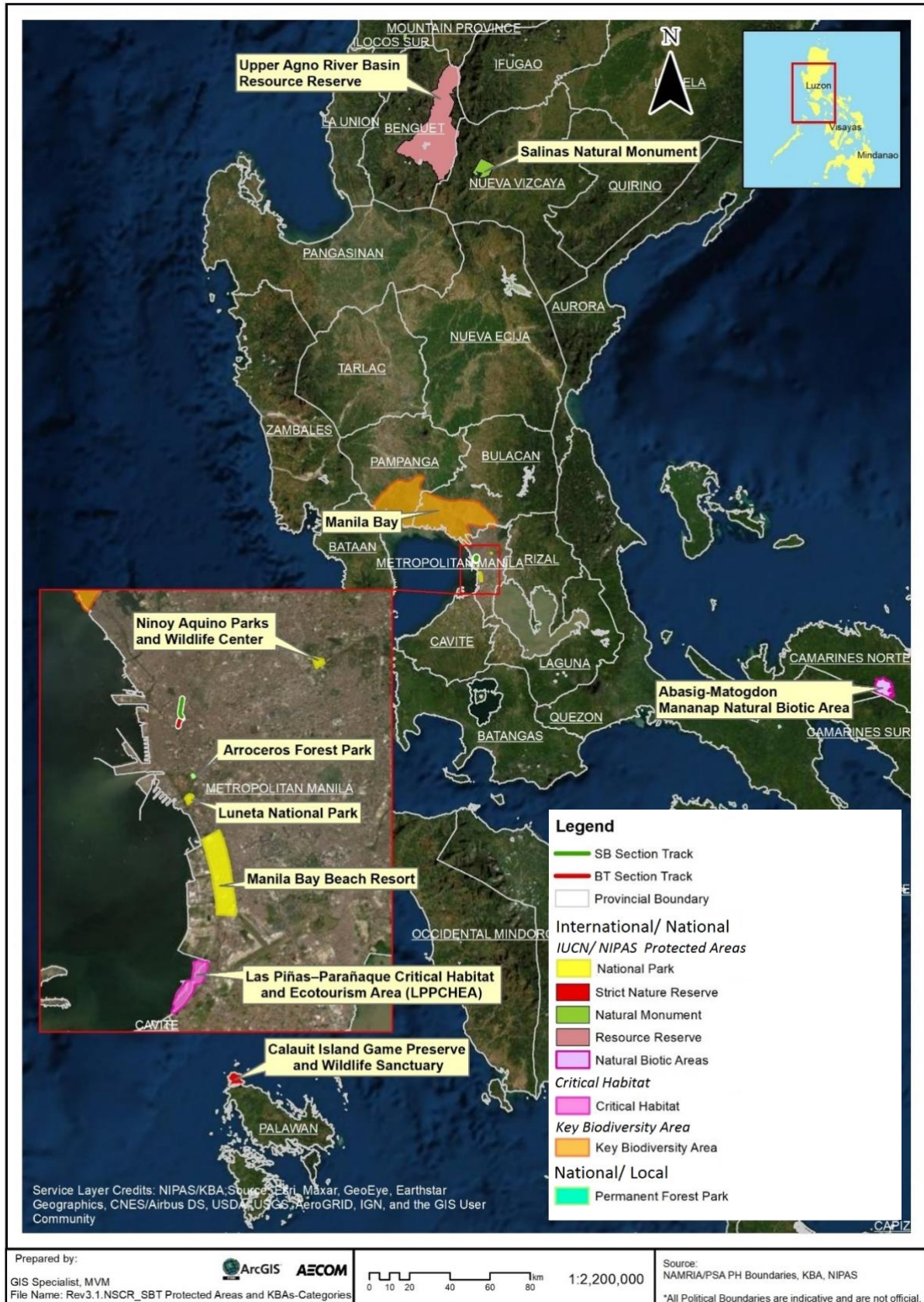


Figure 4.2.6 Protected Areas and KBA in the vicinity of the Project Site

4.2.3 Terrestrial Ecology

225. This assessment describes the baseline conditions and value of the ecological resources along the SBT track section. Assessment of impacts will be described in Chapter 5.

4.2.3.1 Scope of Study

(1) Study Area

226. The study area will consider the area over which changes to the environment are likely to occur as a result of the construction or operation of the Project. For ecology, the EIA considers the area within the ROW, habitats close by, but also the effect on mobile species such as birds and mammals and the effects on the ecology of water courses that cross the ROW. The area of influence (AOI) is detailed below.

227. The AOI of the project is dependent on the species being considered. In particular, highly mobile species such as bats and birds that move between pockets of habitat for feeding or in migration may be impacted by a project as a barrier to movement, loss of feeding site or as a source of mortality (bird strikes). Thus, breeding colonies elsewhere can still be negatively affected by a project at some distance from them. Following explains the AOI set for the project:

228. For the range spans of passerine birds, in a study by Rechetelo et. al. (2016)³, more than 50% of the 102 banded black-throated finch (*Poephila cincta*) were sighted 200 m away from the banding site while only three individuals were sighted 15 km from the banding location. This particular study observed that long-distance (15 km) movements could be attributed to resource bottle-neck periods. The extreme case scenario (~ 15 km) for passerine birds was adopted as the AOI for this study.

229. For the range spans of bats: Reiter and Curio (2001)⁴ recorded the range spans of 10 (five males and five females) musky fruit bats (*Ptenochirus jagor*) showed varied from 533 m to 1.6 km. In keeping with birds, the extreme case scenario (~ 2 km) for fruit bats was adopted as the AOI for this study

230. For vegetation: In a study by Marcantonio et al (2013)⁵, of roads through forest a strong effect on biodiversity up to 20m was shown and the effect was still significant up to 200m. Although the effect was due to motor vehicles the effect may be similar during construction operations rather than operation. In keeping with the above an AOI of 200m was adopted for vegetation.

(2) Guidelines Applied

231. DAO 2003-30 Annex 2-7a outlines the requirements of the Philippines EIA system. Furthermore, the project complies with JICA Guidelines (2010) which conforms with World Bank safeguard policy. International Finance Corporation (IFC), a division of World Bank, produces the Impact Assessment Advice for the World Bank. Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources (June 2019) and Guidance Note 1 Assessment and Management of Environmental and Social Risks and Impacts (June 2021) have been used to develop the following methodology and the terrestrial ecology will be assessed in relation to the biodiversity values emphasized in the IFC PS6.

³ Rechetelo J, et al (2016) Movement Patterns, Home Range Size and Habitat Selection of an Endangered Resource Tracking Species, the Black-Throated Finch (*Poephila cincta cincta*). PLoS ONE 11(11)

⁴ Reiter, J., Curio, E., Tacud, B., Urbina, H., & Geronimo, F. (2006). Tracking Bat-Dispersed Seeds Using Fluorescent Pigment. *Biotropica*, 38(1), 64–68

⁵ Marcantonio et al (2013) Biodiversity, roads, & landscape fragmentation: Two Mediterranean cases, *Applied Geography*, Volume 42, 2013, Pages 63-72,

(3) Assumptions and Limitiations

232. Due to the safety hazards associated with the COVID-19 pandemic, the use of mist nets to capture bats and use of traps for small non-volant (rodents and shrews) were not employed in this assessment. According to various scientific research groups, there is a strong possibility that COVID-19 originated from bats and other mammals. Potential cross-transmissions of COVID-19 virus from bats to humans is very unlikely, however, from humans to bats is likely due to the continuous increase of COVID-19 cases in the Philippines. A potential transmission from humans to bats could lead to potential extirpation of their local population in the area. Secondary data based on field research conducted in UP Diliman and Ateneo de Manila (approximately 10 km east of the ROW) was used in this study instead.

233. The tree survey conducted under this study is partial for assessment purpose and the 100% tree inventory of the entire ROW for tree cutting required by DENR will be conducted during the implementation phase. Information gathered from the inventory will provide additional data on trees not captured during baseline studies and will be used to design a pre-clearing plan to manage, replace, and relocate trees that can be balled out. It will also include management and monitoring schemes for selected relocation sites outside the ROW.

4.2.3.2 Survey Methodology

234. The key objective of the baseline ecology site survey was to determine the rare and protected species present on site, specifically the taxa on the IUCN Red List of Threatened Species and the Philippine Red List and the endemic species. In addition, an assessment of the site habitat type was to be made by assessment of the species assemblages present and the site history.

(1) Data Collection

235. The terrestrial ecology study was completed using rapid site assessments techniques undertaken by two specialists and assisted by an environmental scientist who have extensive experience in conducting field surveys. Rapid Site Assessment uses standardized methods to achieve accurate assessment of species presence⁶.

236. The field survey was conducted in October 2020, which represents the tail-end of the wet season and the start of dry season in the area. Thus, not all individuals of each species were recorded. As such the primary data is considered to be dry season data and secondary sources such as NSCR Project EPRMP (2015) and NSCR Calamba Ex EIS (2020) were used to supplement the study data for the wet season.

(2) Data Analysis

237. The data collected are further analysis for its endemism, diversity, and encounter rate as below.

1) Diversity Indices

238. Diversity indices are statistical representations of biodiversity in different aspects (richness, evenness, and dominance). Species diversity was calculated from the recorded data following the enumerated formula below; where ni refers to the total number of individuals per species; N is the total number of individuals; and S is the total number of species. This index provided a quantitative measure of the diversity level in the SBT Section ROW. Moreover, it provided information if recorded species

⁶ Larsen, T.H. (ed.). (2016) Core Standardized Methods for Rapid Biological Field Assessment. Conservation International,

are evenly distributed (in terms of abundance) or certain species dominated the area. Calculated species diversity was analyzed and interpreted together with the detailed list of recorded species.

$$\text{Shannon diversity index (H)} = - \sum (n_i / N) \ln (n_i / N)$$

- Species diversity - the number of different species in a particular area and their relative abundance. It has two components: species richness and species evenness (Ha and Shleiger, 2021)
- Species richness - refers to the number of different kinds of species present in a particular area (Ha and Shleiger, 2021)
- Species evenness - describes the relative abundance of each species in the area (Ha and Shleiger, 2021)
- Species abundance - is the number of individuals for each species in a particular area (Pyron, 2010)

2) Endemicity and Vulnerability

239. Published books and articles, and repositories of online database were accessed to acquire the needed information on species identification. Relevant literature⁷ were also consulted. For vegetation, names of the identified species were verified in the International Plant Names Index (IPNI) and standardized based from the Plant List (<http://www.theplantlist.org>). Additionally, distribution and endemism were determined using available online databases such as the Catalogue of Life (<http://catalogueoflife.org/>), as well as Global Biodiversity Information Facility (<http://GBIF.org>). The range distributions of recorded species for wildlife (i.e., resident breeders, endemics, introductions, migratory, migratory with resident breeding population/s, and native but non-endemic) were based on published references: Kennedy et al., 2000 and IUCN 2020. Conservation status (e.g., threatened species, Least Concern, and not yet been assessed) were adopted from the IUCN Red List of Threatened Species 2020 (The IUCN Red List of Threatened Species. Version 2020-03. <www.iucnredlist.org>), RA 9147, *Philippine Wildlife Act of 2001*, and DAO 2019-09, *Updated National List of Threatened Philippine Fauna and their Categories*. Moreover, the list provided in the Convention on International Trade of Endangered Species (CITES) of Wild Flora and Fauna 2020 (<http://www.cites.org/>) was also considered.

3) Encounter Rates

240. The encounter rates method in Bibby et. al., (1998) was adopted and the computed relative abundance were scored and categorized on the ordinal scale (**Table 4.2.6**) of abundance formulated by Lowen (1996). The encounter rates and relative abundance per recorded species in the SBT Section ROW were included in the study to serve as an indicative quantitative measure of their local numbers (abundance) in the area. This information was used to supplement the vegetation study in determining if the SBT Section ROW is a Modified Habitat or Natural Habitat and if a Critical Habitat.

Table 4.2.6 Scoring and Categorization of Relative Abundance based on Transect Survey

Number of individuals / Field hours	Abundance Scale	Ordinal Scale
< 0.1	1	Rare
0.1 - 2.0	2	Uncommon
2.1 - 10.0	3	Frequent
10.1 - 40.0	4	Common
40.0 +	5	Abundant

Source: Lowen, 1996

⁷ Co's Digital Flora of the Philippines (<https://www.philippineplants.org/>), *Flora Malesiana* (<https://floramalesiana.org/new/>), (Merrill, 1912) *A Flora of Manila*, (Merrill, 1912) *An Enumeration of Philippine Flowering Plants*, and (Elmer, 1906-1908) *Leaflets of Philippine Botany*

4.2.3.3 Sampling Site

241. For the terrestrial vegetation, the desktop site assessment determined that approximately 1.5 ha of the 4 ha site was vegetated. All the vegetated patches in the ROW were visited and all species present were identified and recorded in a data sheet. This included all vascular plants; trees, shrubs, vines, grasses, herbs, and epiphytes. A transect walk along the length of the ROW was made on 29 October 2020. Opportunistic samplings involving listing of species outside the transect area were also carried out to account for the maximum possible species in the area.

242. Field survey for the terrestrial wildlife was conducted in the morning (07:00 a.m. to 09:00 a.m.) of 28 October 2020, and in the morning (07:00 a.m. to 09:00 a.m.) and afternoon (03:30 p.m. to 05:30 p.m.) of 04, 05, and 09 November 2020. Two transect lines along the Solis-Blumentritt and the Blumentritt-Tutuban sections were established to survey birds. An observer walked along the alignment completing the whole stretch in at least 1.5 hours and at the most 2 hours. More observation time (5 to 10 mins) was given to mixed feeding flocks to ascertain identities of individuals. All individuals observed and/or heard were noted by recording the species name and number of individuals. One observer conducted the entire survey and the transect route was passed-through at least once (i.e., in the morning from 7:00 a.m. to 9:00 a.m./ in the afternoon from 3:30 p.m. to 5:00 p.m.).

243. The locations of the terrestrial ecology are shown in **Table 4.2.7** and **Plate 4.2.1**. the locations of the transect lines are shown in **Figure 4.2.9** and **Figure 4.2.8** respectively.

Table 4.2.7 Sampling Sites for Terrestrial Ecology

Station Name	Barangay			City
SBT-1 (SB section)	Barangay 161 Barangay 162 Barangay 164	Barangay 165 Barangay 185 Barangay 186 Barangay 198	Barangay 200 Barangay 203 Barangay 204 Barangay 217	Tondo I/II - Manila
SBT-2 (BT section)	Barangay 227 Barangay 228 Barangay 231	Barangay 160 Barangay 218 Barangay 155		Tondo I/II - Manila

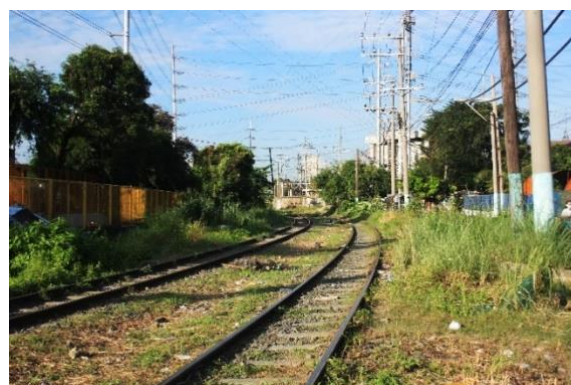


Plate 4.2.1 SBT-1 Transect (Near Solis Station) (Left Photo); SBT- 2 Transect (Between Blumentritt Station and Tutuban Station) (Right Photo)

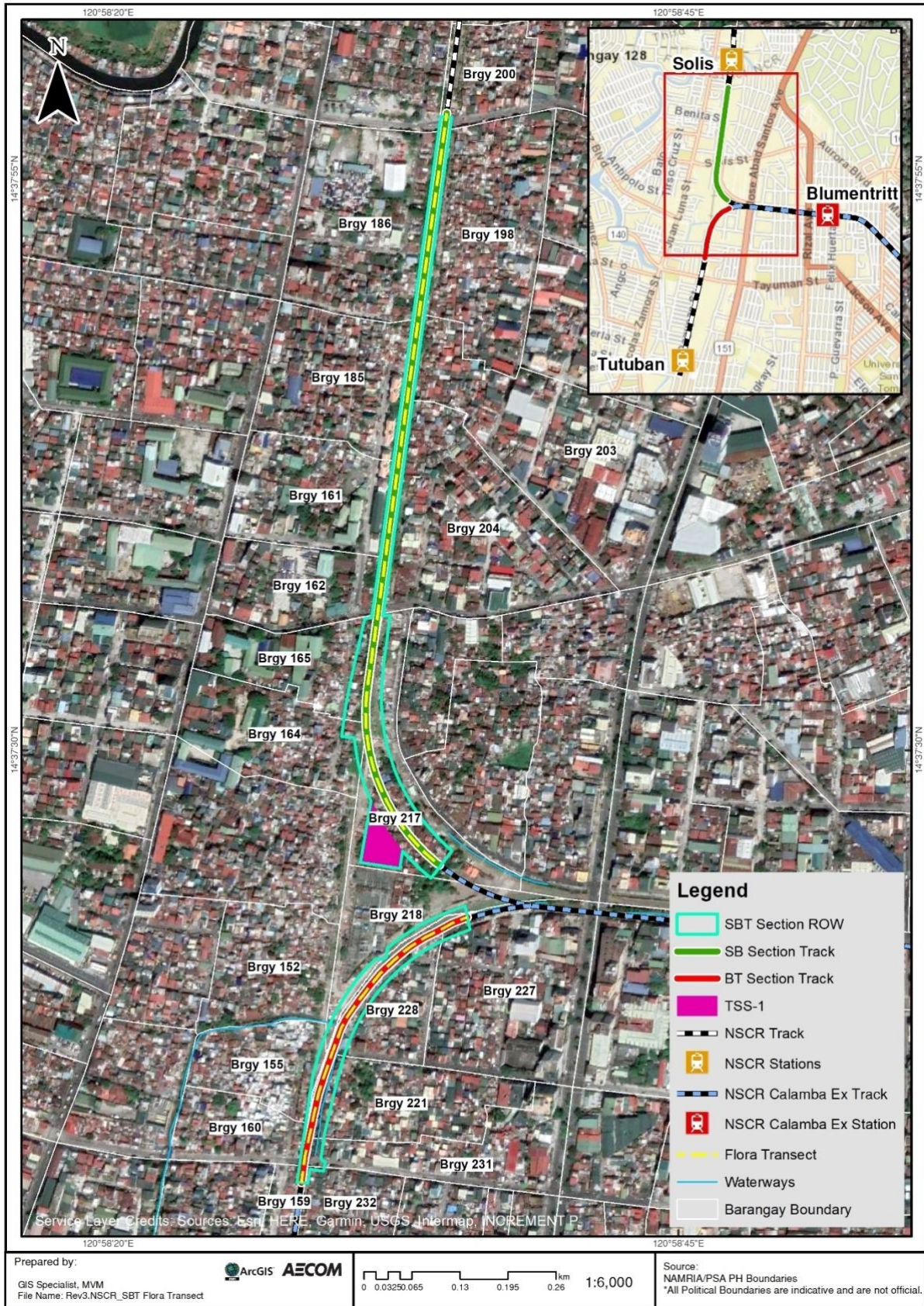


Figure 4.2.7 Terrestrial Vegetation Assessment Transects



Figure 4.2.8 Terrestrial Wildlife Assessment Transects

4.2.3.4 Survey Results

(1) Terrestrial Vegetation

244. A total of 123 plant morpho-species in 195 individuals belonging to 54 families were recorded along the SBT Section. The complete list of recorded species is presented in **Annex D-2**.

245. Twelve plant growth habits were observed from the 123 species recorded along the alignment. The SBT Section were dominated by trees with 37 species (30.1%) and herb/forb with 33 species (26.8%). Other plant growth habits were shrub with 16 species (13.0%), climber with 13 species (10.6%), grass with 11 species (8.9%), palm and sedge with three species each (2.4%), bamboo and ferns with two species each (1.6%), and cactus, herb (aquatic), orchid with one species each (0.8%).

1) Species Diversity

246. Computed vegetation species diversity was very high at $H' = 4.68$ (see **Annex D-3**). This indicates that plant diversity in the remaining vegetation patches of the ROW is very high. It is mainly attributed to high species richness (123 species) and relatively even abundance (195 individuals) recorded. However, although species richness was high, majority of recorded plants were exotic or introduced (not native to the Philippines). Species diversity includes two components: species richness and evenness. Species richness is the number of species per unit area (geobotanical description). Evenness is the abundance distribution of species in a community. There is a positive correlation between these indices; however, high species richness is not necessarily accompanied by high-degree evenness (Vasilevich, 2009).

2) Endemicity and Vulnerability

247. Of the 123 plant morpho-species recorded in the ROW, 95 (77%) were exotic or introduced, 23 (19%) were native non-endemics, two (2%) were Philippine endemics, and three (2%) morphospecies that were identified up to genus level only. The result of the vegetation study for the SBT Section clearly shows that majority of the plants within the ROW are exotics or introduced. This finding is aligned with the vegetation study result of the NSCR Project EPRMP (2015) wherein most of its recorded species were also exotics or introduced species. The NSCR Project EPRMP (2015) recorded 116 species in 43 Families. Of this, 83 (71%) species were exotics or introduced while only 33 (28%) species are natives. This trend of exotics or introduced species dominating the vegetation assemblage was also observed in the Project ROW.

248. This vegetation study recorded four threatened (i.e., one Endangered and three Vulnerable) tree species in the SBT Section ROW. These are Narra (*Pterocarpus indicus*), a native forest tree, represented by four individuals; Is-is (*Ficus ulmifolia*), an endemic pioneer tree in forested areas, with two individuals; big-leafed mahogany (*Swietenia macrophylla*), an exotic or introduced forest tree, with one individual; and Manila Palm (*Adonidia merrillii*), a native palm in limestone karst and coastal areas, with one individual. Also recorded was an individual of an endemic Antipolo (*Artocarpus blancoi*). Antipolo was included as a threatened species however, more recent data from IUCN 2021 shows that said species has been delisted and is no longer considered as threatened. **Table 4.2.8** summarises the findings and analysis.

Table 4.2.8 List of Endemic & Threatened Vegetation Species Recorded within SBT Section

Family/ Species (Common Name)	Endemicity	Conservation Status		Natural Habitat and Distribution	Habitat Status and Condition in AOI	Location of Species found
		IUCN 2020	DAO 2017-11			
Arecaceae <i>Adonidia merrillii</i> Becc. (Manila palm (Engl.))	Native non-endemic	Vulnerable	Other Wildlife Species	Natural habitat: Karst limestone formations, sandy coastal areas, often subgregarious in Coron and Northern Palawan. Distribution: Native to the Philippines (Palawan and Danjugan Island), and Malaysia (Sabah). Use: A popular ornamental grown for its bright red fruits and minimum maintenance requirement.	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Potential natural habitat area close to the project: Sandy coastal areas (Manila Bay and LPPCHEA)	Single mature specimen found on ROW. This specimen was most likely planted.
Leguminosae <i>Pterocarpus indicus</i> Willd. (narra in most dialects)	Native non-endemic	Endangered	Vulnerable	Natural habitat: Lowland (usually evergreen) forests, ascending to 1300m. Distribution: Native to the Philippines and its natural distribution range is SE Asia Pen. Thailand, Cambodia, Malesia, Pacific, Ryuku Islands, Caroline Islands, among others. Use: A preferred reforestation species due to its limited invasive effect to other native plants; fast growth; adaptation to stress; ease in reproduction; and aesthetic value.	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Potential natural habitat area close to the project: Lowland evergreen forest (mountains of Rizal, Bulacan, Cavite, and Laguna Provinces)	Four mature specimens found on ROW. These specimens were most likely planted.
Moraceae <i>Ficus ulmifolia</i> Lam. (is-is (Neg.))	Endemic	Vulnerable	Other Wildlife Species	Natural habitat: Lowland second-growth forest, open grassy places, on rocky sites, extreme ultramafic sites. Distribution: Philippine endemic. Widespread, but not in Palawan and Mindanao. Use: Harvested from the wild for local use as a food, medicine, and substitute for sandpaper.	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Potential natural habitat area close to the project: Lowland second-growth forest (mountains of Rizal, Bulacan, Cavite, and Laguna Provinces)	Two mature specimens found on ROW. These specimens were most likely planted by local resident as a source of natural scrubbing pads for cleaning wood benches, pots, and pans.
Meliaceae <i>Swietenia macrophylla</i> King (large-leafed mahogany (Engl.))	Exotic or introduced	Vulnerable	Other Wildlife Species	Natural habitat: Tropical dry and tropical wet forest types. Distribution: Exotic or introduced species. Original distribution is Central and South America. Use: Previously favored for its good lumber and fast-growing characteristics for government revegetation programs	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Potential natural habitat area close to the project: Not applicable as this species is exotic or introduced. Observed negative impacts to native and/or endemic plants has prompted the DENR to discontinue its use for revegetation programs.	Single mature specimen found on ROW. This specimen was most likely planted.
Moraceae <i>Artocarpus blancoi</i> (Blanco) Merr. (antipolo (Tag.))	Endemic	Other Wildlife Species	Other Wildlife Species	Natural habitat: Thickets and forests at low and medium elevation. Distribution: Philippine endemic (Batan, Cebu, Luzon: Bataan, Ilocos Norte, Rizal, Mindanao, Mindoro, Negros, Palawan). Use: Its fruits and seeds are cooked and eaten. Wood used for carving and light construction. Used as fiber plant for making pulp and paper, insect repellent from burnt dry leaves, and hunter's sap.	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Potential natural habitat area close to the project: Lowland Forest (mountains of Rizal, Bulacan, Cavite, and Laguna Provinces)	A mature specimen found on ROW. This specimen was most likely planted by local resident for use as shade.

3) Encounter Rates

249. The Critically Endangered (CR) and/or Endangered (EN) species and Endemic species do not represent significant populations of these species. The total recorded abundance of threatened species (nine individuals) is unlikely to represent globally important concentrations of an IUCN Red-listed Endangered ($\geq 0.5\%$ of the global population and ≥ 5 reproductive units) and Vulnerable species. With only two endemic individuals, the Project ROW is unlikely to be considered as an area that holds $\geq 10\%$ of the global population size and ≥ 10 reproductive units of a species. The circumstances describing the presence of these threatened and/or endemic species, their very limited presence in the ROW relative to their natural populations, and the ROW being a highly Modified Habitat suggest the area is not a Critical Habitat

(2) Terrestrial Wildlife

250. A total of 15 species comprised of 468 individuals in 12 Families were documented in the SBT Section representing a one-time sampling during the wet season. **Annex D-4** presents a complete listing of record bird species for SBT Section survey. Only five bird species were documented in the Solis station as part of the NSCR Calamba Ex EIS conducted in February 2018 representing a one-time sampling during the dry season. Because of the limited information (one-time sampling), the two data set cannot be compared directly. Also, given that the study area is highly urbanized birds do not inhabit the area therefore accounting for the low number of species recorded for both seasons.

1) Species Diversity

251. Although the ROW is a highly disturbed and modified habitat, recorded species richness was high while abundance was very high ($H' = 3.27$) in this survey (see Annex D-5). Recorded high values for species richness and abundance suggest that these species thrive and are highly adapted to the area.

2) Endemicity and Vulnerability

252. Range distribution of birds were mainly comprised of resident breeders with nine (60%) out of the 15 recorded species. There are no species listed as threatened status are recorded, whereas there were two Philippine endemics (13%) while one (7%) species is an introduction. Endemics are those found only in the Philippines and nowhere else in the world while introduced species are not originally from the Philippines but are assumed to stay and breed the entire time in the country since their introduction. Resident breeders, endemics, and introductions represent 13 (80.0% of the total) out of the 15 species recorded in this survey. The dominance of resident breeders in the SBT Section ROW indicates that habitat features in the area are simple (as opposed to complex forest habitat) and modified. **Figure 4.2.9** shows the distribution range of recorded species for SBT Section survey.

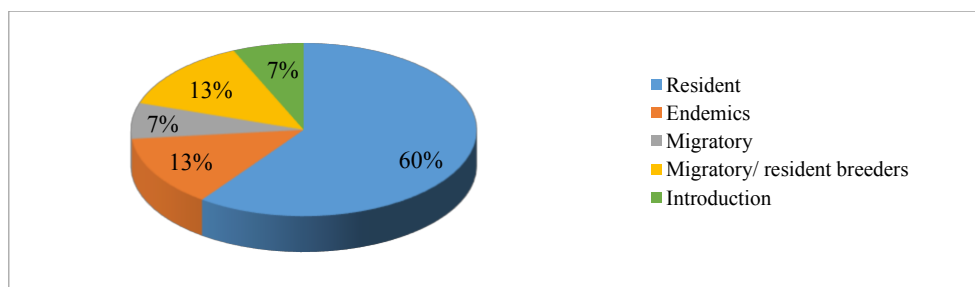


Figure 4.2.9 Distribution Range of Recorded Bird Species

253. Two endemics recorded during the study, were namely *Rhipidura nigritorquis* or Philippine pied fantail and *Picoides maculatus* or Philippine pygmy woodpecker. Both species were categorized as Least Concern (LC) under the IUCN Red List of Threatened species 2020 and are not included in the list under the Philippine Wildlife Act of 2001 (RA9147) as stipulated in DAO 2019-09. There were no recorded threatened bird species based on this survey. Thus, only Least Concern (LC) and Other Wildlife Species (OWS) were reflected in the conservation status of **Table 4.2.10**.

254. For data on bats, species recorded from nearby areas that have the potential to use the remaining vegetated patches in the SBT Section as a transitory habitat was included in this study. Based on the study of Ong et al. (2000), two bat species were recorded in the campuses of UP Diliman and Ateneo de Manila (approximately 10 km east of the ROW).. These are the lesser short-nosed fruit bat (*Cynopterus branchyotis*) and the lesser Asiatic yellow bat (*Scotophilus kuhlii*). Both species are native but non-endemics with widespread distribution in the Philippines and southeast Asia. IUCN 2020 and/or DAO 2019-09 do not include both species in their list, hence, are considered as Least Concern (LC) and Other Wildlife Species (OWS), respectively. They both thrive in highly urbanized settings using various man-made structures as their roosting areas.

3) Encounter Rates

255. Encounter rates of species observed in the SBT Section ROW were computed. Most species observed were within the ordinal scale of common and frequent while four species were abundant (Glossy swiftlet or *Collocalia esculenta*, Yellow-vented bulbul or *Pycnonotus goiavier*, Asian glossy starling or *Aplonis panayensis*, and Eurasian tree sparrow or *Passer montanus*) **Table 4.2.9** presents the encounter rates of recorded birds in the ROW. The recorded abundant, common, and frequent species are distinctive features of open and highly disturbed areas. These species are generalist birds which have been recorded in various areas of the NCR and are known to tolerate intense anthropogenic disturbances. Their increased numbers in the ROW based on the encounter rates further support the vegetation study (i.e., ROW is comprised of grasslands with open areas and dominated by exotic or introduced plant species). The limited number of endemic and the absence of threatened species show that the ROW is not the natural habitat for these species.

256. For further information on recorded endemic species (Philippine pied fantail or *Rhipidura nigritorquis* and Philippine pygmy woodpecker or *Picoides maculatus*), the former belongs to Family Rhipiduridae (with fan-like tail characteristics) while the latter is with Family Picidae (woodpeckers). They overlap in habitat requirements such as woodland areas, second growth forest, residential communities, and parks and gardens (in highly urban areas). In various areas (woodlands, open areas, grasslands, scrubland, rice paddy fields with bordering trees, tree plantation, and secondary forest), these two species never failed to show and/or announce (thru their distinct calls) their presence in the area, which attest to their widespread distribution and generalist habitat preference behaviour (not sensitive to disturbances). Their occurrences in areas being monitored could be described as common to very common. BirdLife International (2022) consider both species with very large distribution range and population trend appears to be stable, and hence does not approach the thresholds for Vulnerable under the range size and under the population trend criterion, respectively.

Table 4.2.9 Bird Species and their Corresponding Relative Abundance

Abundant	Common	Frequent
<i>Pycnonotus goiavier</i> (97.78)	<i>Streptopelia tranquebarica</i> (20.0)	<i>Lanius schach</i> (4.44)
<i>Passer montanus</i> (171.11)	<i>Geopelia striata</i> (30.0)	<i>Rhipidura nigritorquis</i> (10.00)
<i>Aplonis panayensis</i> (46.67)	<i>Egretta garzetta</i> (27.78)	<i>Artamus leucorhynchus</i> (3.33)
<i>Collocalia esculenta</i> (57.78)	<i>Lanius cristatus</i> (16.67)	<i>Picoides maculatus</i> (2.22)
	<i>Hirundo tahitica</i> (20.00)	<i>Hirundo rustica</i> (8.89)
		<i>Gerygone sulphurea</i> (3.33)

Note: Abundance expressed as encounter rates, indicated after the species name in parenthesis

4) General Habitat

257. The main bird-habitat associations for the SBT Section survey were non-forest with 11 species (73.0%); non-forest to forest with 3 species (20.0%); and wetlands with one species (7.0%); Non-forest habitats dominate the alignment which accounts and strongly corresponds to the dominance of the observed bird-habitat associations.

Table 4.2.10 List of Terrestrial Wildlife Species Recorded within SBT Section

Species (Common Name)	Distribution Range	Conservation Status		Natural Habitat and Distribution	Habitat Status and Condition in AOI	Location of Species found in AOI
		IUCN 2020	DAO 2019- 09			
<i>Rhipidura nigritorquis</i> (Philippine pied fantail)	Endemic	Least Concern	Other Wildlife Species	Natural habitat: Woodland, bamboo thickets, mangroves, scrub, swamp forest, second growth, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Picoides maculatus</i> (Philippine pygmy woodpecker)	Endemic	Least Concern	Other Wildlife Species	Natural habitat: Secondary Forest, plantations, woodland areas, grassy clearing with scattered trees, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines except Palawan and Sulu archipelago Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Pycnonotus goiavier</i> (Yellow-vented bulbul)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Dry woodlands, marshes, scrub, swamp forest, second growth, parks, gardens, urban areas, and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Streptopelia tranquebarica</i> (Red turtledove)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Dry woodland, open country, scrub, plains, and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; tends to avoid urban environment or human settlements.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Geopelia striata</i> (Zebra dove)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Woodland, agricultural land, dry shrubland, moist shrubland, second growth, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Passer montanus</i> (Eurasian tree sparrow)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Pastureland, agricultural land, second growth, parks, gardens, and urban and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.

Species (Common Name)	Distribution Range	Conservation Status		Natural Habitat and Distribution	Habitat Status and Condition in AOI	Location of Species found in AOI
		IUCN 2020	DAO 2019- 09			
<i>Aplonis panayensis</i> (Asian glossy starling)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Moist lowland forests, mangrove forests, grasslands with scattered trees, and urban and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; adapted to urban environment and can be found in various habitats outside its natural habitat.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Collocalia esculenta</i> (Glossy swiftlet)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Moist Forest, caves, second growth, parks, gardens, urban areas, and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Lanius schach</i> (Long-tailed shrike)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Woodland, plantations, bamboo thickets, wetlands (inland), scrub, shrubland, swamp forest, grassland, second growth, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Egretta garzetta</i> (Little egret)	Migratory	Least Concern	Other Wildlife Species	Natural habitat: Ponds, lakes, creeks, mangrove areas, flooded grasslands, swamps, beaches, shorelines, mud flats, tidepools, estuaries, inland wetlands, flooded agricultural lands. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment, seen especially in urban creeks, drainages, and ponds.	AOI: ROW Status: The ROW is NOT the natural habitat or significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Two individuals were recorded flying over the ROW.
<i>Artamus leucorhynchus</i> (White-breasted wood-swallow)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Canals, drainages, agricultural land, rivers, streams, creeks, lakes, plantations, secondary growth, urban areas, mangrove areas, lowland forests, grasslands, flooded grasslands, swamps, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Lanius cristatus</i> (Brown shrike)	Migratory w/ resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Woodland, agricultural land, grassland, parks, gardens, urban areas, and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.

Species (Common Name)	Distribution Range	Conservation Status		Natural Habitat and Distribution	Habitat Status and Condition in AOI	Location of Species found in AOI
		IUCN 2020	DAO 2019- 09			
<i>Hirundo rustica</i> (Barn swallow)	Migratory	Least Concern	Other Wildlife Species	Natural habitat: Woodland, bamboo thickets, mangroves, scrub, swamp forest, second growth, parks, gardens, and residential and urban areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment but requires presence of waterways.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Gerygone sulphurea</i> (Golden-bellied flyeater)	Resident breeder	Least Concern	Other Wildlife Species	Natural habitat: Plantation, mangrove vegetation (above high tide level), lowland forests, second growth, parks, gardens, urban areas, and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Cynopterus brachyotis</i> (Short-nosed fruit bat)	Native (non- endemic)	Least Concern	Other Wildlife Species	Natural habitat: Tropical rainforests, secondary forests, riverine areas, agricultural areas, and residential areas Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.
<i>Scotophilus kuhlii</i> (Lesser Asiatic yellow bat)	Native (non- endemic)	Least Concern	Other Wildlife Species	Natural habitat: Hollow trees, grasslands with scattered trees, under fronds of palms, urban and residential areas. Distribution: Throughout the Philippines. Adaptability: Common to very common in various habitats that it occupies; highly adapted to urban environment.	AOI: ROW Status: The ROW is part of the significant modified habitat for this species. Other Potential natural habitat area close to the project: Any green spaces with scattered trees.	Several individuals were recorded in the ROW.

(3) Habitat Classification

258. Intense anthropogenic disturbances characterize the SBT Section ROW. These are clear indications that existing habitat in the Project ROW has been greatly modified in the past. Historically in the 1800s, the NCR like other vast areas in the Philippines, was covered with lowland evergreen forest and mangroves (along Manila Bay area). But due to massive clearing activities in line with timber requirements and area developments, the NCR slowly lost in original vegetation cover. By the 1970s, all natural habitats in the NCR were gone and replaced by man-made green spaces if any. As Manila City is within the NCR bordered on all sides by other equally urbanized cities, the surrounding landscapes do not differ much in terms of land use and anthropogenic disturbances. Previous to 1991 the ROW was maintained by railway authorities with minimal vegetation. Based on Manila CLUP (2018), the Project ROW is situated in a densely populated area and is classified as a highly urbanized city. Moreover, high density residential areas, medium to high intensity commercial areas, and general institution zones are among the land uses that characterize the boundaries of the ROW.

259. The ROW is now comprised of grasslands that is heavily interspersed with exotic trees with a large proportion (i.e., 71% to 77%) of recorded plants being exotic or introduced together with various human activities as part of urban greening projects and/or for practical community use (e.g., aesthetics, shade, and source of cleaning material) for the informal settlers.

260. Based on bird species recorded, encounter rates of these species, and their range distribution, the SBT Section ROW provides a suitable environment for resident breeding (non-endemic) generalist birds. Based on the study of Callaghan et al. (2019), “generalists are the most urban-tolerant birds.” The study also showed that they occupy a wider set of habitat types (non-forest, grasslands, open and urban areas, etc.) and are not specialized feeders (able to eat insects, seeds, food scraps, etc.). Encounter rates in the ROW were particularly high (ordinal scale: abundant and common) for generalist species that require non-forest habitat (e.g., grassland and open areas). Distribution range was mostly resident breeders which corresponds to the dominance of non-forest habitat in the area. Most endemic and/or threatened species prefer pristine forest habitat to survive, their absence or limited numbers in the ROW, suggests that this habitat type is very limited or non-existent in the area.

261. Similarly, the bat species (based on secondary data) included in this study are known abundant inhabitants of residential and urban areas. They are highly associated with anthropogenic structures and disturbances such that they are uncommon in good quality forest. The species of birds and bats recorded in the ROW are completely aligned with and further support the results of vegetation study conducted. As the habitat type in the SBT Section ROW is highly modified and disturbed (mainly grassland with some open areas and dominated by exotic or introduced species), it attracts wildlife species that are adapted to it. Moreover, values recorded for encounter rates, range distribution, and habitat associations of birds provide a quantitative measure of the assemblage type (i.e., generalists) that could thrive and tolerate the ROW.

262. The SBT Section ROW is heavily disturbed area wherein anthropogenic impacts dominate. GN35 in WB-IFC, Performance Standard 6 (2019), states that “*Human activity may modify the structure and composition of natural habitats to the degree that non-native species become dominant and/or the natural ecological functions of the habitat fundamentally change. At the extreme, this takes the form of urbanized areas.*” Furthermore, WB-IFC Performance Standard 6 (2019) defines Modified Habitat as “*areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.* GN27 in the above document further states that “*Clients are responsible for delineating the project site as best as possible in terms of modified and natural habitat. This determination is made based on the level of human-induced disturbance (for example, presence of invasive species, level of pollution, extent of habitat fragmentation, viability of*

existing naturally occurring species assemblages, resemblance of existing ecosystem functionality and structure to historical conditions, degree of other types of habitat degradation) and the biodiversity values of the site (for example, threatened species, ecosystems, and ecological processes necessary for maintaining nearby critical habitats)”. In light of the above baseline condition, the whole SBT Section ROW is classified as a Modified Habitat, Non-Critical. Impacts on the ROW habitat will be assessed in Chapter 5.

4.3 THE WATER

4.3.1 Surface Water Quality

263. The surface water quality assessment was undertaken to establish the current water quality conditions of surface water bodies in the vicinity of the SBT Section and identify existing sources of pollution to these waterways. The assessment also aimed to identify potential impacts of the Project to the water quality these surface water bodies, and to formulate options to prevent or mitigate these identified impacts.

4.3.1.1 Scope of Study

(1) Study Area

264. The project site is located in Tondo Manila, approximately two km away from the shore of Manila Bay. There are two esteros (creeks) in the vicinity of the project site –‘South Antipolo Creek’ or ‘Old Antipolo Open Canal’ but is referred in this report as South Antipolo Canal, and an unnamed estero near Antipolo St., referred to in this report as ‘Antipolo Creek.’ According to residents near these creeks, these waterways pass through the sewage treatment plant of the Metro Manila Development Authority (MMDA) located in Estero de Vitas before eventually draining into the Pasig River. The Pasig River is officially classified by the DENR as Class C freshwater body. The river drains either to the Manila Bay or the Laguna Lake depending on the season and water level.

265. South Antipolo Canal and Antipolo Creek flow through medium to high intensity commercial zones and high-density residential areas. Most of the commercial establishments that surround the sampling sites are automotive (bicycle/motorcycle) shops. Informal settlers were observed within the ROW of PNR. Based on anecdotal information from residents, both creeks are solely used for drainage. Regular cleaning efforts of these creeks are spearheaded by concerned barangays.

266. Pollutants currently impacting the two creeks based on site observations and field interviews include wastewater from dishwashing, laundering, car washing, domestic solid wastes including human excreta, unconsumed domestic animal feeds, oil and grease from bicycle and motor shops, and road surface run-off.

4.3.1.2 Survey Methodology

(1) Water Quality Sampling

267. Water quality sampling at the two surface water quality sampling sites was conducted through a combination of in-situ measurements and grab sampling. The water quality sampling and handling procedures, sampling protocols, and laboratory methods, were based on the following references:

- Department of the Environment and Natural Resources (DENR) Manual on Ambient Water Quality Monitoring (2008);
- Australian Standards/New Zealand Standards Water Quality Sampling: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples AS/NZS 5667.1;

- Australian Standards/New Zealand Standards Water Quality Sampling: Guidance on sampling of rivers and streams AS/NZS 5667.6.;
- Standard Methods for the Examination of Water and Wastewater (23rd edition) by the American Public Health Association, American Water Works Association, and the Water Environment Federation; and
- DENR Memorandum Circular No. 012 Series of 2016 (DMC 2016-012) (EMB Approved Methods of Analysis for Water and Wastewater)

1) In-Situ Measurement

268. *In-situ* parameters (i.e. pH, dissolved oxygen, temperature, and conductivity) were measured using calibrated handheld meters. Water pH was measured using a HORIBA™ glass electrode-pH meter (D-52 model), while electrical conductivity and temperature were measured using YSI EC300 multiparameter meter. Dissolved oxygen was measured using an internally calibrated Extech ExStick II Dissolved Oxygen handheld meter. All meters were internally calibrated prior to the sampling activity to ensure the validity and accuracy of readings. The pH meter and the YSI EC300 multiparameter are also calibrated annually by an accredited external laboratory.

2) Grab Sampling

269. Grab samples of stream water were collected using a TeleScoop – Water Sampler which was submerged against the flow/drift at a depth of approximately 20 cm. Samples were then transferred to sampling containers which were provided and certified clean by a DENR-accredited laboratory. Water samples for oil and grease was obtained from the surface of the water body using the water sampler and then transferred into 1 L wide-mouthed glass bottles. An aluminum sheet was placed on the mouth of the bottle right after the sample collection to prevent the oil and/or grease from adhering to the plastic container cap. Water samples for fecal and total coliform were stored in 250 mL sterilized glass bottles (covered in aluminum foil).

270. After the collection of samples, appropriate reagents were added to the water samples to prolong their holding time and retard the chemical and biological changes that inevitably continue after sample collection. Each sample container was then labelled with the sample date and time, sample identification code, preservation method, and site location name. The samples were then cool stored to approximately 4°C using ice and transported for laboratory analysis. Chain-of-Custody (CoC) forms containing the project name, project number, project location, sampler name and signature, sample number, date and time of sampling, and the method by which each sample will be analyzed were used to track samples from the point of origin in the field through laboratory processing and disposal.

271. The samples were transported to a DENR-accredited laboratory within the day of collection for laboratory analysis. Samples were analyzed using the laboratory analysis methods provided in DMC 2016-012, *EMB Approved Methods of Analysis for Water and Wastewater*, and the Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association, American Water Works Association, and the Water Environment Federation (2012). The handling procedures and test methods for the analyzed parameters are indicated in **Table 4.3.1**.

Table 4.3.1 Handling Procedures and Test Methods for the Analyzed Water Quality Parameters

Parameter	Unit	Sampling Container	Preservation	Holding Time	Test Method	Method Detection Limit
Temperature	°C	-	-	-	<i>In-situ</i> reading	-
pH	-	-	-	-	<i>In-situ</i> reading	-
Dissolved oxygen	mg/L	-	-	-	<i>In-situ</i> reading	-
Conductivity	mS/cm	-	-	-	<i>In-situ</i> reading	-
Color	TCU	1 Gallon PET	Unpreserved	24 hours	APHA 2120 B (Visual Comparison Method)	-

Parameter	Unit	Sampling Container	Preservation	Holding Time	Test Method	Method Detection Limit
Biological oxygen demand (BOD)	mg/L			24 hours	APHA 5210 B (5-Day BOD Test)	-
Total suspended solids (TSS)	mg/L			7 days	APHA 2540 D (Gravimetric Analysis at 103-105 °C)	2.5
Surfactants (MBAs)	mg/L			48 hours	APHA 5540 C (Anionic Surfactants as MBAs)	0.0235
Nitrate as Nitrogen	mg/L			48 hours	EPA 352.1 (Colorimetric, Brucine Method)	0.00587
Phosphate	mg/L			48 hours	APHA 4500 P B/D (Stannous Chloride Method)	0.00737
Chloride	mg/L			28 days	APHA 4500 Cl- B (Iodometric Method)	0.8624
Hexavalent Chromium	mg/L			24 hours	APHA 3500 Cr B (Atomic Absorption Method for Total Chromium)	0.00114
Oil and grease (Petroleum Ether Extracts)	mg/L	1 L Wide Mouth Jar	HCl Lab Preserved	28 days	APHA 5520 B (Partition-Gravimetric Method)	0.939
Phenols	mg/L	1 L Amber Bottle	H2SO4	14 days	APHA 5530 C (Chloroform Extraction & Colorimetric)	0.00356
Fecal Coliform	MPN/100 mL	8 oz Glass Jar	Sterilized	8 hours	APHA 9221 E (Fecal Coliform Test)	-
Total Coliform	MPN/100 mL				APHA 9221 B (Standard Total Coliform Fermentation Technique)	-
Dissolved Copper	mg/L	500 mL PET	Unpreserved	180 days	Total ICP APHA 3120 B (Inductively Coupled Plasma Method)	0.00509
Arsenic	mg/L	1 L PET	HNO3	180 days	Total ICP APHA 3120 B (Inductively Coupled Plasma Method)	0.00416
Cadmium	mg/L				Total ICP APHA 3120 B (Inductively Coupled Plasma Method)	0.000727
Lead	mg/L				Total ICP APHA 3120 B (Inductively Coupled Plasma Method)	0.00517
Total Mercury	mg/L			28 days	EPA 7470 (Cold-Vapor Atomic Absorption Method)	0.000161
Cyanide	mg/L	500 mL PET	NaOH	14 days	APHA 4500 CN-E Cyanide (Distillation & Colorimetric Methods)	-
Organophosphate	mg/L	1 L Amber Bottle	Unpreserved	7 days	EPA 8141 (Organophosphorus Compounds by Gas Chromatography)	-

4.3.1.3 Sampling Site

272. Baseline surface water quality sampling activities were undertaken last 30 October 2020 during the wet season in South Antipolo Canal and Antipolo Creek. Water quality sampling points were located in these waterbodies since these are:

- Situated adjacent the SBT Section's proposed alignment;

- South Antipolo Canal will be used as a receiving waterbody of stormwater drains for the Project;
- Located near existing road networks (accessibility and easy replication of sampling); and
- Near residential areas (permanent structures).

273. **Table 4.3.2** and **Figure 4.3.1** show the coordinates and locations of the water quality sampling sites. **Plate 4.3.1** shows site photographs taken during the baseline sampling activity.

Table 4.3.2 Description of Water Quality Sampling Sites

Station Name	Site Description	Barangay	Coordinates
SBT WQ1 Antipolo Creek	• The site is locally called Antipolo Creek. It is bounded by dense household/commercial areas on one side. The sampling site is located at about 15 meters in front of the Barangay Hall of Barangay 218. • During field sampling, the weather condition was sunny with little to no cloud cover. Bubbling was observed in the estero. The water was flowing from east to west. Little solid waste was observed in the creek. • Interview with the locals revealed that the creek is only used for drainage. However, the residents sometimes use the creek also for disposal of human excreta. The creek has a regular clearing activity set up by the barangay to prevent accumulation of solid waste.	Barangay 218	14°37'25.80"N 120°58'35.51"E
SBT WQ2 South Antipolo Canal	• The estero is called the South Antipolo Canal. It is bounded by dense household/commercial areas on one side and informal settlers on the other side. • The weather condition during field sampling was sunny with little to no cloud cover. The water was flowing from east to west. A few chunks of solid wastes were observed in the creek. A waste filter was set up upstream of the creek to prevent solid wastes from accumulating downstream. • Interviews with the locals revealed that the creek is only used for drainage. However, the residents also sometimes use the creek for human excreta disposal. Informal settlers were also observed to be washing their clothes and disposing the water in the creek during the sampling activity. They were also observed to be urinating in the creek. The creek has a regular clearing activity set up by the barangay to prevent accumulation of solid waste.	Barangay 227	14°37'22.48"N 120°58'35.48"E

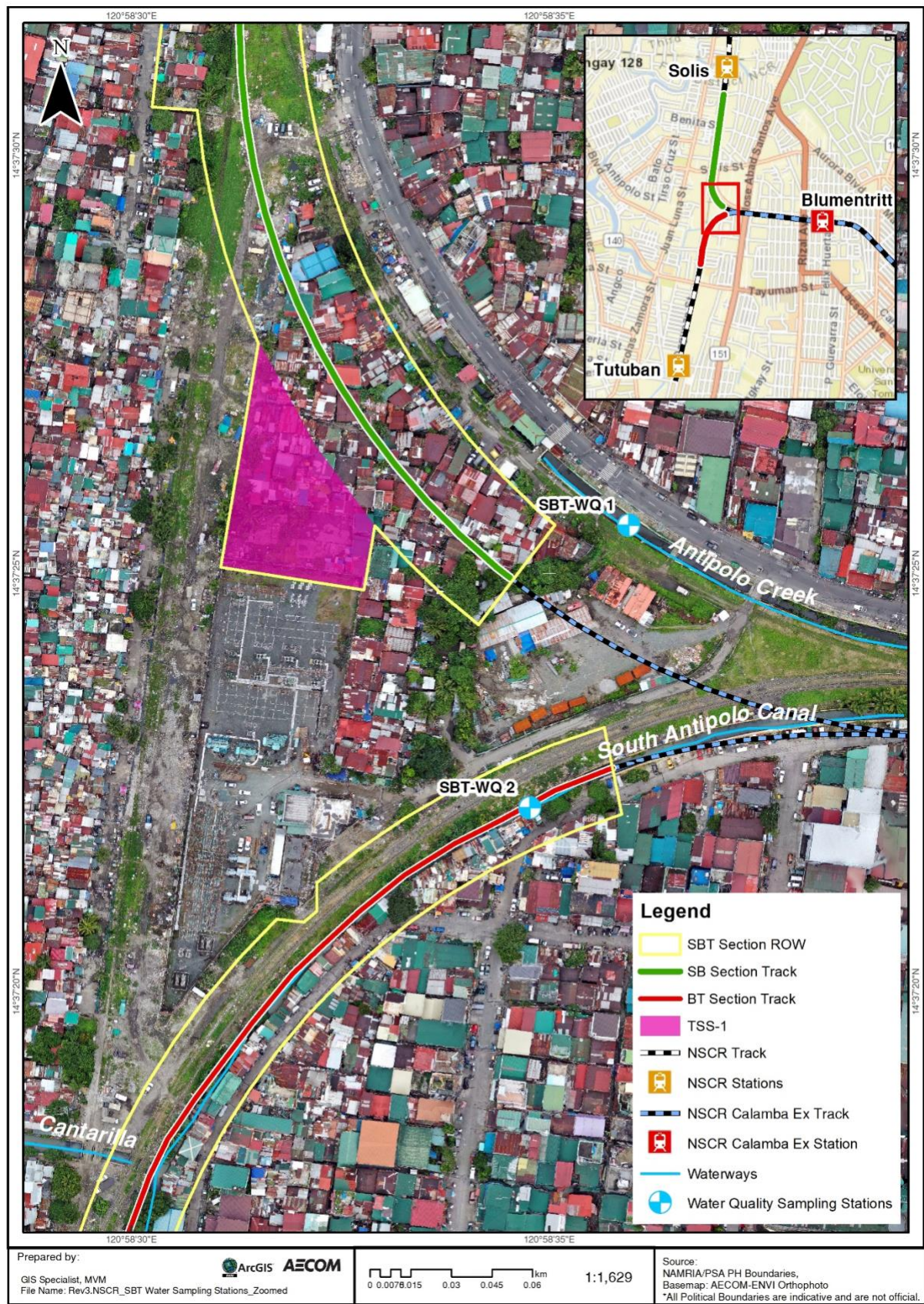


Figure 4.3.1 Surface Water Quality Assessment Sampling Sites

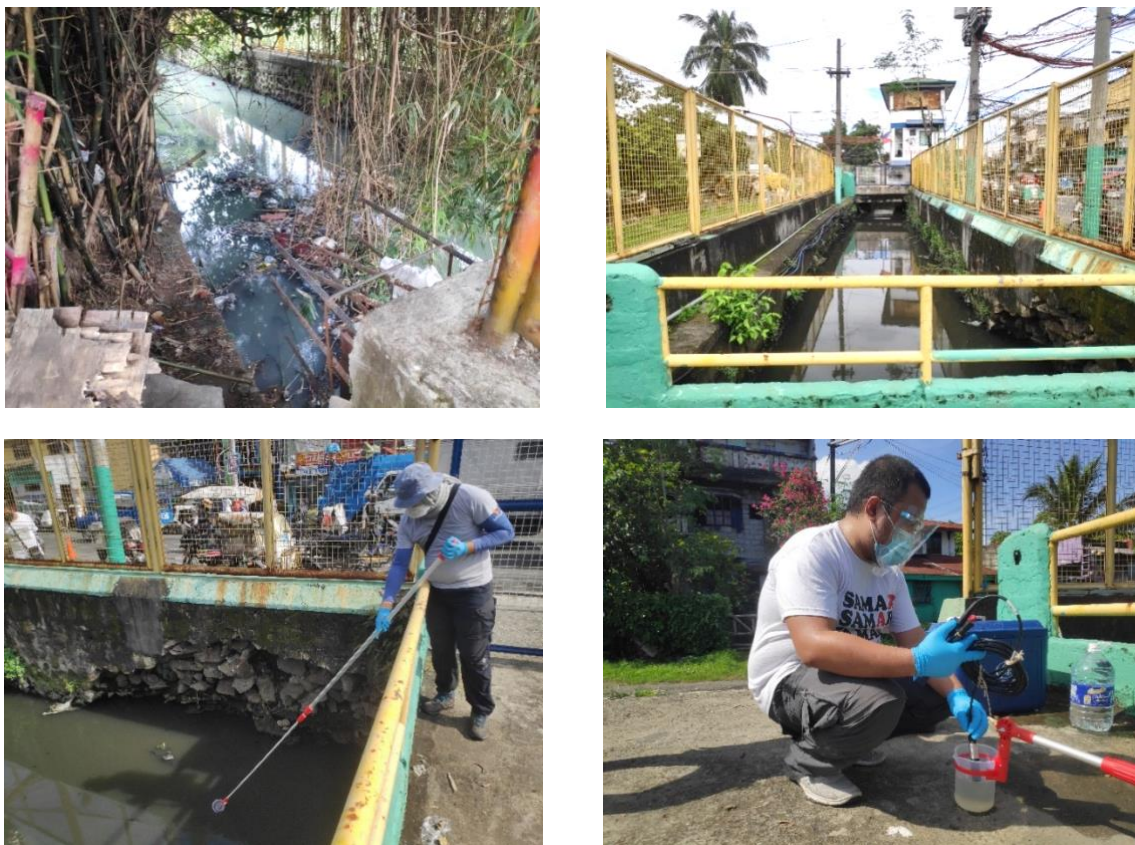


Plate 4.3.1 SBT WQ1 (Upper Left Photo), SBT WQ2 (Upper Right Photo), Sampling using Telescoop (Lower Right Photo), In-situ Parameter measurement (Lower Left Photo)

4.3.1.4 Data Assessment

274. At present, South Antipolo Canal and Antipolo Creek are drainage systems where domestic wastewater and human excreta are being disposed of by nearby settlements. Both creeks currently have no official DENR waterbody classification but both creeks drain to a Class C waterbody (i.e. Pasig River). Both creeks can therefore be assessed using the Class C WQG as confirmed with the DENR-EMB (Chapter 3 has further details about DAO 2016-08).

275. The study did not include actual water sampling for the dry season, thus secondary data were utilized to fill the gaps. Both South Antipolo Canal and Antipolo Creek have not been studied in the past. However, water quality analyses for Estero de Maypajo which is about 2km away from both creeks were carried out in July 2014, September 2014, and January 2015 during the preparation of NSCR Project EPRMP (2015). The water quality test results from Estero de Maypajo were analyzed along with the water quality test results of South Antipolo Canal and Antipolo Creek. Considering that all three water bodies are within Manila City and are within the same watershed, has similar land uses, and fall within the same climate type (Type I), it is assumed that South Antipolo Canal and Antipolo Creek is affected by seasonal variation in the same manner as Estero de Maypajo. Based on PAGASA, the Philippine weather bureau, Manila City has Type I climate. Type I climate has two pronounced seasons: dry from November to April and wet during the rest of the year. Maximum rain period is from June to September.

276. **Table 4.3.3** shows the water quality test results of Estero de Maypajo. The test results of July 2014 and September 2014 represent the wet season data. The test results of January 2015 represent the dry season data.

Table 4.3.3 Surface Water Quality of Estero de Maypajo

Parameter	Date of Sampling			DAO 2016-08 / DAO 2021-19 (Class C)
	Jul 2014	Sep 2014	Jan 2015	
Temperature °C	-	26.5	25	25 - 31
pH	7.0	-	7.2	6.5-9.0
Dissolved Oxygen (DO), mg/L	5.0	-	<0.5	5 (minimum)
Conductivity, µS/cm	-	-	-	-
Color, TCU	30	-	75	75
Biochemical Oxygen Demand (BOD), mg/L	33	-	63.2	7
Total Suspended Solids (TSS), mg/L	21.2	-	47.5	80
Surfactants (MBAs), mg/L	-	2.7	3.9	1.5
Oil and Grease, mg/L	-	-	3.7, 0.8	2
Nitrogen as NO ₃ ⁻ , mg/L	-	0.2	21.8	7
Phosphate, mg/L	-	0.5	2.74	0.025*
Phenols, mg/L	-	<0.0006	<0.01	0.05
Fecal Coliform, MPN/100 mL	1.7x10 ⁶	-	5.4x10 ⁶	200**
Total Coliform, MPN/100 mL	7.0x10 ⁶	-	9.2x10 ⁶	-
Chloride (Cl), mg/L	-	20	40.3	350
Dissolved Copper (Cu), mg/L***	-	<0.003	<0.001	0.02
Arsenic (As), mg/L	-	<0.001	<0.004	0.02
Cadmium (Cd), mg/L	-	<0.006	<0.001	0.005
Hexavalent Chromium (Cr ⁶⁺), mg/L	-	<0.001	<0.001	0.01
Cyanide (CN ⁻), mg/L	<0.002	-	<0.01	0.1
Lead (Pb), mg/L	<0.05	-	<0.05	0.05
Total Mercury (Hg), mg/L	-	<0.001	<0.0001	0.002
Organophosphate, mg/L	-	-	-	3

Notes: < indicates that the concentration is below the Laboratory's Limits of Reporting

- the parameter was not analyzed

* based on DAO 2021-19

** parameter included in DAO 2021-19 but no change in value from DAO 2016-08 to 2021-19 WQG for Class C waters

*** standard applied to Dissolved Cu is still DAO 2016-08 since the parameter in DAO 2021-19 is updated to Total Cu.
orange highlights indicate exceedance/s with respect to DAO 2016-08/ DAO 2021-19 WQG for Class C waters.

Source: Environmental Impact Statement for North South Commuter
(NSCR) Calamba Extension Project Volume 1, Jan 2020

277. The lower water temperature recorded in the NSCR Project EPRMP (2015) study is brought by the effect of trade winds to the general ambient temperature. Lower dissolved oxygen measurements are generally expected during dry seasons since creeks tend to have low flow velocities brought by decreased water input. For the other parameters, they tend to increase in concentration in dry seasons due to low water input needed to dilute these parameters.

278. Results of the laboratory analysis of the water samples were assessed against the Class C Water Quality Guidelines (WQG) provided in DAO 2016-08, *Water Quality Guidelines and General Effluent Standards of 2016*. Class C waterbodies are defined in the DAO 2016-08 as waterbodies whose intended beneficial use include fishery water for the propagation and growth of fish and other aquatic resources, recreational water for boating, fishing, or similar activities, and for agriculture, irrigation, and livestock watering.

4.3.1.5 Survey Results

(1) Surface Water Quality

279. **Table 4.3.4** presents the results of the laboratory analyses of the water samples from the two creeks. Laboratory certificates are presented in **Annex D-6**. The recent amendment to the WQG and GES (DAO 2021-09) is also included in the table as a reference to the new guideline values. DAO

2016-08 will still be used for the analysis of the results as the data is covered under the effectivity of the DAO 2016-08.

Table 4.3.4 Surface Water Quality Laboratory Results

Parameters	DAO 2021-09 (Class C)	DAO 2016-08 (Class C)	Sampling Date: 30 October 2020		
			SBT WQ1 Antipolo Creek	SBT WQ2 South Antipolo Canal	SBT WQ2B*** (QA/QC Sample)
Temperature*, °C	25 - 31	25 - 31	28.60	28.47	28.23
pH*	6.5-9.0	6.5-9.0	7.35	7.52	7.49
Dissolved Oxygen (DO)*, mg/L	5 (minimum)	5 (minimum)	0.77	0.90	0.89
Conductivity, µS/cm	-	-	6.19	433.43	433.13
Color, TCU	75	75	75	75	75
Biochemical Oxygen Demand (BOD), mg/L	7	7	515	303	595
Total Suspended Solids (TSS), mg/L	80	80	17.2	41.7	15.6
Surfactants (MBAs), mg/L	1.5	1.5	0.918	1.38	2.18*
Oil and Grease, mg/L	2	2	6.02	3.72	3.33
Nitrogen as NO ₃ -, mg/L	7	7	0.0561	< 0.0390	< 0.0390
Phosphate, mg/L (DAO 2016-08) Phosphate as Phosphorus (Total, Reactive), mg/L (DAO 2021-19)	- 0.025	0.5 -	3.02	2.78	1.36
Phenols, mg/L	0.05	0.05	7.27	< 1.92	< 1.92
Fecal Coliform, MPN/100 mL	200	200	35,000	49,000	13,000
Total Coliform, MPN/100 mL	-	-	92,000	54,000	92,000
Chloride (Cl), mg/L	350	350	39.8	19.1	19.6
Dissolved Copper (Cu), mg/L (DAO 2016-08) Total Copper (Cu) mg/L (DAO 2021-19)	- 0.2	0.02 -	< 0.0102	< 0.0102	< 0.0102
Arsenic (As), mg/L	0.02	0.02	< 0.0100	< 0.0100	< 0.0100
Cadmium (Cd), mg/L	0.005	0.005	< 0.00200	< 0.00200	< 0.00200
Hexavalent Chromium (Cr ⁶⁺), mg/L	0.01	0.01	< 0.00500	< 0.00500	< 0.00500
Cyanide (CN ⁻), mg/L	0.1	0.1	6.03	3.37	1.93
Lead (Pb), mg/L	0.05	0.05	< 0.0200	< 0.0200	< 0.0200
Total Mercury (Hg), mg/L	0.002	0.002	ND	ND	ND
Organophosphate, mg/L	3	3	ND	ND	ND

Note: values below the Laboratory's Limits of Reporting are presented as <

ND – not detected

* - measured in-situ

** - QA/QC sample

orange highlight – parameters with exceedance/s with respect to DAO 2016-08 WQG for Class C waters

280. Both South Antipolo Canal and Antipolo Creek have high levels of organic pollution and impacts associated with sewage and waste disposal from surrounding households and commercial establishments. Elevated levels of BOD and phosphates were recorded in both creeks which exceeded the corresponding DAO 2016-08 Class C WQG for these parameters (**Table 4.3.4**). At the time of sampling, bubbling was observed in SBT WQ1 while patches of organic solid wastes were present in SBT WQ2. In rivers and streams, BOD measures the amount of oxygen demanded by aerobic microorganisms in the decomposition of organic matter (USEPA, 2012). Although BOD levels in streams are naturally linked to the decomposition of organic matter from plant debris and animal waste, high BOD levels may indicate the transport of organic matter through surface runoff from nearby residential and industrial areas. Phosphates on the other hand, are considered as one of the two most common nutrients that act as limiting factors to the primary productivity of an aquatic ecosystem, along with nitrates (Webster, D'Angelo & Peters, 1991). Excess amounts of phosphates can lead to nutrient enrichment, and consequently eutrophication. In freshwater bodies near residential and industrial areas, phosphate is considered as they key nutrient that can lead to eutrophication due to potential runoff from the households (European Environment Agency, 2016).

281. High fecal coliform concentrations were also recorded in the two sampling sites, exceeding the Class C limit by a high margin (**Table 4.3.4**). Fecal coliform refers to the coliforms that only originate from the fecal waste of warm-blooded organisms (i.e. humans, animals), whereas total coliform account for all the types of coliforms in the environment regardless of their origin. The presence of coliform in stream water suggests the occurrence of pathogenic microorganisms, which can pose health risks for the public (USEPA, 2012). Moreover, it also indicates potential contamination of the water body by the sewage/wastewater disposal and runoff from nearby residential areas.

282. Very low DO concentrations that did not meet the DAO 2016-08 Class C DO WQG were also recorded in South Antipolo Canal and Antipolo Creek. The low DO levels are consistent with the high BOD concentrations. DO levels in stream water are usually supplied through the natural aeration that occurs between the water/air interface through the strong current, as well as through the photosynthetic organisms (i.e. phytoplankton and aquatic plants) that may be present in the water body. The amount of DO in water bodies is crucial in the survival of some aquatic species since these organisms require specific DO levels to thrive. Although DO levels fluctuate depending on the seasonal factors, DO is generally influenced by parameters such as temperature, biological oxygen demand, and light penetration, among others.

283. Oil and grease and free cyanide concentrations in both sampling sites and phenols concentration in SBT WQ1 also exceeded their respective DAO 2016-08 Class C WQG. Oil and grease form a buoyant oil film on the surface of the water due to its density and insoluble characteristic (Fulazzaky & Omar, 2012). Therefore, the accumulation of oil and grease in surface water may possibly reduce the availability of dissolved oxygen for aquatic biota, and consequently suffocate them (Eljaiek-Urzola et al., 2019). Constituents of oil and grease include petroleum and petroleum derivatives, vegetable oil, and animal fats (Khwakaram, 2016). Moreover, increased levels of oil and grease may reduce the aesthetic quality of the rivers and streams.

284. Phenolic compounds exist in aquatic environments due to improper industrial, and domestic sewage discharge. It may also be sourced from agricultural runoffs. Moreover, it may also be sourced from degrading organic compounds. Phenolic compounds usually exist in background concentrations in the environment. In excess, it can be lethal to living things and act as a carcinogen.

285. Cyanide compounds are usually released in the environment by industrial activities. This pollute the soil and eventually the groundwater. Free cyanide concentrations in surface waters without nearby industrial activities may come from the smoke emissions of vehicles. Other sources may include biodegradation of organic matter which have inherent high cyanide concentration. Cyanide is lethal to living organisms in excess amounts.

286. Surfactant concentrations in the two sampling sites meet the DAO 2016-08 Class C WQG criterion. The presence of surfactants indicates that the creeks receive laundry wastewater that contains surfactants (**Figure 4.3.3**). Surfactants are widely used as an ingredient in cleaning materials. Residual concentrations of surfactants after use are usually being discharged into sewage systems or into the environment. Surfactants usually occur in background concentrations, but excess concentrations of surfactants can be lethal to ecosystems.

287. Heavy metals (As, Cd, Cr⁺⁶, Pb, Cu, and Hg) which are considered as hazardous chemicals in the environment were not detected by the analytical methods. This indicates that although these metals may be present in the water body, the concentrations are very low and does not pose a risk to the environment.

288. In terms of physical characteristics, water in South Antipolo Canal and Antipolo Creek appeared gray during the sampling activities. The color measurements for both water quality sampling sites were at 75 TCU, which is the color limit provided in the DAO 2016-08 WQG for Class C waters. Color is greatly influenced by the suspended and dissolved components of the water and can be a

supportive proof of pollution since pollutants are usually suspended or dissolved in the water. The creeks are slightly alkaline. TSS concentrations in both waterways meet the DAO 2016-08 TSS WQG for Class C waters. Temperature readings in the two sampling sites are within the regulatory standards. Graphs of recorded color, pH, TSS, and temperature levels in the sampling sites are shown in **Figure 4.3.3**. Other water quality parameters analyzed as part of the assessment meet the available DAO 2016-08 Class C WQG. The graphs of the results for each water quality parameter are also provided in **Annex D-7**.

289. Comparing the water quality test results of South Antipolo Canal and Antipolo Creek with those of Estero de Maypajo (**Table 4.3.5**), it appears that seasonal variation does not greatly influence the water quality. However, this could not be fully established owing to the limited data. But the test results confirm that heavy metals are either not present or the concentrations are below the detection limits of the laboratory method. This may be because there are no heavy industries discharging wastewater containing heavy metals into the water systems. The high concentrations of BOD, oil and grease, and fecal coliform and low concentrations of DO indicate that water quality is affected mainly by organic pollution load.

Table 4.3.5 Surface Water Quality Laboratory Results in Comparison with Estero de Maypajo

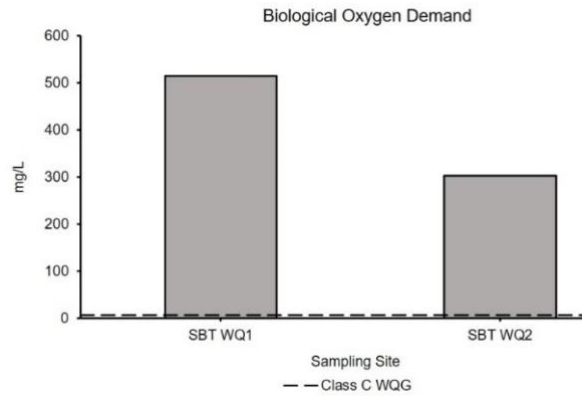
Parameter	Estero de Maypajo			South Antipolo Canal (SBT-WQ2)	Antipolo Creek (SBT-WQ1)	DAO 2016-08/ DAO 2021-19 (Class C)
	Jul 2014	Sep 2014	Jan 2015	30 Oct 2020	30 Oct 2020	
Temperature °C	-	26.5	25	28.60	28.47	25 - 31
pH	7.0	-	7.2	7.35	7.52	6.5-9.0
Dissolved Oxygen (DO), mg/L	5.0	-	<0.5	0.77	0.90	5 (minimum)
Conductivity, µS/cm	-	-	-	6.19	433.43	-
Color, TCU	30	-	75	75	75	75
Biochemical Oxygen Demand (BOD), mg/L	33	-	63.2	515	303	7
Total Suspended Solids (TSS), mg/L	21.2	-	47.5	17.2	41.7	80
Surfactants (MBAs), mg/L	-	2.7	3.9	0.918	1.38	1.5
Oil and Grease, mg/L	-	-	3.7	6.02	3.72	2
Nitrogen as NO ₃ ⁻ , mg/L	-	0.2	21.8	0.0561	< 0.0390	7
Phosphate, mg/L	-	0.5	2.74	3.02	2.78	0.025*
Phenols, mg/L	-	<0.0006	<0.01	7.27	1.92	0.05
Fecal Coliform, MPN/100 mL	1.7x10 ⁶	-	5.4x10 ⁶	35,000	4,900	200**
Total Coliform, MPN/100 mL	7.0x10 ⁶	-	9.2x10 ⁶	92,000	54,000	-
Chloride (Cl), mg/L	-	20	40.3	39.8	19.1	350
Dissolved Copper (Cu), mg/L ***	-	<0.003	<0.001	< 0.0102	< 0.0102	0.02
Arsenic (As), mg/L	-	<0.001	<0.004	< 0.0100	< 0.0100	0.02
Cadmium (Cd), mg/L	-	<0.006	<0.001	< 0.00200	< 0.00200	0.005
Hexavalent Chromium (Cr ⁶⁺), mg/L	-	<0.001	<0.001	< 0.00500	< 0.00500	0.01
Cyanide (CN ⁻), mg/L	<0.002	-	<0.01	6.03	3.37	0.1
Lead (Pb), mg/L	<0.05	-	<0.05	< 0.0200	< 0.0200	0.05
Total Mercury (Hg), mg/L	-	<0.001	<0.0001	ND	ND	0.002
Organophosphate, mg/L	-	-	-	ND	ND	3

Note: * updated based on DAO 2021-19

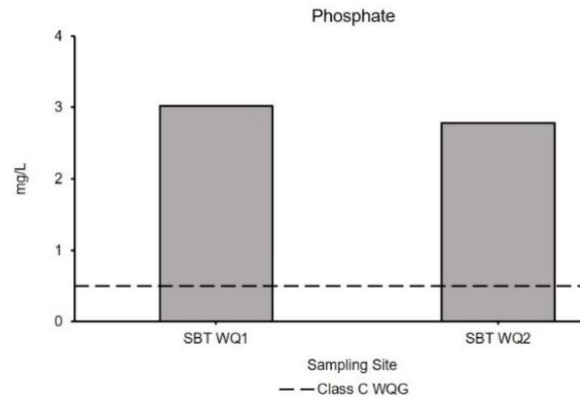
** parameter included in DAO 2021-19 but no change in value from DAO 2016-08 to 2021-19 WQG for Class C waters

*** standard applied to Dissolved Cu is still DAO 2016-08 since the parameter in DAO 2021-19 is updated to Total Cu.

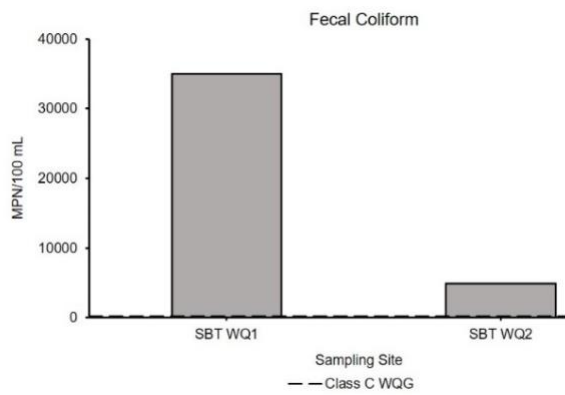
Orange highlights indicate exceedance/s with respect to DAO 2016-08/ DAO 2021-19 WQG for Class C waters.



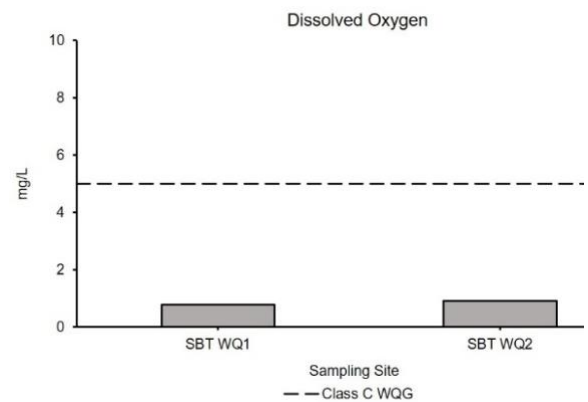
(a) Biological Oxygen Demand



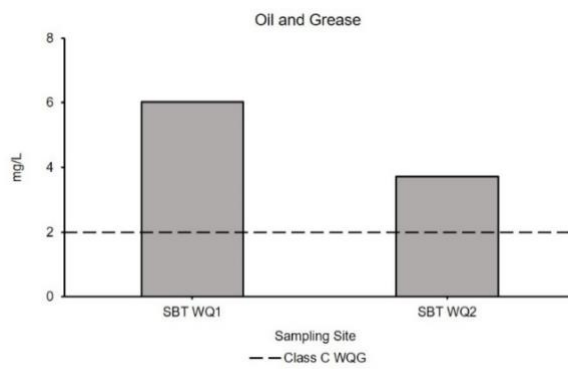
(b) Phosphate



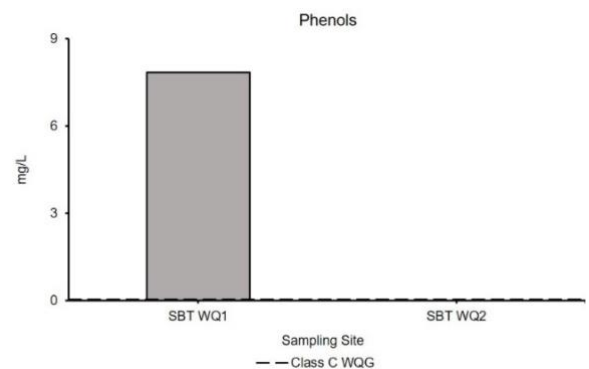
(c) Fecal Coliform



(d) Dissolved Oxygen



(e) Oil & Grease



(f) Phenol

Figure 4.3.2 Concentrations of (a) Biological Oxygen Demand, (b) Phosphate, (c) Fecal Coliform, (d) Dissolved Oxygen, (e) Oil & Grease and (f) Phenol

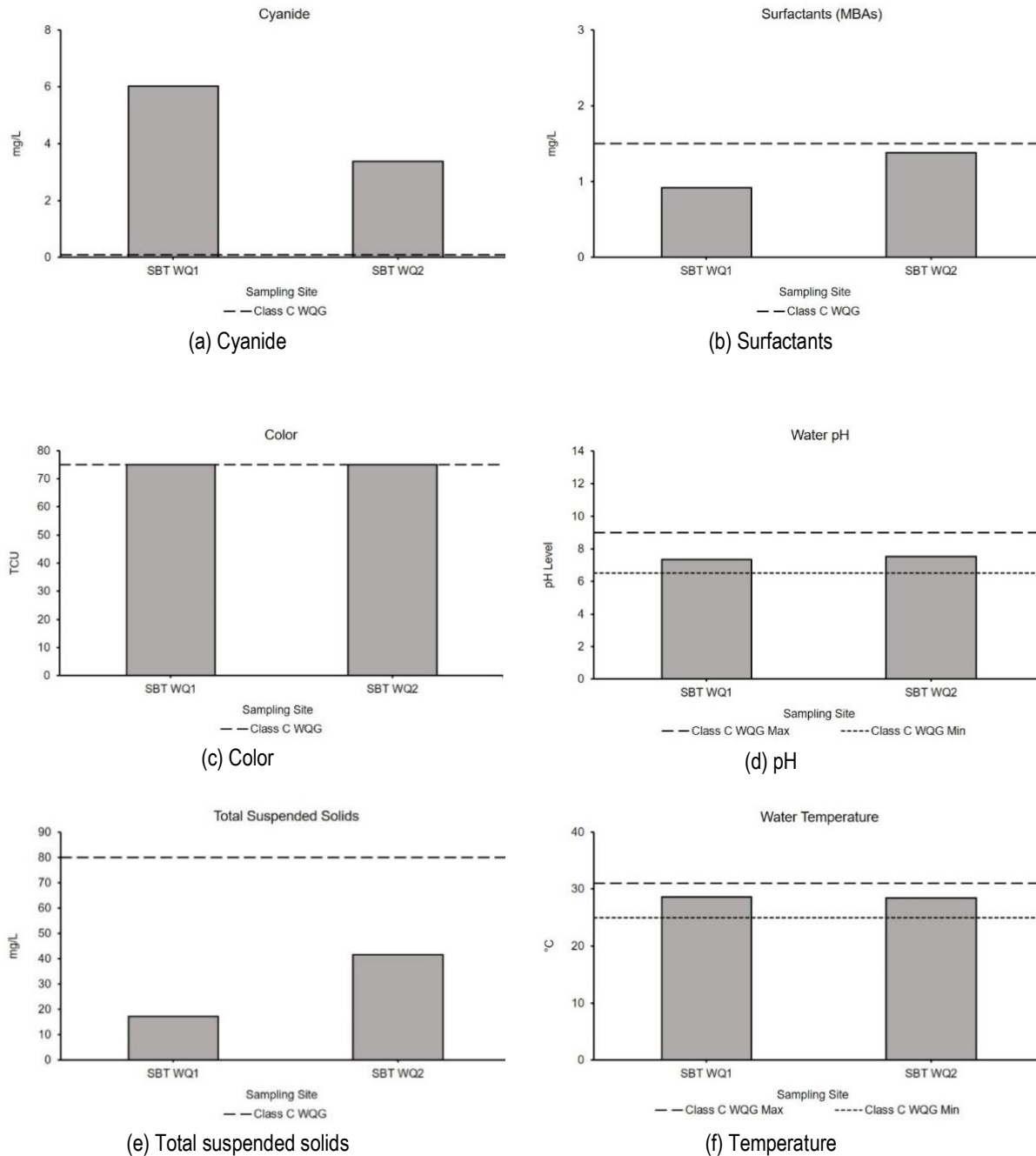


Figure 4.3.3 Concentrations of (a) Cyanide, (b) Surfactants, (c) Color, (d) pH, (e) Total suspended solids and (f) Temperature

(2) Existing Potential Sources of Pollution

290. Potential pollutants currently impacting the two creeks based on site observations and field interviews may include wastewater from dishwashing, laundering, and car washing, domestic solid wastes including human excreta, unconsumed domestic animal feeds, and oil and grease from bicycle and motor shops, and road surface run-off.

4.4 THE AIR

4.4.1 Climate

4.4.1.1 Baseline Environment

(1) Climate Type

291. The project site is in an area classified as Type I based on the Modified Corona's Classification. This climate type is characterized as having two very pronounced seasons: dry season from November to April and Wet during the rest of the year. The maximum rain period is from June to September. Two principal airstreams dominate the Philippines: the Northeast Monsoon (*Amihan*) which prevails from October to April, and the Southwest Monsoon (*Habagat*) which is prevalent from May to September. Since the project site is in the western portion of Luzon, it is more likely affected by *Habagat*.

(2) Frequency of Tropical Cyclones

292. Approximately 20 tropical cyclones enter the Philippine Area of Responsibility (PAR) per year². A tropical cyclone is a non-frontal low-pressure system of synoptic scale developing over warm waters having organized convection and a maximum mean wind speed of 63 km or greater extending more than half-way around near the center and persisting for at least six hours. PAGASA categorizes a tropical cyclone based on the intensity of its maximum winds as it enters the PAR. The project site is in an area traversed by 24 tropical cyclones in 12 years (two tropical cyclones per year) based on data from 1948 to 2015⁸.

(3) Rainfall

293. The three-decade climate data shows that the rainfall patterns in Metro Manila has a distinct pattern (**Table 4.4.1** and **Figure 4.4.1**). For both weather stations (although the NAIA Terminal 3 station has less total rainfall), the total monthly rainfall starts to increase during the month of May, with an increasing trend until peaking during the months of July, August, and September. A decreasing trend in rainfall is observed from October to April. This is consistent with the characteristics of a Type I climate. It is also observable that the number of rainy days is directly proportional to the total monthly amount of rainfall.

294. The total monthly rainfall at the PAGASA synoptic weather station in NAIA Terminal 3 ranges from 4 mm (March) to 418.4 mm (August). The total annual rainfall amounts to 1,767.90 mm with an annual number of rainy days of 105 days or approximately 29.0% of the year. The rainfall in the PAGASA synoptic weather station in Science Garden were higher. The total rainfall ranges from 14.6 mm (February) to 504.2 mm (August) with a total annual rainfall of 2,574.30 mm. The annual number of rainy days is 151, corresponding to 41.4% of the year.

295. The total annual rainfall at the PAGASA synoptic weather station in NAIA Terminal 3 and Science Garden are within the range of other areas in the Philippines classified as Type I climate: Cabanatuan, Nueva Ecija (1,854.9 mm), Clark, Pampanga (2,026.8 mm), Dagupan City, Pangasinan (2,380.9 mm), Iba, Zambales (3,450.7 mm), Laoag City, Ilocos Norte (2,182.8 mm), NAIA, Pasay City (1,767.8 mm), Port Area, Manila (2,103.6 mm), Ambulong, Batangas City (1,767.0 mm), and Vigan, Ilocos Sur (2,277.4 mm).

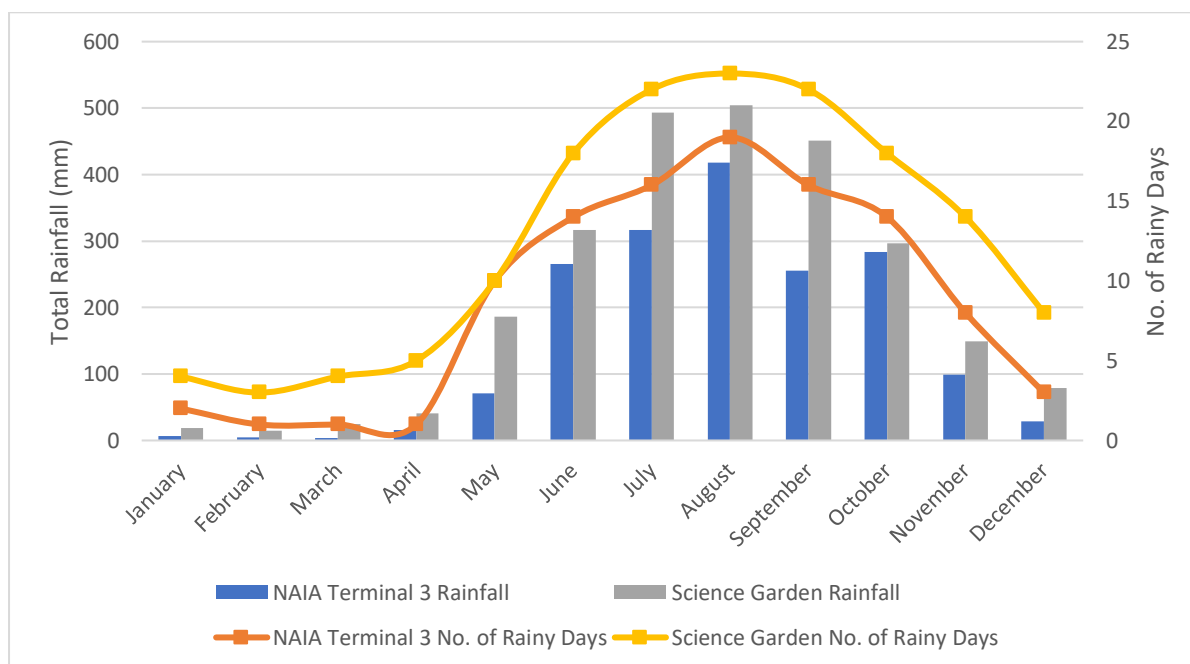
296. The highest daily rainfall recorded at the NAIA Terminal 3 was 472.4 mm on July 20, 1972. For the PAGASA Science Garden weather station. The highest daily rainfall was 455.0 mm on September 26, 2009 during Typhoon *Ondoy* (International name Ketsana).

⁸ Data from PAGASA: <https://www.pagasa.dost.gov.ph/climate/tropical-cyclone-information>

Table 4.4.1 Total monthly rainfall and number of rainy days at the PAGASA synoptic weather stations in Science Garden and NAIA Terminal 3

Month	NAIA Terminal 3		Science Garden	
	Rainfall	No. of Rainy Days	Rainfall	No. of Rainy Days
January	6.8	2	18.5	4
February	4.2	1	14.6	3
March	4	1	24.8	4
April	16	1	40.4	5
May	70.4	10	186.7	10
June	265.2	14	316.5	18
July	316.7	16	493.3	22
August	418.4	19	504.2	23
September	255.2	16	451.2	22
October	283.4	14	296.6	18
November	99	8	148.8	14
December	28.6	3	78.7	8
Annual	1,767.90	105.00	2,574.30	151.00

Source: PAGASA CADS



Source: PAGASA CADS

Figure 4.4.1 Total monthly rainfall and number of rainy days at the PAGASA synoptic weather stations in Science Garden and NAIA Terminal 3, 1981 to 2010

(4) Temperature

297. Table 4.4.2, Figure 4.4.2, and Figure 4.4.3 present the maximum, minimum, and mean temperatures (in °C) at the PAGASA synoptic weather stations in Science Garden and NAIA Terminal 3 from 1981 to 2010.

298. At NAIA Terminal 3, the mean temperatures ranged from 26.1 °C (January) to 29.7 °C (May), with an annual average mean temperature of 27.8 °C. Although the temperature ranges (difference

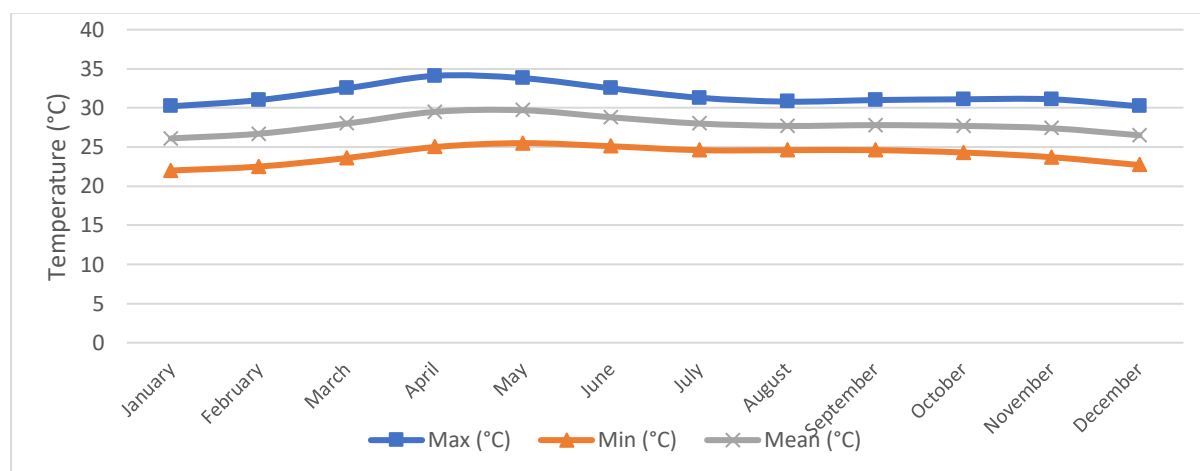
between maximum and minimum temperatures) are higher in Science Garden, the average annual mean temperature is similar (27.7 °C). The coldest month is January (25.7 °C) while May is the hottest (29.7 °C). In both weather stations, temperatures are higher during the MAM period and lower during the DJF period.

299. The highest temperature recorded in NAIA Terminal 3 was 38.2 °C on May 18, 1969, while the coldest was 14.6°C on February 1, 1962. At the PAGASA Science Garden, the highest temperature was 38.5 °C on May 14, 1987, while the coldest was 14.9 °C on March 1, 1963.

Table 4.4.2 Monthly minimum, maximum, and mean temperatures at the PAGASA synoptic weather stations in Science Garden and NAIA Terminal 3

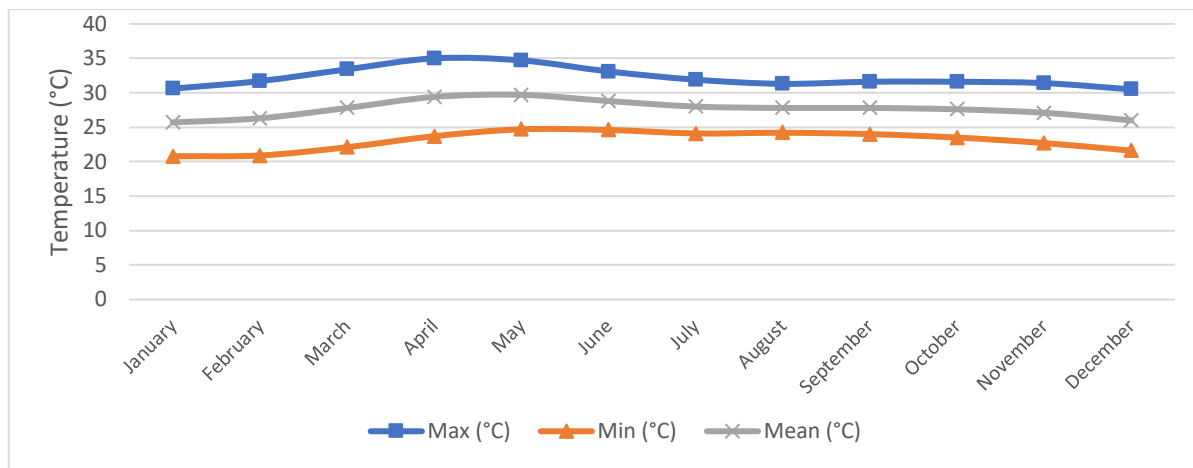
Month	NAIA Terminal 3			Science Garden		
	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)
January	30.2	22.0	26.1	30.6	20.8	25.7
February	31	22.5	26.7	31.7	20.9	26.3
March	32.5	23.6	28	33.4	22.1	27.8
April	34.1	25	29.5	35	23.7	29.4
May	33.8	25.5	29.7	34.7	24.7	29.7
June	32.5	25.1	28.8	33.1	24.6	28.8
July	31.3	24.6	28	31.9	24.1	28
August	30.8	24.6	27.7	31.3	24.2	27.8
September	31	24.6	27.8	31.6	24	27.8
October	31.1	24.3	27.7	31.6	23.5	27.6
November	31.1	23.7	27.4	31.4	22.7	27.1
December	30.2	22.7	26.5	30.5	21.6	26
Annual	31.6	24	27.8	32.2	23.1	27.7

Source: PAGASA CADS



Source: PAGASA CADS

Figure 4.4.2 Monthly minimum, maximum, and mean temperatures at the PAGASA NAIA Terminal 3 synoptic weather station, 1981 to 2010



Source: PAGASA CADS

Figure 4.4.3 Monthly minimum, maximum, and mean temperatures at the PAGASA Science Garden synoptic weather station, 1981 to 2010

(5) Wind Speed

300. Long-term wind data indicate that the average wind speeds in NAIA Terminal 3 and PAGASA Science Garden ranges from approximately 2.2 m/s to 3.2 m/s, and 1.9 m/s to 2.3 m/s, respectively. Based on the Beaufort Wind Force Scale, these wind speeds are classified as ‘light breeze.’

301. Wind rose analysis of the 30-year daily wind data at the PAGASA synoptic weather station in NAIA Terminal 3 shows that the prevalent wind direction is to the west, east, and southeast directions (**Figure 4.4.4**). The wind directions are to the east and southeast directions during the months of October to April and starts to shift to the west in May, lasting until September. At the PAGASA synoptic weather station in Science Garden, the wind direction throughout the year is predominantly to the north (**Figure 4.4.5**). From October to April, the predominant wind direction is to the north, and shifts to the south and southwest directions from May to September. These characteristics are consistent with the two principal airstreams that dominate the Philippines: the Northeast Monsoon (*Amihan*) which prevails from October to April and the Southwest Monsoon (*Habagat*) which is prevalent from May to September.

302. The highest wind speed recorded in NAIA Terminal 3 is 56 m/s on November 19, 1970 during Typhoon *Yoling* (int. name “Patsy”). In Science Garden, the highest recorded windspeed is 50 m/s on November 3, 1995 during Typhoon *Rosing* (int. name “Angela.”)



Figure 4.4.4 Annual wind rose diagram at the PAGASA synoptic weather station in NAIA Terminal 3, 1989 to 2018

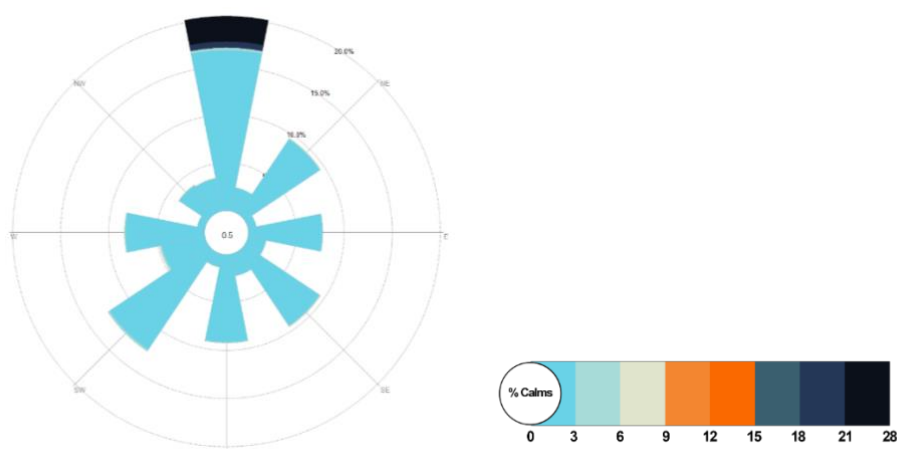


Figure 4.4.5 Annual wind rose diagram at the PAGASA synoptic weather station in Science Garden, 1989 to 2018

(6) Climate Projections

303. The projected frequency of extreme weather events in Metro Manila under the medium-range scenario is presented in **Table 4.4.3**.

Table 4.4.3 Frequency of Extreme Weather Events in 2020 and 2050 under the medium range emission scenario in Metro Manila (Science Garden)

Weather Event	Observed Baseline (1971 to 2000)	Projected in 2020 (2001 to 2035)	Projected in 2050 (2036 to 2065)
No. of Days with $T_{max} > 35^{\circ}C^9$	1,095	1,984	3,126
No. of Dry Days ¹⁰	7,476	6,302	6,220
No. of Days with Rainfall $> 200\text{ mm}^{11}$	9	13	17

Source: PAGASA Climate Change Projections

304. The projected rainfall change in Metro Manila in 2020 and 2050 is presented in **Table 4.4.4**. The simulations indicate that for the medium-range emission scenario, rainfall is expected to decrease during the dry seasons (DJF and MAM) and increase during the wet seasons (JJA and SON) in both time-slices, making the dry season drier and the wet season wetter.

Table 4.4.4 Seasonal rainfall change (in %) in 2020 and 2050 under the medium-range emission scenario in Metro Manila

Season	Observed Baseline (1971-2000), mm	Projected Rainfall in 2020 (2006-2035), mm	Projected Rainfall in 2050 (2036-2065), mm
DJF	107.5	93.74 (-12.8 %)	88.90 (-17.3 %)
MAM	198.5	132.40 (-33.3)	122.08 (-38.5)
JJA	1,170.2	1,269.67 (8.5)	1,419.45 (21.3)
SON	758.7	758.7 (0.0)	786.77 (3.7)

⁹ Following the threshold values used in other countries in the Asia Pacific Region

¹⁰ Assessed as number of dry days or day with rainfall equal or less than 2.5 mm per day, following the World Meteorological Organization (World Meteorological Organization, 2011) standard definition of dry days used in a number of countries

¹¹ Assessed as number of days with daily rainfall greater than 200 mm, which for wet tropical areas, like the Philippines, is considerably intense that could trigger disastrous events

Source: PAGASA Climate Change Projections

305. **Table 4.4.5** present the projected changes in mean temperatures in Metro Manila in two time slices under the medium-range emission scenario.

306. The results of the simulation show that ambient mean temperatures have an increasing trend in 2020 and 2050 from the baseline. For the medium-range emission scenario, the temperature will range from 27.1 °C to 29.9 °C in 2020 and 29.3 to 30.9 °C in 2050. In both 2020 and 2050 time slices, MAM is projected to be the warmest season every year.

Table 4.4.5 Projected change in mean temperature in 2020 and 2050 under the medium range emission scenario in Metro Manila

Season	Observed Baseline (1971-2000), °C	2020: Change in Mean Temperature (Projected Value), °C	2050: Change in Mean Temperature (Projected Value), °C
DJF	26.1	27.1 (1.0)	28.1 (2.0)
MAM	28.8	29.9 (1.1)	30.9 (2.1)
JJA	28.0	28.9 (0.9)	29.8 (1.8)
SON	27.4	28.4 (1.0)	29.3 (1.9)

Source: PAGASA Climate Change Projections

4.4.2 Ambient Air Quality

307. Ambient air quality monitoring was conducted to establish baseline air quality values in the project site and set objectives for the Project's compliance to National Air Quality Guidelines (NAAQGV) and standards (NAAQS) of the Philippines. The specific objectives of the assessment are to:

- identify, assess, and set the baseline air quality on the project site;
- address potential impacts and other relevant issues of the Project; and
- propose options for prevention, mitigation, and/or enhancement measures to reduce project impacts to the air quality in the area.

4.4.2.1 Scope of Study

(1) Study Area

308. The project site is within the National Capital Region Airshed as designated under DAO 2011-11, *Re-Designation of the Metro Manila Airshed into Three Individual Airsheds and Establishment of their Governing Boards*. It is situated in a flat terrain that runs north to south in Tondo, Manila. The project site is surrounded by high density residential, medium, and high intensity commercial, general institutional, and general public open space areas based on the City of Manila's CLUP. However, the current land use surrounding the project site are mostly high density residential based on ground-truthing.

(2) Sensitive Receptors

309. The closest residences to the project construction area after the relocation activities would be from the edge of the ROW which varies from 15 m to 30 m from the centerline of the SBT Section alignment. The receptors include residences where people may be reasonably expected to be present continuously as part of the normal pattern of actual land use.

310. The barangays traversed by the project direct impact areas (DIAs) and sensitive receptors located near the project alignment are presented in **Table 4.4.6**.

Table 4.4.6 Locations of Sensitive Receptors and Distance from ROW

Key	Name	Type	Coordinates	Barangay	Approximate Distance from ROW (km)
1	Vineyard Christian Fellowship	Church/Place of Worship	120°58'42.283"E 14°37'14.806"N	Barangay 223	0.32
2	194 Barangay Hall (Manila)	Institutional	120°58'44.054"E 14°38'5.746"N	Barangay 194	0.37
3	Amisola Maternity Hospital	Hospital	120°58'41.355"E 14°37'57.987"N	Barangay 202	0.20
4	St. Joseph the Worker Parish Church	Church/Place of Worship	120°58'42.03"E 14°37'52.673"N	Barangay 201	0.24
5	Gagalangin Fire Station	Fire Station	120°58'23.644"E 14°37'28.047"N	Barangay 163	0.24
6	Florentino Torres High School	School/Academe	120°58'21.873"E 14°37'38.252"N	Barangay 174	0.30
7	Lakandula High School	School/Academe	120°58'23.56"E 14°37'29.565"N	Barangay 163	0.23
8	Immaculate Conception Parish	Church/Place of Worship	120°58'32.078"E 14°37'2.324"N	Barangay 233	0.21
9	Manila Cathedral School	School/Academe	120°58'30.223"E 14°37'2.493"N	Barangay 232	0.18
10	Patricia ('PARAISO') Complex	Green Space	120°58'27.187"E 14°38'2.541"N	Barangay 177	0.27
11	Basketball Court	Green Space	120°58'32.668"E 14°38'5.661"N	Barangay 184	0.25
12	216 Barangay Hall	Institutional	120°58'39.879"E 14°37'27.914"N	Barangay 216	0.16
13	213 Barangay Hall	Institutional	120°58'35.168"E 14°37'28.021"N	Barangay 213	0.48
14	St Joseph Gagalangin Parish	Church/Place of Worship	120°58'24.488"E 14°37'45.252"N	Barangay 179	0.26
15	Dr. Jose P Rizal Elementary School	School/Academe	120°58'18.078"E 14°37'2.324"N	Barangay 55	0.34
16	TESDA Tayuman	School/Academe	120°58'28.283"E 14°37'4.264"N	Barangay 232	0.11

4.4.2.2 Survey Methodology

(1) Sampling Site Selection

311. The ambient air quality sampling stations were selected with reference to the DENR-EMB Air Quality Monitoring Manual (1994) and the Australia and New Zealand Standard Methods for Sampling and Analysis of Ambient Air, Part 1.1: Guide to siting air monitoring equipment (AS/NZS 3580.1.1:2016). The area surrounding the SBT Section project site are mostly high-density residential areas. In the selection of a particular site, it is essential that the sampling stations be located on an area so as to yield data which are representative of the location.

312. Guidance in determining sampling site locations provided in Section 2.2 of the *DENR-EMB Ambient Air Quality Monitoring Manual (1994)* state that the:

- site must be located in a populated area;
- sites must be located downwind of the major emission sources; and
- samples intake must be exposed to the pollutants in an open area.

313. In addition to these, Section 2.2.1 of the *DENR-EMB Air Quality Monitoring Manual (1994)* provides guidance on site selection such as accessibility, availability of power, instrument security, and relationship to possible interfering pollutant factors.

314. Guidance provided in Section 7 of *AS/NZS 2580.1.1:2016* for the determination of the sampling sites include the following:

- that have restricted airflows in the vicinity of the sampling inlet, such as sites directly adjacent to trees, buildings, walls, etc. As a general rule, the sampling inlet should be located away from a nearby structure to the extent that the sampling inlet has a minimum clear sky angle of 120°. However, this rule is not always applicable, i.e. in monitoring stations located in a heavily urbanized area such as the project site. The proposed sampling stations are located in the areas where the clear sky angle can be achieved; and
- which are adjacent to objects which may alter pollutant concentrations by adsorption or absorption such as those near some building surfaces or near leafy vegetation.

315. The sampling stations should be located in:

- areas that are secure and have low potential for vandalism;
- have adequate access for transporting equipment;
- have adequate and reliable electricity supply;
- where sound levels generated by sampling equipment do not impose on the local residents/population. The station location should be selected in order to minimize the impact on the general activities of local population and should not be restrictive on the intended usage of the location, i.e. in a sidewalk or side street, ensure that the monitoring equipment does not restrict normal activities; and
- where personnel will be able to perform their activities in a safe and secure environment in accordance with HSE requirements. Assess exposure to traffic, heat, weather, and other hazards including COVID-19 health risks.

(2) Sampling Methodology

316. The ambient air quality monitoring parameters that were sampled as part of this assessment and their corresponding methods of sampling and analyses are summarized in **Table 4.4.7**.

Table 4.4.7 Ambient Air Quality Parameters and Methods of Sampling and Analysis

Parameters	Air Sampling and Analytical Procedures	Reference Methodology
TSP	High Volume - Gravimetric	USEPA 40 CFR Part 50, App B
PM ₁₀	High Volume with PM ₁₀ Inlet - Gravimetric	USEPA 40 CFR Part 50, App J
PM _{2.5}	High Volume with PM _{2.5} Inlet - Gravimetric	USEPA 40 CFR Part 50, App L
SO ₂	Gas Bubbler - Colorimetric Pararosaniline	USEPA 40 CFR Part 50, App A
NO ₂	Gas Bubbler - Griess Saltzman Reaction	USEPA 40 CFR Part 50, App F
CO	Non-Dispersive Infrared Photometry (NDIR)	USEPA 40 CFR Part 50, App C
Pb	High Volume – Inductively Coupled Plasma Spectroscopy (ICP-MS)	USEPA 40 CFR Part 50, App G
O ₃	Gas Bubbler - Spectrophotometrical	Method 411, Methods of Air Sampling and Analysis, Lodge

1) Particulate Matter

317. Measurement of particulate matter (TSP, PM₁₀, and PM_{2.5}) in the air is likely the oldest form of air quality sampling (Wight, 1994). High-volume samplers, PM₁₀, and PM_{2.5} samplers all employ filtration sampling and require flow monitoring and sampler air volume measurement. The basic applications of filtration method to particulate air sampling are discussed below.

318. TSP were collected from the air using a high-volume sampler. The “high-vol” sampler, which utilizes a high flow rate vacuum pump driven by an electric motor, draws a large, accurately known volume of air over a known time period through a glass-filter paper (Wight, 1994). The mass of the collected particulates was determined by the difference in filter weights prior to and after sampling. The concentration of TSP is calculated by dividing the weight gain of the glass-filter paper by the volume of air sampled (Robson & Foster, 1962; Olin & Kurz, 1975).

319. The flow diagram of the routine operating procedure of particulate matter sampling is as follows. The glass-filter papers used in the collection were pre-assigned with specific ID numbers and were dried for 48 hours and pre-weighed prior to the sampling activity. The filters were separately placed between two clean lint-free papers and stored in manila envelopes to minimize contamination. During field sampling, the filters were secured and installed in the high-volume sampler and the flow rate was adjusted to 1.10 m³/min. Sampling conditions such as the sampling date, elapsed time, initial flow rate, atmospheric pressure, meteorological conditions, relative humidity, and ambient temperature were also noted. After sampling, the filters which contained the samples were retrieved, folded lengthwise with the exposed side inward, and were inserted in their respective containers.

320. Coarse particles (particulate matter with < 10 µm in aerodynamic diameter (PM₁₀)) and fine particulates (particulate matter with < 2.5 µm in aerodynamic diameter (PM_{2.5})) were collected using PM₁₀ and PM_{2.5} samplers, respectively. The PM₁₀ and PM_{2.5} samplers function basically the same fashion as high-volume samplers and requires the same or more care in flow rate and volume measurement, but modified to remove the larger particles before the air reaches the filter through variously designed impaction or settling chamber inlets (Wight, 1994). Sampling protocols, including handling procedures and QA/QC protocols are the same with TSP sampling.

321. Pb is extracted from the TSP samples using the methodologies described in US EPA 40 CFR Appendix G to Part 50. The concentrations of Pb were analyzed using Inductively Coupled Plasma Spectroscopy (ICP-MS).

2) Gaseous Pollutants

322. Gas-liquid absorption is the technique used for nearly all gaseous pollutant sampling (Wight, 1994). Absorption of air pollutants in a liquid and later analysis is still the reference method approved by DENR for NO₂ and SO₂. Using an SKC Handy Gas Sampler, air was continuously impinged and bubbled into absorbing solutions inside midjet impinger tubes with frits.

323. NO₂ is absorbed in azo dye forming reagent (Saltzman, 1954) while SO₂ is absorbed in a solution of 0.7 M potassium tetrachloromercurate (TCM) (Dasgupta & DeCesare, 1982). The impingers containing the azo dye forming reagent and 0.7 M TCM were partially submerged in an improvised ice bath to maintain good absorption and prevent the solutions from degrading.

324. The gas sampler flow rate was adjusted to 0.4 L/min for NO₂ and SO₂. After sampling, the absorbing solutions were carefully transferred to their containers and stored in ice coolers for preservation. Samples were sent to the laboratory for analysis. The absorbance of the samples was measured and compared with standard absorbance curves of NO₂ and SO₂. Concentrations of NO₂ and SO₂ were determined by taking the ratio of the total mass analyzed to the total volume of air sampled.

325. Measurements of CO in ambient air are based on automated measurement of the absorption of infrared radiation by CO in an ambient air sample drawn into an analyzer employing non-wavelength-dispersive, infrared photometry (NDIR method).

326. Like SO₂ and NO₂ sampling, O₃ was impinged in midjet impinger tubes with 1.0% solution of potassium iodide. O₃ liberates iodine from the solution and is determined spectrophotometrically by measuring the absorption of triiodide at 352 nm.

4.4.2.3 Sampling Site

327. Ambient air quality monitoring was conducted from 17 to 19 November 2020 at two locations approximately 25 m and 13 m from the project site, and was performed with reference to the methodologies outlined under DAO 2000-81, *Implementing Rules and Regulations of the Philippine Clean Air Act of 1999* and DAO 2020-14, *Establishing the Breakpoints for Particulate Matter 2.5 (PM_{2.5}) Air Quality Index (AQI) and Amending Section 5(a) of DAO 2013-13 “Establishing the Provisional National Ambient Air Quality Guideline Values for Particulate Matter 2.5 (PM_{2.5})”*. The sampling stations were located in residential areas (the most sensitive receptors for the Project) and were selected based on their site suitability as discussed above (**Table 4.4.8**, **Figure 4.4.6**, and **Figure 4.4.7**).

Table 4.4.8 Ambient Air Quality Monitoring Stations

Station Name	Barangay	City	Coordinates
AQ1	Barangay 185	Tondo I/II – City of Manila	14.628786 N 120.975485 E
AQ2	Barangay 218	Tondo I/II – City of Manila	14.621882 N 120.975104 E

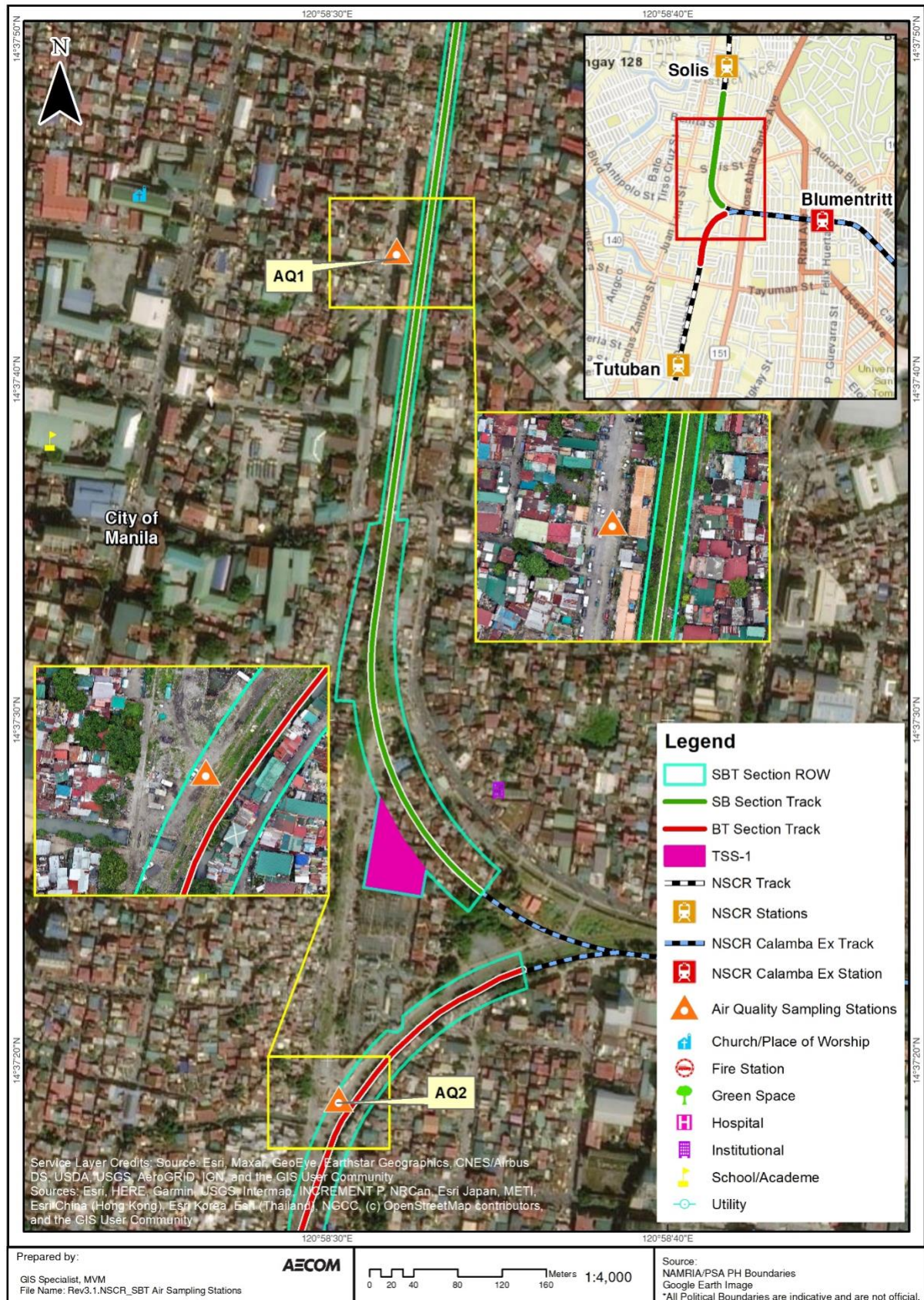


Figure 4.4.6 Ambient Air Quality Monitoring Stations

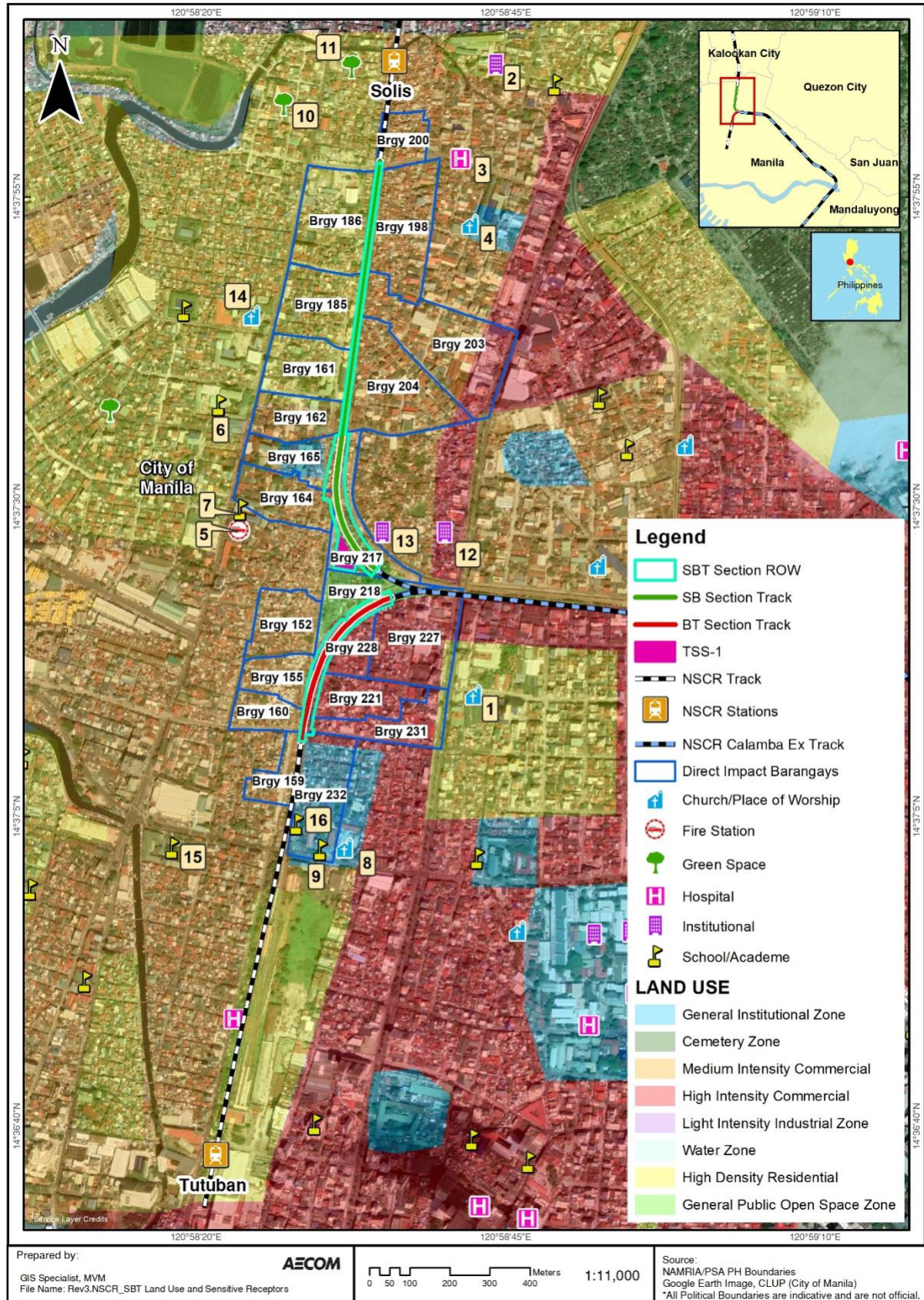


Figure 4.4.7 Land Use Map of the Project Site including locations of Sensitive Receptors



Plate 4.4.1 Station AQ1 (Barangay 185, Tondo, Manila) (Left Photo); Station AQ2 (Barangay 218, Tondo, Manila) (Right Photo)

4.4.2.4 Data Assessment

328. Ambient air quality sampling results were compared with the National Ambient Air Quality Guideline Values (NAAQGV) of the DAO 2000-81, the IRR of the Clean Air Act (CAA). The 24-hour readings were compared with the NAAQGV of the CAA. The NAAQGV are typically used during the baseline studies to assess the air quality of an air shed or a region/locale prior to the implementation of the Project. The PM_{2.5} results were compared to the DAO 2020-14 PM_{2.5} standard. Existing air quality conditions were classified using the air quality indices specified in DAO No. 2000-81 and DAO 2020-14 (Chapter 3).

4.4.2.5 Survey Results

329. The results of the ambient air quality monitoring for Stations AQ1 and AQ2 are presented in **Table 4.4.9** and **Table 4.4.10**. The laboratory certificates of analyses are attached as Annex D-8. In general, all particulate and gaseous pollutants monitored were below their respective NAAQS and NAAQGV except for PM_{2.5} and O₃. The major source of these pollutants is vehicular traffic which is heavy in the area. Ground level ozone is not emitted directly into the air but is created by chemical reactions between NO_x and VOCs when pollutants emitted by vehicles react with sunlight. Based on Annex A of the DAO 2000-81 (Air Quality Indices), the air quality in the project site is considered as *acutely unhealthy*.

Table 4.4.9 Results of Ambient Air Quality Monitoring (NAAQS)

Station ID	Location	NO ₂	SO ₂	TSP	PM ₁₀	PM _{2.5}	Pb
		µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm
AQ1	Barangay 185, Tondo Manila	< 7.24	< 24.9	78.7	51.7	30.2	< 0.00814
AQ2	Barangay 218, Tondo, Manila	13.7	< 24.9	118	71.4	52.4	< 0.00814
DAO 2000-81 NAAQS		260	260	340	300	200	-
Averaging Time		1 hour	1 hour	1 hour	1 hour	1 hour	30 minutes

Table 4.4.10 Results of Ambient Air Quality Monitoring (NAAQGV)

Station ID	Location	NO ₂	SO ₂	TSP	PM ₁₀	PM _{2.5}	Lead	CO	O ₃	
		µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	ppm	ppm	
AQ1	Barangay 185, Tondo, Manila	< 3.02	< 10.3	61.2	44.7	42.7	< 0.00034	< 1	0.10	0.01
AQ2	Barangay 218, Tondo, Manila	< 3.02	< 10.3	89.1	56.7	5.4	0.00131	< 1	0.28	0.02

Station ID	Location	NO ₂	SO ₂	TSP	PM ₁₀	PM _{2.5}	Lead	CO	O ₃	
		µg/Nc m	µg/Nc m	µg/Nc m	µg/Nc m	µg/Nc m	µg/Ncm	ppm	ppm	
DAO 2000-81 NAAQGV		150	180	230	150	-	1.5	30	0.07	-
DAO 2020-14		-	-	-	-	35	-	-	-	-
Averaging Time		24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	1 hour	1 hour	24 hours

Note: orange highlights are parameters with exceedance/s with respect to DAO 2000-81 / DAO 2020-14 guideline values

(1) Particulate Matter

330. Particulate matter (TSP, PM₁₀, and PM_{2.5}) is composed of solid and liquid particles in the air that are small enough to be inhaled. Natural sources of these include sea salt, dust (such as airborne soil), and pollen, but it also includes material from volcanic eruptions and particles formed from natural gaseous precursors. However, in the project site, particulate matter is mainly emitted in the air as a direct result of the combustion process in vehicles. The project site is in a highly urbanized area with heavy traffic flows which generate large amounts of particulate matter.

331. TSP represent a complex mixture of organic and inorganic substances (European Environment Agency, 2016), covering a wide range of diameters, from < 0.1 µm to 100 µm. The mass and composition of TSP is divided into two principal groups: coarse particulates (> 2.5 µm in aerodynamic diameter) and fine particulates (< 2.5 µm in aerodynamic diameter). Fine particles contain secondarily formed aerosols (gas to particle conversion), combustion particles, and re-condensed organic and metal vapors, while the larger particles usually contain crystal materials and fugitive dusts from roads and industries. TSP is removed from the atmosphere by dry and wet deposition.

332. For TSP, the 1-hour concentrations were 78.7 µg/NCM in Station AQ1 and 118 µg/NCM in Station AQ2. For the 24-hour monitoring, the TSP concentrations were 61.2 µg/NCM and 89.1 µg/NCM in Stations AQ1 and AQ2, respectively. These values are within the DAO 2000-81 NAAQS (300 µg/NCM) and NAAQGV (230 µg/NCM).

333. The 1-hour PM₁₀ concentrations were 51.7 µg/NCM and 71.4 µg/NCM in Stations AQ1 and AQ2, respectively. For the 24-hour monitoring, the PM₁₀ concentrations were 44.7 µg/NCM in Station AQ1 and 56.7 µg/NCM in Station AQ2. These values are within the DAO 2000-81 NAAQS (200 µg/NCM) and NAAQGV (150 µg/NCM).

334. For the 1-hour PM_{2.5} concentrations were 30.2 µg/NCM in Station AQ1 and 52.4 µg/NCM in Station AQ2. For the 24-hour monitoring, PM_{2.5} concentrations were 42.7 µg/NCM and 53.4 µg/NCM in Stations AQ1 and AQ2, respectively. The concentrations of PM_{2.5} for the 24-hour monitoring exceeded the DAO 2020-14 guideline value (35 µg/NCM). Based on the AQI in DAO 2020-14, AQ1 is characterized as unhealthy for sensitive groups while AQ2 is very unhealthy. There are no standards for 1-hour PM_{2.5} under the DAO 2000-81 or DAO 2020-14.

335. Pb concentrations were undetected (< 0.00814 µg/NCM) for the 30-minute monitoring in Stations AQ1 and AQ2 and are within the DAO 2000-81 NAAQS (< 20 µg/NCM). For the 24-hour monitoring, the Pb concentration in Station AQ1 was below the detection limit (< 0.00034 µg/NCM). In Station AQ2, the 24-hour Pb concentration was 0.00131 µg/NCM. There are no guideline values set for Pb under the DAO 2000-81 NAAQGV.

(2) Gaseous Pollutants

336. NO₂ is mainly formed from oxidation of nitric oxide (NO) emitted in the process of combustion. Apart from its impacts to the human respiratory system, NO₂ can also be oxidized in the air to form nitrate, which has significant impact on the levels of particulate matter, acid rain, and visibility. The 1-hour concentrations of NO₂ in Stations AQ1 and AQ2 were below the detection limit (< 3.02 µg/NCM)

and 13.7 µg/NCM, respectively. For the 24-hour monitoring, the NO₂ concentrations in both monitoring stations were below the detection limit (< 3.02 µg/NCM). These values are within the DAO 2000-81 NAAQS (260 µg/NCM) and NAAQGV (150 µg/NCM).

337. SO₂ is generated mainly from the combustion of sulfur-containing fossil fuel. Apart from its impact on the human respiratory system, SO₂ can also oxidize in the air to form sulfate, which has a significant impact on the concentrations of particulate matter (TSP, PM₁₀, and PM_{2.5}), acid rain, and visibility in the area. The concentrations of SO₂ were below the detection limit for both 1-hour (< 24.9 µg/NCM) and 24-hour (< 10.3 µg/NCM) in both monitoring stations. These are below the DAO 2000-81 NAAQS (340 µg/NCM) and NAAQGV (180 µg/NCM).

338. In urban areas, the most common sources of CO are vehicle exhausts (Cunnington and Hombrey, 2002). However, the concentrations of CO were both undetected in Stations AQ1 and AQ2 and are within the DAO 2000-81 NAAQGV (30 ppm).

339. The 1-hour O₃ concentrations were 201 µg/NCM and 552 µg/NCM in Stations AQ1 and AQ2, respectively. These values exceed the DAO 2000-81 NAAQGV (140 µg/NCM). For the 24-hour O₃ monitoring, the concentrations were 27.6 µg/NCM in Station AQ1 and 38.5 µg/NCM in Station AQ2. There are no guideline values set for O₃ under the DAO 2000-81. Ground level O₃ is not emitted directly into the air but is created by chemical reactions between NO_x and VOCs when pollutants emitted by vehicles react with sunlight (US EPA, 2021). In terms of O₃, the air quality in the area is *acutely unhealthy* based on the DAO 2000-81 Air Quality Indices (Annex A of the DAO 2000-81).

4.4.3 Noise

340. Baseline noise monitoring was conducted to establish typical sound levels at representative locations within the project site and to identify existing sources of environmental noise as the PEISS also requires the overall baseline characterization of the existing environmental quality. Noise levels are also predicted during construction and operation and significant impacts are discussed in Chapter 5.

4.4.3.1 Scope of Study

(1) Study Area

341. The Project ROW including the area extending 200 m from the centerline of the ROW was considered appropriate for assessing noise impacts for the works described in the project description as the area encompasses the closest noise sensitive receptors either side of the rail alignment ROW.

(2) Assessment Criteria

1) Baseline Noise Criteria

342. The measured noise levels were compared to “Environmental Quality Standards for Noise in General Areas, Section 78. Ambient Noise Quality and Emission Standards for Noise, National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980 (NPCC MC 1980-002, 1980)” (Table 4.4.11), “Environmental Quality Standards for Noise, Environment Agency Notification No. 64, Ministry of the Environment, Government of Japan (Japan Environment Agency Notification 64, 1998)” (Table 4.4.12), and “Noise Level Guidelines, Section 1.7. Noise, Environmental, Health, and Safety (EHS) Guidelines, World Bank Group (WBG) / International Finance Corporation (IFC) (WBG EHS Guidelines, 2007)” (Table 4.4.13).

Table 4.4.11 NPCC Environmental Quality Standards for Noise in General Areas

Class	Maximum Allowable Noise Level (dBA)		
	Daytime (9AM - 6PM)	Morning (5AM-9AM)/ Evening (6PM – 10PM)	Nighttime (10PM – 5AM)
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

Note:

- AA - a section or contiguous area which requires quietness, such areas within 100m from school sites, nursery schools, hospitals and special homes for the aged.
- A - a section or contiguous areas which is primarily used for residential purposes
- B - a section or contiguous areas which is primarily a commercial area
- C - a section primarily reserved as light industrial area
- D - a section which is primarily reserved as heavy industrial area

Source: NPCC MC 1980-002, 1980

Table 4.4.12 Japan Environmental Quality Standard for Noise

Class	A-weight effective sound power level (dB)	
	Day (6:00 – 22:00)	Night (22:00 –6:00)
AA	50	40
A	55	45
B	55	45
C	60	50

Note:

- AA - areas requiring particular quietness, such as healthcare facilities
- A - areas used exclusively for residences
- B - areas used mainly for residences
- C - areas used for commerce and industry as well as for a significant number of residences.

Source: Japan Environment Agency Notification 64, 1998

Table 4.4.13 WBG-IFC Noise Level Guidelines

Receptor	One Hour LA _{eq} (dBA) ¹	
	Daytime 0700H – 2200H	Nighttime 2200H – 0700H
Residential; institutional; educational ²	55	45
Industrial; commercial	70	70

Note:

1. Guideline values are for noise levels measured out of doors.
2. For acceptable indoor noise levels for residential, institutional and educational settings refer to World Health Organization (WHO) (1999).

Source: WBG EHS Guidelines, 2007

2) Construction Noise Criteria

343. The prediction noise levels are compared to “Noise Standards for Construction Activities, Section 78. Ambient Noise Quality and Emission Standards for Noise, NPCC Memorandum Circular No. 002 Series of 1980 (NPCC MC 1980-002, 1980)” (**Table 4.4.14**), “Standards for the Regulation of Noise Generated by Specific Construction Work, Appendix II, Cabinet Order (CO) for Implementation of the Noise Regulation Law of the Ministry of the Environment, Government of Japan (Japan Noise Regulation Law, 2000)” (**Table 4.4.15**), and “Noise Level Guidelines, Section 1.7. Noise, EHS Guidelines of the WBG / IFC (WBG EHS Guidelines, 2007)(**Table 4.4.16**).

344. Of the abovementioned standards, WBG Noise Level Guidelines states that, “noise impacts should not exceed the result in a maximum increase in background levels of 3dB at the nearest receptor location off-site”. Based on the ambient noise levels around residential area of approximately 72 dB in daytime and 63 dB in night time, the WBG Noise Guidelines for daytime (55 dB) and nighttime (45dB)

are exceeded. Therefore, in compliance with WBG, the noise standard value is set at 75 dB in daytime and 66 dB in nighttime.

Table 4.4.14 NPCC Noise Standards for Construction Activities

Class	Maximum Allowable Noise Level (dBA)	Permit working time slice
Class 1	90	7 AM – 7 PM
Class 2	85	7 AM – 7 PM
Class 3	75	7 AM – 9 PM
Class 4	75	7 AM – 9 PM

Note:

Class 1 - work which requires pile drivers (excluding manual type), pile extractors, reveting hammers or combination thereof. This class 1 fication does not include work in which pile drivers are used in combination with earth augers.

Class 2 - Work which requires rock drills, or similar equipment like jack hammers or pavement breakers.

Class 3 - Work which requires air compressor (limited to those compressores which use power other than electric motors with a rated output of 15 kW or more). Air compressors powering rock drills, jack hammers, pavement breakers are excluded.

Class 4 – operation involving batching plant (limited to those with amixer capacity of 0.5 or more cubic meters) and/or asphalt plants (limited to those with mixer capacity of 200 kg or more), batching plants for the making of mortar are excluded.

Source: NPCC MC 1980-002, 1980

Table 4.4.15 Japan Standards for the Regulation of Noise Generated by Specific Construction Work

Class ¹	Upper end value of 90% range(dB)	Working hours per day ²
Class 1	85	10 hours (7 AM – 7 PM)
Class 2		14 hours (6 AM – 10 PM)

Note:

1) Class 1 - 80 meters around the perimeter of the library and nursing home. Class 2 - Areas outside Class 1.

2) The number of working days shall not exceed six consecutive days. The working days shall be days other than holidays and national holidays.

Source: Japan Noise Regulation Law, 2000

Table 4.4.16 WBG Noise Level Guidelines

Receptor	One Hour LA _{eq} (dBA) ^a	
	Daytime 0700H – 2200H	Nighttime 2200H – 0700H
Residential; institutional; educational ^b	55 (75)	45 (65)
Industrial; commercial	70	70

Note:

^a Guideline values are for noise levels measured out of doors.

^b Noise impacts should not exceed the levels presented in above table, or result in a maximum increase in background levels of 3dB at the nearest receptor location off-site. The values in parentheses are used for this assessment.

Source: WBG EHS Guidelines, 2007

3) Operational Noise Criteria

345. The predicted operation noise levels were compared to “Noise Guideline Values for New Project and Large-Scale Modification of the Conventional Railway in Japan of the Environmental Agency of Japan” (Japan Environmental Agency Noise Guideline Values, 1995) and “Noise Level Guidelines, Section 1.7. Noise, EHS Guidelines of the WBG / IFC” (WBG EHS Guidelines, 2007).

346. Of the abovementioned standards, WBG Noise Level Guidelines states that, “noise impacts should not exceed the result in a maximum increase in background levels of 3dB at the nearest receptor location off-site”. Based on the ambient noise levels around residential area of approximately 72 dB in daytime and 63 dB in night time, the WBG Noise Guidelines for daytime (55 dB) and nighttime (45dB) are exceeded. Therefore, in compliance with WBG, the noise standard value is set at 75 dB in daytime and 66 dB in nighttime.

347. It notes that the Japan Environmental Agency Noise Guideline Values assesses operation noise at a distance of 12.5 m from the center of the nearest track not at a distance from the edge of the ROW.

Table 4.4.17 Japan Noise Guideline Values for New Project and Large-Scale Modification

Project	One Hour LA _{eq} (dBA) ¹	
	Day 7:00 - 22:00	Night 22:00 - 07:00
New project	60	55
large-scale modification	Improving the noise level situation from that before the improvement.	

Note: The guideline values are used to further reduce the noise in areas where the residential environments should be protected, such as exclusive residential area. The assessment point is the horizontal distance 12.5 m from near track centerline.

Source: Japan Environmental Agency Noise Guideline Values, 1995

Table 4.4.18 WBG Noise Level Guidelines

Receptor	One Hour LA _{eq} (dBA) ¹	
	Daytime 0700H – 2200H	Nighttime 2200H – 0700H
Residential; institutional; educational ²	55 (75)	45 (65)
Industrial; commercial	70	70

1) Guideline values are for noise levels measured out of doors.

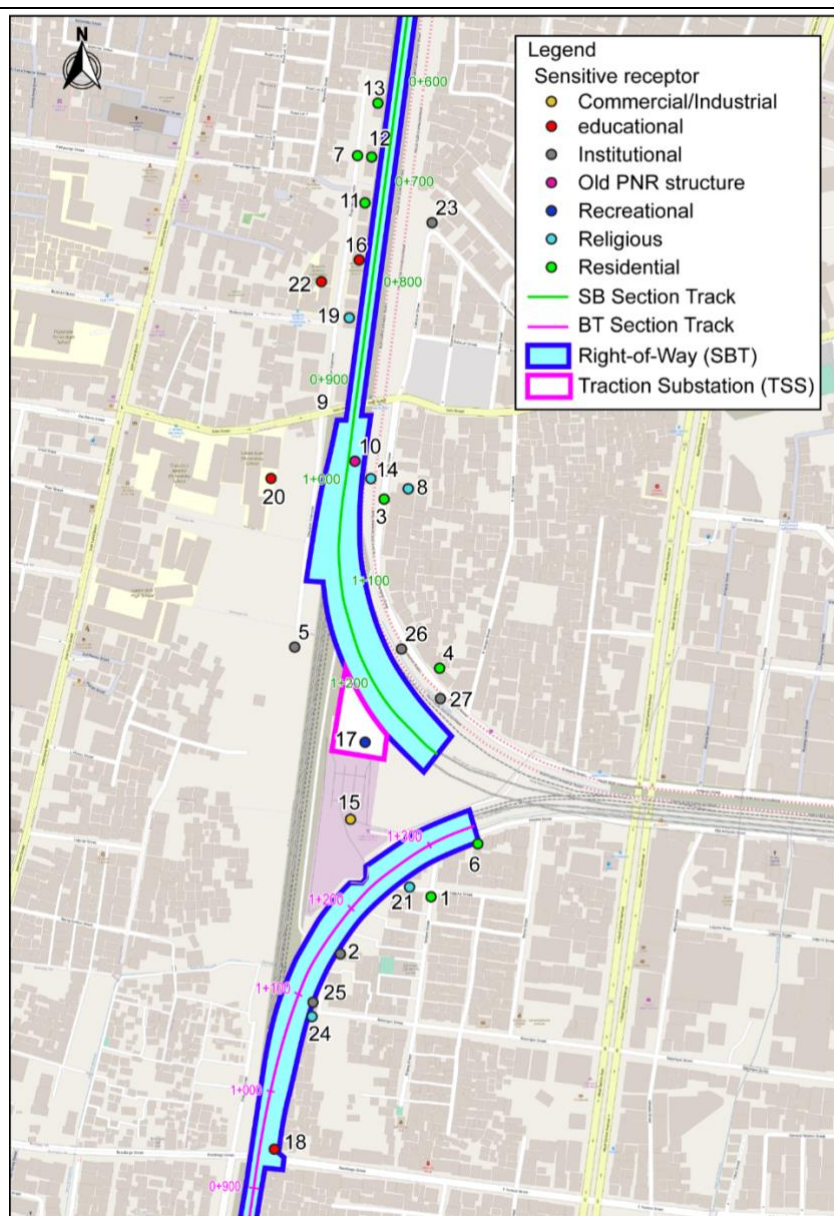
2) Noise impacts should not exceed the levels presented in above table, or result in a maximum increase in background levels of 3dB at the nearest receptor location off-site. The values in parentheses are used for this assessment.

Source: WBG EHS Guidelines, 2007

(3) Noise Sensitive Receptors

348. The sensitive receptors identified within 50 m from the edge of the ROW of the project site include residential areas/buildings, schools, health facilities (hospitals/clinics), religious and government institutions as shown in **Figure 4.4.8**.

No.	Location	Land Use Type
1	Molave St. 3124	Residential
2	Barangay 228 Hall	Institutional
3	Antipolo St 945	Residential
4	Antipolo St (King of Glory Christian Family Church)	Residential, Institutional
5	Our Lady of Lourdes, Dagupan Ext	Residential/ Institutional
6	Old Antipolo St 1124	Residential
7	Dagupan Ext	Residential
8	Tondo Christian Church	Religious
9	Solis-Dagupan Basketball Court	Recreational
10	Solis Signal Tower (Casitas de Tondo)	Historical (Old PNR Structure)
11	NHA MRB Dagupan Ext. (Bldg 6)	Residential
12	NHA MRB Dagupan Ext. (Bldg 5)	Residential
13	NHA MRB Dagupan Ext. (Bldg 4)	Residential
14	New Antipolo Chapel	Religious
15	MERALCO Power Grid Station	Commercial/ Industrial
16	Melchora Aquino Elementary School (near existing PNR)	Educational
17	Maria Guizon Basketball Court	Recreational
18	Manila Day Care Center	Educational
19	Light of the World Christian Church	Religious
20	Lakan Dula Elementary School	Educational
21	Harvester's Christian Fellowship Tondo Church	Religious
22	Gregoria de Jesus Elementary School (other side of the road)	Educational
23	Barangay 204 Hall	Institutional
24	Batangas Dulo Chapel	Religious
25	Barangay 228 Carlo Lopez Multi-Purpose Hall	Institutional
26	Barangay 217 Hall	Institutional
27	Barangay 213 Hall	Institutional



Note: No. 9, 14 and 26 have already been demolished or have different buildings as of October 2022.

Source: JICA Design Team

Figure 4.4.8 Distribution of Sensitive Receptors

4.4.3.2 Baseline Assessment

(1) Sampling Methodology

1) Survey Design

349. An EXTECH Model SDL600 (Class 2) digital sound level meter was deployed at the noise monitoring sites. Class 2 noise monitors (loggers) are considered acceptable for measuring ambient noise levels in accordance with international guidelines. All sound level meters were field-calibrated using an acoustic calibrator both before and after noise measurements to monitor drifts in calibration. No drifts in excess of 0.5 dBA were noted throughout the monitoring exercise. The microphone was placed at approximately 1.2 meters above the ground and at least 3.5 meters from all reflecting surfaces including building walls, sheds, solid fences etc. (i.e. in the free-field). Each noise monitor was checked

in the field for calibration with a hand-held calibrator at the start and completion of the monitoring period. No significant drifts in calibration occurred between the pre- and post-monitoring field checks.

350. Existing sound levels were measured and reported with reference to the equivalent sound pressure level, L_{Aeq} . The L_{Aeq} reflects all noise occurring during the measurement period and is commonly referred to as the ambient noise level. It approximately equates to the average level for many typical environmental noise scenarios. L_{Aeq} is typically used to quantify industrial noise and to assess environmental noise impacts.

2) Sampling Location

351. Suitable monitoring locations were identified in areas where sensitive receptors could be affected by construction and operational activities associated with the Project. Available aerial images of the area, site investigations, and engagement with key stakeholders and the community were used to refine and prioritize the locations.

352. All monitoring sites were located in areas that are primarily used for residential purposes as they are considered representative of typical sensitive receiver locations adjacent to the project alignment. Ambient noise monitoring was undertaken at two locations in the project area from the 17 to 19 November 2020 (N1 and N2). N1 sampling station was located in Barangay 185 as high-density residential buildings are immediately adjacent to the proposed SBT Section where existing railways still operate at the time of baseline monitoring and therefore at the highest risk of being impacted by noise throughout the Project. N2 sampling station was located in Barangay 228 near residential areas adjacent to the existing train tracks. Additional noise measurement was undertaken from 22 to 23 March 2021 near the proposed substation location (TSS-1) to capture typical noise levels close to the railway line and at closest sensitive receptors in Barangay 164 and Barangay 217 which are identified as barangays to be most affected by TSS-1 activities. The results measured have also been supplemented by previous works in NSCR Calamba Ex Project from 27 January to 27 March 2018 (Station 1). As such, ambient background levels measured at the locations have been used to approximate the noise environment and to develop appropriate criteria for these locations where relevant.

353. **Table 4.4.19** and **Figure 4.4.9** provides a summary of the noise, and vibration measurement locations in context of the surrounding area. Photos of the noise monitoring locations are presented in **Plate 4.4.2**.

Table 4.4.19 Noise Monitoring Locations

Station Name	Description	Barangay	District/ City	Coordinates	Sampling Date
N1	The location featured a small road in a community which is adjacent to the PNR railway system.	185	Tondo I/II – City of Manila	14.628786 N, 120.975485 E	17-18 November 2020
N2	The location was situated approximately 10 m from the PNR railroad tracks and near a large community of residential receptors.	228	Tondo I/II – City of Manila	14.621882 N, 120.975104 E	18-19 November 2020
TSS-1	The location was situated within the existing PNR railroad ROW. This location has been earmarked for a future substation building.	217	Tondo I/II – City of Manila	14.624843 N, 120.975409 E	22-23 March 2021
Station 1*	The location is adjacent to N1 and located within 25 meters of Gregoria de Jesus Elementary School.	204	Tondo I/II – City of Manila	14.628381 N, 120.975800 E	27 January-27 March 2018

Note: *Station 1 was noise monitoring conducted for NSCR Calamba Ex Project.

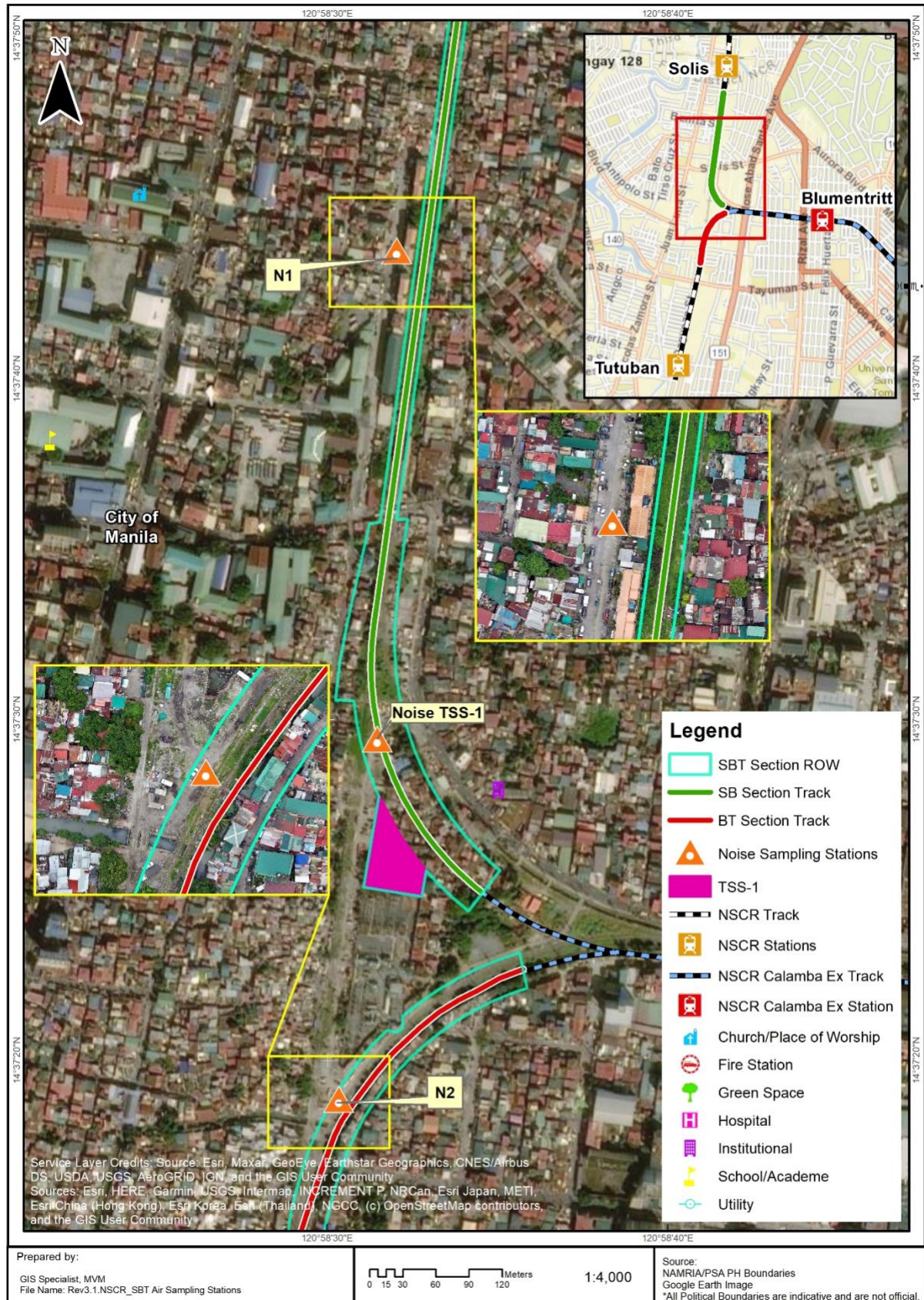


Figure 4.4.9 Noise Monitoring Stations



Station N1 (Left Photo); Station N2 (Right Photo)



Station N1 (Left Photo); Station N2 (Right Photo)



Ambient Noise Station TSS-1

Plate 4.4.2 Ambient Noise Level Monitoring Stations

3) Data Assessment

354. Regular five-minute ambient sound pressure levels ($L_{A(5-min)}$, dB) were collected at each noise monitoring location. The equivalent sound levels for one-hour durations, $L_{Aeq(1h)}$, were calculated from

the logarithmic average of twelve five-minute measurements and were compared with the relevant criteria for each time period. The minimum, maximum and average values of $L_{Aeq(1h)}$ for each specific time periods were calculated and compared with NPCC MC 1980-002, WBG-EHS Guidelines and Japanese Guidelines.

(2) Results and Discussion

355. The result of ambient noise level sampling in **Table 4.4.20 - Table 4.4.22** shows that all sampling points exceeded the standards for noise. Noise levels around the project area are high. The dominant sources of noise include local residential activity and animal noises from dogs and birds. Traffic noise was also identified as a significant source at SBT Section. Hourly train passby events on the existing railway line were also included in the measurements.

Table 4.4.20 Comparison of Noise Survey Results with National Standard (NPCC Noise Standards)

Sampling Time	Derived hourly ambient sound pressure levels (LAeq(1h), dB)			NPCC Guideline (dBA)		noise sources
	Minimum	Maximum	Average ^a	Area Category ^b	Criteria	
Station N1						
09:00-18:00 (Daytime)	64	75	71	A	55	predominantly from light vehicles, domestic noise, animals, and train pass-bys. The traffic conditions were light to moderate during the measurement period.
18:00-22:00 (Evening)	69	77	73		50	
22:00–05:00 (Nighttime)	54	67	63		45	
05:00–09:00 (Morning)	61	70	66		50	
Station N2						
09:00-18:00 Daytime)	57	83	68	A	55	predominantly train pass-bys, domestic noise and animals
18:00-22:00 (Evening)	63	83	67		50	
22:00–05:00 (Nighttime)	61	69	70		45	
05:00–09:00 (Morning)	59	82	66		50	
TSS-1						
09:00-18:00 (Daytime)	57	87	80	A	55	predominantly train pass-bys, domestic noise and animals
18:00-22:00 (Evening)	52	74	65		50	
22:00–05:00 (Nighttime)	49	83	67		45	
05:00–09:00 (Morning)	56	84	75		50	

Note:

^a Colored cells in orange indicate values that exceeded the NPCC Noise Standards.

^b Environmental Quality Standards for Noise: Class A: Residential area, Class B: Commercial area.

Source: Supplemental EIA Report for the NSCR (Malolos-Tutuban) SBT Section, Vol. I: Main Report, 2022 (Revised by JICA Design Team)

Table 4.4.21 Station 01 Monitoring Results

Date	Sampling Time	Ambient sound pressure levels ($L_{Aeq,T}$, dB)	Noise Levels (dBA) WBG EHS Guidelines 2007
Jan 21, 2018	06:48 (Morning)	77	55
Jan 21, 2018	12:58 (Daytime)	64	55
Jan 20, 2018	18:58 (Evening)	66	45
Jan 21, 2018	22:58 (Nighttime)	59	45/55

Table 4.4.22 Comparison of Noise Survey Results with International Standards (Japanese and WBG-IFC Noise Standards)

Sampling Time	Ambient Sound ¹ (LAeq, dB)	Japanese Guideline (dBA)		WBG-EHS Guideline (dBA)		Noise Sources
		Area Category ²	Criteria	Area Category	Criteria	
Station N1						
06:00 - 22:00 (Day)	72	B	55	Residential; institutional; educational	55	Predominantly from light vehicles, domestic noise, animals, and train pass-bys. The traffic conditions were light to moderate during the measurement period.
22:00-6:00 (Night)	63		45		45	
Station N2						
07:00 - 22:00 (Day)	67	B	55	Residential; Industrial; commercial	55	Predominantly train pass-bys, domestic noise and animals
22:00-7:00 (Night)	70		45		45	
TSS-1						
07:00 - 22:00 (Day)	78	B	55	Residential; Industrial; commercial	55	Predominantly train pass-bys, domestic noise and animals
22:00-7:00 (Night)	67		45		45	

Note:

1. Colored cells in orange indicate values that exceeded either the Japanese Guideline or WBG-EHS Guideline. Colored cells in pink indicate values that exceeded both Japanese Guideline and WBG-EHS Guideline.

2. Environmental Quality Standards for Noise: Class B: Areas used mainly for residences, Class C: Residential, commercial, industrial.

Source: Supplemental EIA Report for the NSCR (Malolos-Tutuban) SBT Section, Vol. I: Main Report, 2022 (Revised by JICA Design Team)

4.4.3.3 Construction Noise Assessment

(1) Prediction Method

356. The prediction model developed in “ASJ Prediction Model 2007 for Construction Noise : Report from the Research Committee on Construction Noise Prediction in Acoustical Society of Japan (ASJ Prediction Model 2007 for Construction Noise, 2007)” is applied. The construction noise prediction methods can be largely classified into "the prediction method by work type" and "the prediction method by machine".

357. The prediction method by construction type is a method to predict the noise source by considering a combination of construction machineries (e.g., piling work, pavement work) as a single noise source in consideration of the work unit. This method is used to predict approximate noise when the construction plan is not yet matured and the details such as the arrangement of individual construction machines are not yet determined.

358. The prediction method by machine is a method that considers each construction machine (e.g., backhoe, roadroller) as a noise source and predicts the propagation of the noise from the machine. This method is used for the prediction at the stage when the construction plan is well-developed and the layout of individual construction machines can be set. In this report, considering the maturity of construction plans, the prediction method by work type is applied.

Prediction Model

359. The noise level at receiving points is calculated using the following formula of sound propagation.

$$L_{A,X1} = L_{A,emission} - 8 - 20 \log r + \Delta L_{cor}$$

Where, $L_{A,X1}$: Noise assessment value at the prediction point (dB)
 $L_{A,emission}$: Noise emission of sound source (dB)
 r : Distance between noise source and receiving point(m)
 ΔL_{cor} : Sum of corrections for various factors affecting propagation(dB)

$$\Delta L_{cor} = \Delta L_{dif} + \Delta L_{grand} + \Delta L_{air} + \Delta L_{etc}$$

Where, ΔL_{dif} : Corrections for attenuation caused by diffraction (dB)
 ΔL_{ground} : Corrections for ground surface effects (dB) [0]
 ΔL_{air} : Corrections for the effect of acoustic absorption of air (dB)[0]
 ΔL_{etc} : Corrections for other influencing factors (dB) [0]

360. At the propagation distance covered by this prediction method, the attenuation caused by acoustic absorption of air is almost negligible, so $\Delta L_{air} = 0$ (dB), Also, attenuation caused by the ground surface depends on the acoustic impedance of the ground surface. If the acoustic characteristics of the ground surface can't be determined in advance, the ground surface is assumed to be rigid and $\Delta L_{ground} = 0$ to avoid excessive attenuation in the calculation.

361. The diffraction corrections are calculated using the following equation based on the line path difference determined from the geometric arrangement of the sound source and prediction points.

<In case the prediction point P is not visible from the sound source S>

$$\Delta L_{dif} = \begin{cases} -10 \log_{10} \delta - 18.4 & \delta \geq 1 \\ -5 - 15.2 \sinh^{-1} \delta^{0.42} & 0 \leq \delta < 1 \end{cases}$$

<In case the prediction point P is visible from the sound source S>

$$\Delta L_{dif} = \begin{cases} -5 + 15.2 \sinh^{-1} \delta^{0.42} & 0 < \delta \leq 0.073 \\ 0 & \delta > 0.073 \end{cases}$$

Where, δ : the path difference (m) = $SO_1 + O_1P - SP$ (as shown below figure)

S : Sound source
 O_1 : Upper Diffraction point
 O_2 : Lower Diffraction point
P : Prediction point)

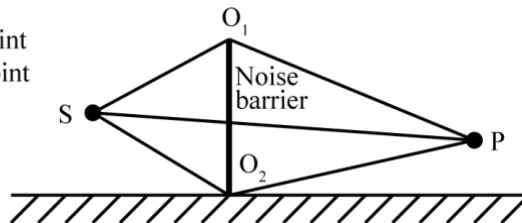


Figure 4.4.10 Path difference in diffraction correction calculation

362. Usually, at construction sites, sound barriers using sound insulating materials such as concrete panels, temporary steel plates, and soundproofing sheets will be installed to prevent the propagation of noise. However, if the sound transmission loss of the material used is not sufficient, it is necessary to consider the contribution of sound transmitted through the sound insulation material itself in addition to diffracted sound. It is calculated using the following formula and the value is treated as corrections for attenuation caused by diffraction (ΔL_{dif}).

$$\Delta L_{dif,trans} = 10 \log_{10} \left(10^{\frac{\Delta L_{dif}}{10}} + 10^{\frac{\Delta L_{dif,slit}}{10}} \cdot 10^{-\frac{R}{10}} \right)$$

Where, $\Delta L_{dif,slit}$: Diffraction corrections when from O_0 to O_1 are considered as slit apertures (dB)

R : Acoustic transmission loss (dB) (dB)

$$\Delta L_{dif,slit} = 10 \log_{10} \left| 10^{\frac{\Delta L_{dif,1}}{10}} - 10^{\frac{\Delta L_{dif,2}}{10}} \right|$$

$\Delta L_{dif,1}$: Diffraction correction with O_1 as edges.

$\Delta L_{dif,2}$: Diffraction correction with O_2 as edges.

363. Acoustic transmission loss of up to 20 dB is achieved in case of installing “general sound barrier” walls or soundproofing panels as a temporary installation, and up to 10 dB in case of installing “sound barrier sheets” in such a way that there are no gaps between them. In this report, sound barrier sheets are assumed to be set at the edge of ROW.

Prediction points

364. The construction noise is predicted at the cross-sections with the narrowest ROW width of the project site (0 + 255.855 – 0 + 950.855 in Solis - Brumentritt), as shown in **Figure 4.4.11** below. For sensitive receptors approximately located within 300 m from the edge of ROW, the prediction points are 1.2 m in height at 0, 10, 20, 30, 40, 50, 100, 200, 300 m from the edge of ROW.

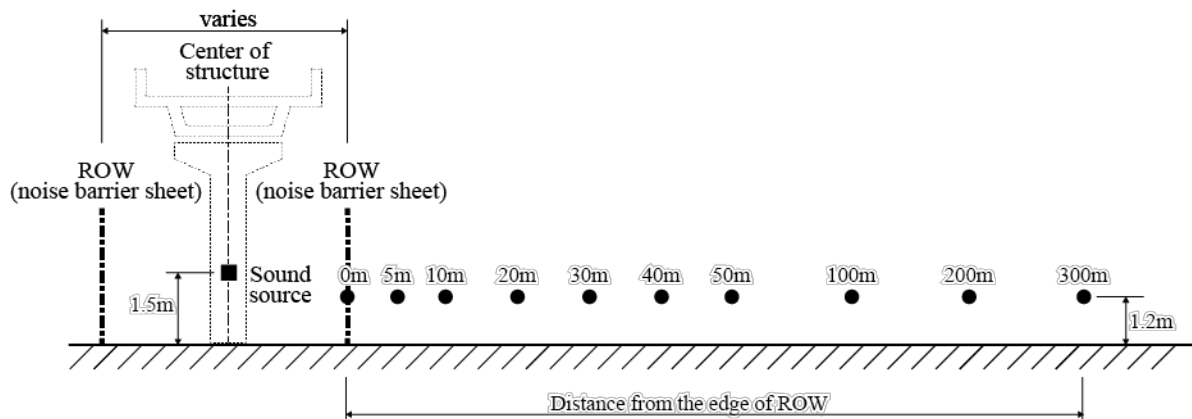


Figure 4.4.11 Prediction point of construction noise

Predictive condition

1. **Location of noise source.** The source of construction noise was set at the center of the structure where the construction equipment was expected to operate. and the height of noise source is set at 1.5 m. The noise barrier sheet (not wall) is set at the edge of the ROW.
2. **Power level of construction machinery.** In the prediction of noise at the early stage of construction planning, it is common to be able to identify the type of construction work, but not the number and arrangement of the individual construction machines to be used. For this reason, a unit consisting of a combination of multiple machinery is treated as a single noise source. The sound power levels of the unit by construction activity for this Project are shown in **Table 4.4.23**.

Table 4.4.23 Weighted Power Level of Construction Type

Work type	Unit	A-weight effective sound power level (dB)
Piling	Earth drills and so on.	106
Footing	Vibration hammer and so on.	112
Pier	Concrete works using a concrete pump vehicle and so on.	105
Cast-in-place box girder		
Erection of box girder segment	Concrete bridge erection and so on	100

Source: ASJ Prediction Model 2007 for Construction Noise, 2007.

3. **Operation hour of construction machinery.** Operation hours of construction machinery is set 24 hours.
4. **Location of prediction points.** The prediction points are 1.2 m in height at 0, 10, 20, 30, 40, 50, 100, 200, 300 m from the edge of ROW.

(2) Prediction Results

365. The results of the prediction of the construction noise are shown in **Table 4.4.24 - Table 4.4.28**. Under 2.5 m the noise barrier, the noise levels of construction activities will exceed the guideline value. Especially, footing activity at nighttime are higher than other construction activity. In other hand. In case of with 3.0 m noise barrier, the predicted noise level can meet all guideline.

Table 4.4.24 Results of Prediction of Construction Noise Level (Without Noise Barrier)

Construction Activity	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
		0	10	20	30	40	50	100	200	300			
Piling	Day	86 (81)	78 (73)	74 (69)	72 (67)	70 (65)	68 (63)	62 (57)	57 (52)	53 (48)	Class 1 85	Class 2 85	75
	Night	86 (81)	78 (73)	74 (69)	72 (67)	70 (65)	68 (63)	62 (57)	57 (52)	53 (48)	Class 1 85	Class 2 85	66
Footing	Day	93 (87)	85 (79)	81 (75)	79 (73)	77 (71)	75 (69)	69 (63)	64 (58)	60 (54)	Class 1 85	Class 2 85	75
	Night	93 (87)	85 (79)	81 (75)	79 (73)	77 (71)	75 (69)	69 (63)	64 (58)	60 (54)	Class 1 85	Class 2 85	66
Pier & Cast-in-place box girder	Day	85 (80)	77 (72)	73 (68)	71 (66)	69 (64)	67 (62)	61 (56)	56 (51)	52 (47)	Class 1 85	Class 3 75	75
	Night	85 (80)	77 (72)	73 (68)	71 (66)	69 (64)	67 (62)	61 (56)	56 (51)	52 (47)	Class 1 85	Class 3 75	66
Erection of box girder segment	Day	80 (75)	72 (67)	68 (63)	66 (61)	64 (59)	62 (57)	56 (51)	51 (46)	47 (42)	Class 1 85	Class 3 75	75
	Night	80 (75)	72 (67)	68 (63)	66 (61)	64 (59)	62 (57)	56 (51)	51 (46)	47 (42)	Class 1 85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L5 or Lmax, the numbers in the lower brackets are LAeq

3) Based on the assessment times in each guideline, L5 or Lmax are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; LAeq is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Source: JICA Design Team

Table 4.4.25 Results of Prediction of Construction Noise Level (With 1.5-m Noise Barrier)

Construction Activity	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
		0	10	20	30	40	50	100	200	300			
Piling	Day	73 (68)	72 (67)	69 (64)	66 (61)	64 (59)	63 (58)	57 (52)	52 (47)	48 (43)	Class 1 85	Class 2 85	75
	Night	73 (68)	72 (67)	69 (64)	66 (61)	64 (59)	63 (58)	57 (52)	52 (47)	48 (43)	Class 1 85	Class 2 85	66
Footing	Day	80 (74)	79 (73)	76 (70)	73 (67)	71 (65)	70 (64)	64 (58)	59 (53)	55 (49)	Class 1 85	Class 2 85	75

Construction Activity	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L ₅)	NPCC Guideline (L _{max})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300			
	Night	80 (74)	79 (73)	76 (70)	73 (67)	71 (65)	70 (64)	64 (58)	59 (53)	55 (49)	Class 1 85	Class 2 85	66
Pier & Cast-in-place box girder	Day	72 (67)	71 (66)	68 (63)	65 (60)	63 (58)	62 (57)	56 (51)	51 (46)	47 (42)	Class 1 85	Class 3 75	75
	Night	72 (67)	71 (66)	68 (63)	65 (60)	63 (58)	62 (57)	56 (51)	51 (46)	47 (42)	Class 1 85	Class 3 75	66
Erection of box girder segment	Day	67 (62)	66 (61)	63 (58)	60 (55)	58 (53)	57 (52)	51 (46)	46 (41)	42 (37)	Class 1 85	Class 3 75	75
	Night	67 (62)	66 (61)	63 (58)	60 (55)	58 (53)	57 (52)	51 (46)	46 (41)	42 (37)	Class 1 85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L₅ or L_{max}, the numbers in the lower brackets are L_{Aeq}

3) Based on the assessment times in each guideline, L₅ or L_{max} are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; L_{Aeq} is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Source: JICA Design Team

Table 4.4.26 Results of Prediction of Construction Noise Level (With 2.0-m Noise Barrier)

Construction Activity	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L ₅)	NPCC Guideline (L _{max})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300			
Piling	Day	69 (64)	69 (64)	66 (61)	63 (58)	61 (56)	60 (55)	55 (50)	49 (44)	46 (41)	Class 1 85	Class 2 85	75
	Night	69 (64)	69 (64)	66 (61)	63 (58)	61 (56)	60 (55)	55 (50)	49 (44)	46 (41)	Class 1 85	Class 2 85	66
Footing	Day	76 (70)	76 (70)	73 (67)	70 (64)	68 (62)	67 (61)	62 (56)	56 (50)	53 (47)	Class 1 85	Class 2 85	75
	Night	76 (70)	76 (70)	73 (67)	70 (64)	68 (62)	67 (61)	62 (56)	56 (50)	53 (47)	Class 1 85	Class 2 85	66
Pier & Cast-in-place box girder	Day	68 (63)	68 (63)	65 (60)	62 (57)	60 (55)	59 (54)	54 (49)	48 (43)	45 (40)	Class 1 85	Class 3 75	75
	Night	68 (63)	68 (63)	65 (60)	62 (57)	60 (55)	59 (54)	54 (49)	48 (43)	45 (40)	Class 1 85	Class 3 75	66
Erection of box girder segment	Day	63 (58)	63 (58)	60 (55)	57 (52)	55 (50)	54 (49)	49 (44)	43 (38)	40 (35)	Class 1 85	Class 3 75	75
	Night	63 (58)	63 (58)	60 (55)	57 (52)	55 (50)	54 (49)	49 (44)	43 (38)	40 (35)	Class 1 85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L₅ or L_{max}, the numbers in the lower brackets are L_{Aeq}

3) Based on the assessment times in each guideline, L₅ or L_{max} are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; L_{Aeq} is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Source: JICA Design Team

Table 4.4.27 Results of Prediction of Construction Noise Level (With 2.5-m Noise Barrier)

Construction Activity	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L ₅)	NPCC Guideline (L _{max})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300			
Piling	Day	66 (61)	67 (62)	64 (59)	61 (56)	59 (54)	58 (53)	53 (48)	47 (42)	44 (39)	Class 1 85	Class 2 85	75
	Night	66 (61)	67 (62)	64 (59)	61 (56)	59 (54)	58 (53)	53 (48)	47 (42)	44 (39)	Class 1 85	Class 2 85	66
Footing	Day	73 (67)	74 (68)	71 (65)	68 (62)	66 (60)	65 (59)	60 (54)	54 (48)	51 (45)	Class 1 85	Class 2 85	75
	Night	73 (67)	74 (68)	71 (65)	68 (62)	66 (60)	65 (59)	60 (54)	54 (48)	51 (45)	Class 1 85	Class 2 85	66
Pier & Cast-in-place box girder	Day	65 (60)	66 (61)	63 (58)	60 (55)	58 (53)	57 (52)	52 (47)	46 (41)	43 (38)	Class 1 85	Class 3 75	75
	Night	65 (60)	66 (61)	63 (58)	60 (55)	58 (53)	57 (52)	52 (47)	46 (41)	43 (38)	Class 1 85	Class 3 75	66

Construction Activity	Day/Night	Distance from ROW (in meters)									Japanese Guideline (L ₅)	NPCC Guideline (L _{max})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300			
Erection of box girder segment	Day	60 (55)	61 (56)	58 (53)	55 (50)	53 (48)	52 (47)	47 (42)	41 (36)	38 (33)	Class 1 85	Class 3 75	75
	Night	60 (55)	61 (56)	58 (53)	55 (50)	53 (48)	52 (47)	47 (42)	41 (36)	38 (33)	Class 1 85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L₅ or L_{max}, the numbers in the lower brackets are L_{Aeq}

3) Based on the assessment times in each guideline, L₅ or L_{max} are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; L_{Aeq} is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Source: JICA Design Team

Table 4.4.28 Results of Prediction of Construction Noise Level (With 3.0 m noise barrier)

Construction Activity	Day/Night	Distance from ROW (in meters)									Japanese Guideline (L ₅)	NPCC Guideline (L _{max})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300			
Piling	Day	65 (60)	65 (60)	62 (57)	60 (55)	58 (53)	56 (51)	51 (46)	46 (41)	42 (37)	Class 1 85	Class 2 85	75
	Night	65 (60)	65 (60)	62 (57)	60 (55)	58 (53)	56 (51)	51 (46)	46 (41)	42 (37)	Class 1 85	Class 2 85	66
Footing	Day	72 (66)	72 (66)	69 (63)	67 (61)	65 (59)	63 (57)	58 (52)	53 (47)	49 (43)	Class 1 85	Class 2 85	75
	Night	72 (66)	72 (66)	69 (63)	67 (61)	65 (59)	63 (57)	58 (52)	53 (47)	49 (43)	Class 1 85	Class 2 85	66
Pier & Cast-in-place box girder	Day	64 (59)	64 (59)	61 (56)	59 (54)	57 (52)	55 (50)	50 (45)	45 (40)	41 (36)	Class 1 85	Class 3 75	75
	Night	64 (59)	64 (59)	61 (56)	59 (54)	57 (52)	55 (50)	50 (45)	45 (40)	41 (36)	Class 1 85	Class 3 75	66
Erection of box girder segment	Day	59 (54)	59 (54)	56 (51)	54 (49)	52 (47)	50 (45)	45 (40)	40 (35)	36 (31)	Class 1 85	Class 3 75	75
	Night	59 (54)	59 (54)	56 (51)	54 (49)	52 (47)	50 (45)	45 (40)	40 (35)	36 (31)	Class 1 85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L₅ or L_{max}, the numbers in the lower brackets are L_{Aeq}

3) Based on the assessment times in each guideline, L₅ or L_{max} are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; L_{Aeq} is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Source: JICA Study Team

366. Under 2.5-m noise barrier, the noise levels of construction activities at some sensitive receptors will exceed the guideline value. In case of the 3.0-m noise barrier, the predicted noise level can meet all guideline except for Melchora Aquino Elementary School.

Table 4.4.29 Prediction of Construction Noise Level from Piling and Footing

No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Piling					Footing					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
1	Molave St. 3124	Residential	1+250	45	19.211	Day	67 (62)	62 (57)	59 (54)	58 (53)	57 (52)	74 (68)	69 (63)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	75
						Night	67 (62)	62 (57)	59 (54)	58 (53)	57 (52)	74 (68)	69 (63)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	66
2	Barangay 228 Hall	Institutional	1+150	10	21.227	Day	73 (68)	67 (62)	65 (60)	62 (57)	61 (56)	80 (74)	74 (68)	72 (66)	69 (63)	68 (62)	Class 1 85	Class 2 85	75
						Night	73 (68)	67 (62)	65 (60)	62 (57)	61 (56)	80 (74)	74 (68)	72 (66)	69 (63)	68 (62)	Class 1 85	Class 2 85	66
3	Antipolo St 945	Residential	1+000	35	19.167	Day	68 (63)	63 (58)	61 (56)	59 (54)	58 (53)	75 (69)	70 (64)	68 (62)	66 (60)	65 (59)	Class 1 85	Class 2 85	75
						Night	68 (63)	63 (58)	61 (56)	59 (54)	58 (53)	75 (69)	70 (64)	68 (62)	66 (60)	65 (59)	Class 1 85	Class 2 85	66
4	Antipolo St (Kingdom of Glory Christian Family Church)	Residential	1+250	40	21.507	Day	67 (62)	62 (57)	60 (55)	58 (53)	57 (52)	74 (68)	69 (63)	67 (61)	65 (59)	64 (58)	Class 1 85	Class 2 85	75
						Night	67 (62)	62 (57)	60 (55)	58 (53)	57 (52)	74 (68)	69 (63)	67 (61)	65 (59)	64 (58)	Class 1 85	Class 2 85	66
5	Our Lady of Lords, Dagupan Ext	Institutional	1+120	30	21.765	Day	69 (64)	63 (58)	61 (56)	60 (55)	58 (53)	76 (70)	70 (64)	68 (62)	67 (61)	65 (59)	Class 1 85	Class 2 85	75
						Night	69 (64)	63 (58)	61 (56)	60 (55)	58 (53)	76 (70)	70 (64)	68 (62)	67 (61)	65 (59)	Class 1 85	Class 2 85	66
6	Old Antipolo St 1124	Residential	1+350	10	19.211	Day	74 (69)	68 (63)	65 (60)	63 (58)	61 (56)	81 (75)	75 (69)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	75
						Night	74 (69)	68 (63)	65 (60)	63 (58)	61 (56)	81 (75)	75 (69)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	66
7	Dagupan Ext	Residential	0+690	23	7.15	Day	73 (68)	68 (63)	65 (60)	63 (58)	61 (56)	80 (74)	75 (69)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	75
						Night	73 (68)	68 (63)	65 (60)	63 (58)	61 (56)	80 (74)	75 (69)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	66
8	Tondo Christian Church	Religious	1+000	47	19.167	Day	67 (62)	61 (56)	59 (54)	58 (53)	57 (52)	74 (68)	68 (62)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Piling					Footing					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	67 (62)	61 (56)	59 (54)	58 (53)	57 (52)	74 (68)	68 (62)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	66
9	Solis-Dagupan Basketball Court	Recreational	0+940	10	7.15	Day	78 (73)	73 (68)	69 (64)	67 (62)	65 (60)	85 (79)	80 (74)	76 (70)	74 (68)	72 (66)	Class 1 85	Class 2 85	75
						Night	78 (73)	73 (68)	69 (64)	67 (62)	65 (60)	85 (79)	80 (74)	76 (70)	74 (68)	72 (66)	Class 1 85	Class 2 85	66
10	Solis Signal Tower (Casitas)	Old PNR structures	0+977	Within	---	Day	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	75
						Night	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	66
11	NHA MRB Dagupan Ext. (Bldg 6)	Residential	0+723	9	7.15	Day	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	75
						Night	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	66
12	NHA MRB Dagupan Ext. (Bldg 5)	Residential	0+680	9	7.15	Day	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	75
						Night	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	66
13	NHA MRB Dagupan Ext. (Bldg 4)	Residential	0+625	9	7.15	Day	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	75
						Night	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	86 (80)	80 (74)	77 (71)	74 (68)	72 (66)	Class 1 85	Class 2 85	66
14	New Antipolo Chapel	Religious	0+995	9	19.167	Day	74 (69)	68 (63)	65 (60)	63 (58)	62 (57)	81 (75)	75 (69)	72 (66)	70 (64)	69 (63)	Class 1 85	Class 2 85	75
						Night	74 (69)	68 (63)	65 (60)	63 (58)	62 (57)	81 (75)	75 (69)	72 (66)	70 (64)	69 (63)	Class 1 85	Class 2 85	66
15	MERALCO Power Grid Station	Commercial/ Industrial	1+270	45	21.765	Day	66 (61)	61 (56)	59 (54)	58 (53)	57 (52)	73 (67)	68 (62)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	75
						Night	66 (61)	61 (56)	59 (54)	58 (53)	57 (52)	73 (67)	68 (62)	66 (60)	65 (59)	64 (58)	Class 1 85	Class 2 85	66
16	Melchora Aquino Elementary School	Educational	0+780	7	7.15	Day	80 (75)	74 (69)	71 (66)	68 (63)	66 (61)	87 (81)	81 (75)	78 (72)	75 (69)	73 (67)	Class 1 85	Class 2 85	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Piling					Footing					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	80 (75)	74 (69)	71 (66)	68 (63)	66 (61)	87 (81)	81 (75)	78 (72)	75 (69)	73 (67)	Class 1 85	Class 2 85	66
17	Maria Guizon Basketball Court	Recreational	1+240	Within	---	Day	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	75
						Night	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	66
18	Manila Day Care Center	Educational	0+950	Within	---	Day	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	75
						Night	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	66
19	Light of the World Christian Church	Religious	0+840	10	7.15	Day	78 (73)	73 (68)	69 (64)	67 (62)	65 (60)	85 (79)	80 (74)	76 (70)	74 (68)	72 (66)	Class 1 85	Class 2 85	75
						Night	78 (73)	73 (68)	69 (64)	67 (62)	65 (60)	85 (79)	80 (74)	76 (70)	74 (68)	72 (66)	Class 1 85	Class 2 85	66
20	Lakan Dula Elementary School	Educational	1+050	51	17.565	Day	66 (61)	61 (56)	59 (54)	57 (52)	56 (51)	73 (67)	68 (62)	66 (60)	64 (58)	63 (57)	Class 1 85	Class 2 85	75
						Night	66 (61)	61 (56)	59 (54)	57 (52)	56 (51)	73 (67)	68 (62)	66 (60)	64 (58)	63 (57)	Class 1 85	Class 2 85	66
21	Harvester's Christian Fellowship Tondo Church	Religious	1+250	11	19.211	Day	73 (68)	67 (62)	65 (60)	63 (58)	61 (56)	80 (74)	74 (68)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	75
						Night	73 (68)	67 (62)	65 (60)	63 (58)	61 (56)	80 (74)	74 (68)	72 (66)	70 (64)	68 (62)	Class 1 85	Class 2 85	66
22	Gregoria de Jesus Elementary School	Educational	0+810	42	7.15	Day	69 (64)	64 (59)	61 (56)	59 (54)	58 (53)	76 (70)	71 (65)	68 (62)	66 (60)	65 (59)	Class 1 85	Class 2 85	75
						Night	69 (64)	64 (59)	61 (56)	59 (54)	58 (53)	76 (70)	71 (65)	68 (62)	66 (60)	65 (59)	Class 1 85	Class 2 85	66
23	Brgy 204 (Barangay Hall)	Institutional	0+740	45	7.15	Day	69 (64)	63 (58)	61 (56)	59 (54)	57 (52)	76 (70)	70 (64)	68 (62)	66 (60)	64 (58)	Class 1 85	Class 2 85	75
						Night	69 (64)	63 (58)	61 (56)	59 (54)	57 (52)	76 (70)	70 (64)	68 (62)	66 (60)	64 (58)	Class 1 85	Class 2 85	66
24	Batangas Dulo Chapel	Religious	1+080	3	22.095	Day	75 (70)	68 (63)	64 (59)	62 (57)	60 (55)	82 (76)	75 (69)	71 (65)	69 (63)	67 (61)	Class 1 85	Class 2 85	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Piling					Footing					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (Laeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	75 (70)	68 (63)	64 (59)	62 (57)	60 (55)	82 (76)	75 (69)	71 (65)	69 (63)	67 (61)	Class 1 85	Class 2 85	66
25	Barangay (228) Carlo Lopez Multi-Purpose Hall	Institutional	1+080	Within	---	Day	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	75
						Night	---	---	---	---	---	---	---	---	---	---	Class 1 85	Class 2 85	66
26	Barangay (217) Hall	Institutional	1+190	13	21.507	Day	72 (67)	66 (61)	64 (59)	62 (57)	60 (55)	79 (73)	73 (67)	71 (65)	69 (63)	67 (61)	Class 1 85	Class 2 85	75
						Night	72 (67)	66 (61)	64 (59)	62 (57)	60 (55)	79 (73)	73 (67)	71 (65)	69 (63)	67 (61)	Class 1 85	Class 2 85	66
27	Barangay (213) Hall	Institutional	1+260	16	21.507	Day	71 (66)	66 (61)	63 (58)	62 (57)	60 (55)	78 (72)	73 (67)	70 (64)	69 (63)	67 (61)	Class 1 85	Class 2 85	75
						Night	71 (66)	66 (61)	63 (58)	62 (57)	60 (55)	78 (72)	73 (67)	70 (64)	69 (63)	67 (61)	Class 1 85	Class 2 85	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L5 or Lmax, the numbers in the lower brackets are Laeq

3) Based on the assessment times in each guideline, L5 or Lmax are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; Laeq is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

Table 4.4.30 • Prediction of Construction Noise Level from the Construction of Piers & Cast-in-place Box Girders

No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Pier & Cast-in-place box girder					Erection of box girder segment					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
1	Molave St. 3124	Residential	1+250	45	19.211	Day	66 (61)	61 (56)	58 (53)	57 (52)	56 (51)	61 (56)	56 (51)	53 (48)	52 (47)	51 (46)	85	Class 3 75	75
						Night	66 (61)	61 (56)	58 (53)	57 (52)	56 (51)	61 (56)	56 (51)	53 (48)	52 (47)	51 (46)	85	Class 3 75	66
2	Barangay 228 Hall	Institutional	1+150	10	21.227	Day	72 (67)	66 (61)	64 (59)	61 (56)	60 (55)	67 (62)	61 (56)	59 (54)	56 (51)	55 (50)	85	Class 3 75	75
						Night	72 (67)	66 (61)	64 (59)	61 (56)	60 (55)	67 (62)	61 (56)	59 (54)	56 (51)	55 (50)	85	Class 3 75	66
3	Antipolo St 945	Residential	1+000	35	19.167	Day	67 (62)	62 (57)	60 (55)	58 (53)	57 (52)	62 (57)	57 (52)	55 (50)	53 (48)	52 (47)	85	Class 3 75	75
						Night	67 (62)	62 (57)	60 (55)	58 (53)	57 (52)	62 (57)	57 (52)	55 (50)	53 (48)	52 (47)	85	Class 3 75	66
4	Antipolo St (Kingdom of Glory Christian Family Church)	Residential	1+250	40	21.507	Day	66 (61)	61 (56)	59 (54)	57 (52)	56 (51)	61 (56)	56 (51)	54 (49)	52 (47)	51 (46)	85	Class 3 75	75
						Night	66 (61)	61 (56)	59 (54)	57 (52)	56 (51)	61 (56)	56 (51)	54 (49)	52 (47)	51 (46)	85	Class 3 75	66
5	Our Lady of Lords, Dagupan Ext	Institutional	1+120	30	21.765	Day	68 (63)	62 (57)	60 (55)	59 (54)	57 (52)	63 (58)	57 (52)	55 (50)	54 (49)	52 (47)	85	Class 3 75	75
						Night	68 (63)	62 (57)	60 (55)	59 (54)	57 (52)	63 (58)	57 (52)	55 (50)	54 (49)	52 (47)	85	Class 3 75	66
6	Old Antipolo St 1124	Residential	1+350	10	19.211	Day	73 (68)	67 (62)	64 (59)	62 (57)	60 (55)	68 (63)	62 (57)	59 (54)	57 (52)	55 (50)	85	Class 3 75	75
						Night	73 (68)	67 (62)	64 (59)	62 (57)	60 (55)	68 (63)	62 (57)	59 (54)	57 (52)	55 (50)	85	Class 3 75	66
7	Dagupan Ext	Residential	0+690	23	7.15	Day	72 (67)	67 (62)	64 (59)	62 (57)	60 (55)	67 (62)	62 (57)	59 (54)	57 (52)	55 (50)	85	Class 3 75	75
						Night	72 (67)	67 (62)	64 (59)	62 (57)	60 (55)	67 (62)	62 (57)	59 (54)	57 (52)	55 (50)	85	Class 3 75	66
8	Tondo Christian Church	Religious	1+000	47	19.167	Day	66 (61)	60 (55)	58 (53)	57 (52)	56 (51)	61 (56)	55 (50)	53 (48)	52 (47)	51 (46)	85	Class 3 75	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Pier & Cast-in-place box girder					Erection of box girder segment					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	66 (61)	60 (55)	58 (53)	57 (52)	56 (51)	61 (56)	55 (50)	53 (48)	52 (47)	51 (46)	85	Class 3 75	66
9	Solis-Dagupan Basketball Court	Recreational	0+940	10	7.15	Day	77 (72)	72 (67)	68 (63)	66 (61)	64 (59)	72 (67)	67 (62)	63 (58)	61 (56)	59 (54)	85	Class 3 75	75
						Night	77 (72)	72 (67)	68 (63)	66 (61)	64 (59)	72 (67)	67 (62)	63 (58)	61 (56)	59 (54)	85	Class 3 75	66
10	Solis Signal Tower (Casitas)	Old PNR structures	0+977	Within	---	Day	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	75
						Night	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	66
11	NHA MRB Dagupan Ext. (Bldg 6)	Residential	0+723	9	7.15	Day	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	75
						Night	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	66
12	NHA MRB Dagupan Ext. (Bldg 5)	Residential	0+680	9	7.15	Day	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	75
						Night	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	66
13	NHA MRB Dagupan Ext. (Bldg 4)	Residential	0+625	9	7.15	Day	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	75
						Night	78 (73)	72 (67)	69 (64)	66 (61)	64 (59)	73 (68)	67 (62)	64 (59)	61 (56)	59 (54)	85	Class 3 75	66
14	New Antipolo Chapel	Religious	0+995	9	19.167	Day	73 (68)	67 (62)	64 (59)	62 (57)	61 (56)	68 (63)	62 (57)	59 (54)	57 (52)	56 (51)	85	Class 3 75	75
						Night	73 (68)	67 (62)	64 (59)	62 (57)	61 (56)	68 (63)	62 (57)	59 (54)	57 (52)	56 (51)	85	Class 3 75	66
15	MERALCO Power Grid Station	Commercial/Industrial	1+270	45	21.765	Day	65 (60)	60 (55)	58 (53)	57 (52)	56 (51)	60 (55)	55 (50)	53 (48)	52 (47)	51 (46)	85	Class 3 75	75
						Night	65 (60)	60 (55)	58 (53)	57 (52)	56 (51)	60 (55)	55 (50)	53 (48)	52 (47)	51 (46)	85	Class 3 75	66
16	Melchora Aquino Elementary School	Educational	0+780	7	7.15	Day	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	74 (69)	68 (63)	65 (60)	62 (57)	60 (55)	85	Class 3 75	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Pier & Cast-in-place box girder					Erection of box girder segment					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (LAeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	79 (74)	73 (68)	70 (65)	67 (62)	65 (60)	74 (69)	68 (63)	65 (60)	62 (57)	60 (55)	85	Class 3 75	66
17	Maria Guizon Basketball Court	Recreational	1+240	Within	---	Day	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	75
						Night	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	66
18	Manila Day Care Center	Educational	0+950	Within	---	Day	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	75
						Night	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	66
19	Light of the World Christian Church	Religious	0+840	10	7.15	Day	77 (72)	72 (67)	68 (63)	66 (61)	64 (59)	72 (67)	67 (62)	63 (58)	61 (56)	59 (54)	85	Class 3 75	75
						Night	77 (72)	72 (67)	68 (63)	66 (61)	64 (59)	72 (67)	67 (62)	63 (58)	61 (56)	59 (54)	85	Class 3 75	66
20	Lakan Dula Elementary School	Educational	1+050	51	17.565	Day	65 (60)	60 (55)	58 (53)	56 (51)	55 (50)	60 (55)	55 (50)	53 (48)	51 (46)	50 (45)	85	Class 3 75	75
						Night	65 (60)	60 (55)	58 (53)	56 (51)	55 (50)	60 (55)	55 (50)	53 (48)	51 (46)	50 (45)	85	Class 3 75	66
21	Harvester's Christian Fellowship Tondo Church	Religious	1+250	11	19.211	Day	72 (67)	66 (61)	64 (59)	62 (57)	60 (55)	67 (62)	61 (56)	59 (54)	57 (52)	55 (50)	85	Class 3 75	75
						Night	72 (67)	66 (61)	64 (59)	62 (57)	60 (55)	67 (62)	61 (56)	59 (54)	57 (52)	55 (50)	85	Class 3 75	66
22	Gregoria de Jesus Elementary School	Educational	0+810	42	7.15	Day	68 (63)	63 (58)	60 (55)	58 (53)	57 (52)	63 (58)	58 (53)	55 (50)	53 (48)	52 (47)	85	Class 3 75	75
						Night	68 (63)	63 (58)	60 (55)	58 (53)	57 (52)	63 (58)	58 (53)	55 (50)	53 (48)	52 (47)	85	Class 3 75	66
23	Brgy 204 (Barangay Hall)	Institutional	0+740	45	7.15	Day	68 (63)	62 (57)	60 (55)	58 (53)	56 (51)	63 (58)	57 (52)	55 (50)	53 (48)	51 (46)	85	Class 3 75	75
						Night	68 (63)	62 (57)	60 (55)	58 (53)	56 (51)	63 (58)	57 (52)	55 (50)	53 (48)	51 (46)	85	Class 3 75	66
24	Batangas Dulo Chapel	Religious	1+080	3	22.095	Day	74 (69)	67 (62)	63 (58)	61 (56)	59 (54)	69 (64)	62 (57)	58 (53)	56 (51)	54 (49)	85	Class 3 75	75

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No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Distance from center of structure (m)	Day / Night	Pier & Cast-in-place box girder					Erection of box girder segment					Japanese Guideline (L5)	NPCC Guideline (Lmax)	WBG-EHS Guideline (Laeq)
							No	1.5 m	2.0 m	2.5 m	3.0 m	No	1.5 m	2.0 m	2.5 m	3.0 m			
						Night	74 (69)	67 (62)	63 (58)	61 (56)	59 (54)	69 (64)	62 (57)	58 (53)	56 (51)	54 (49)	85	Class 3 75	66
25	Barangay (228) Carlo Lopez Multi-Purpose Hall	Institutional	1+080	Within	---	Day	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	75
						Night	---	---	---	---	---	---	---	---	---	---	85	Class 3 75	66
26	Barangay (217) Hall	Institutional	1+190	13	21.507	Day	71 (66)	65 (60)	63 (58)	61 (56)	59 (54)	66 (61)	60 (55)	58 (53)	56 (51)	54 (49)	85	Class 3 75	75
						Night	71 (66)	65 (60)	63 (58)	61 (56)	59 (54)	66 (61)	60 (55)	58 (53)	56 (51)	54 (49)	85	Class 3 75	66
27	Barangay (213) Hall	Institutional	1+260	16	21.507	Day	70 (65)	65 (60)	62 (57)	61 (56)	59 (54)	65 (60)	60 (55)	57 (52)	56 (51)	54 (49)	85	Class 3 75	75
						Night	70 (65)	65 (60)	62 (57)	61 (56)	59 (54)	65 (60)	60 (55)	57 (52)	56 (51)	54 (49)	85	Class 3 75	66

Note 1) Pink cells are values that exceed guideline value.

2) The numbers in the upper row are L5 or Lmax, the numbers in the lower brackets are Laeq

3) Based on the assessment times in each guideline, L5 or Lmax are the assessment value for daytime 7:00-19:00 and nighttime 19:00-7:00; Laeq is the assessment value for daytime 7:00-22:00 and nighttime 22:00-7:00.

4.4.3.4 Operational Noise Assessment

(1) Prediction Method

367. Operational noise or noise from train operation was examined with reference to “Proposal of a Prediction Model for Noise of Conventional Railway, Noise Control Engineering 20(3), Institute of Noise Control Engineering INCE, Japan, 1996 (INCE-Japan Prediction Model for Noise of Conventional Railway, 1996)”.

1) Prediction Model

Basic model formula

368. The method was formulated based on section structure and train velocity. The maximum noise level value at the time of the run of 1 train (L_{Amax} , L_{AE}) is presented in the formula below.

$$L_{Amax} = PWL - 5 - 10 \log_{10} d + 10 \log_{10} \left[\frac{\frac{s}{2d}}{1 + \left(\frac{s}{2d}\right)^2} + \tan^{-1} \frac{s}{2d} \right]$$

$$L_{AE} = PWL - 5 + 10 \log_{10} d + 10 \log_{10} \left(\frac{\pi s}{2v} \right)$$

Where, L_{Amax} :	Maximum value of noise level (dB)
L_{AE} :	Sound exposure level (dB)
PWL :	Sound power level (dB)
d :	Distance between sound source and sound receiving point (m)
s :	Length of linear source (m)
v :	Train velocity (km/h)

369. Usually, train operation noise compounds three (3) main sound sources including rolling sound of running train, structure sound from vibration of slab on concrete viaduct, and motor fan sound. In addition, “aerodynamic sound of rolling stock” and “sliding sound of pantographs and overhead wires” are also generated but often ignored as these sounds are smaller than the abovementioned 3 types of sound.

Railway vehicle sound

370. Railway vehicle sound can be calculated using the formula below.

$$L_{Amax}(R) = PWL(R) - 5 - 10 \log_{10} d_1 + 10 \log_{10} \left[\frac{\frac{s}{2d_1}}{1 + \left(\frac{s}{2d_1}\right)^2} + \tan^{-1} \frac{s}{2d_1} \right] + \alpha_1$$

Where, $L_{Amax}(R)$:	maximum value of noise level of rolling sound (dB)
$PWL(R)$:	Sound power level of rolling sound (dB)
	$PWL(R) = 102.5 + 30 \log_{10} \left(\frac{v}{100} \right)$
d_1 :	Distance between center of run orbit and sound receiving point (m)
s :	Length of linear source (m)
v :	Train velocity (km/h)
α_1 :	Effect of sound diffraction (dB)

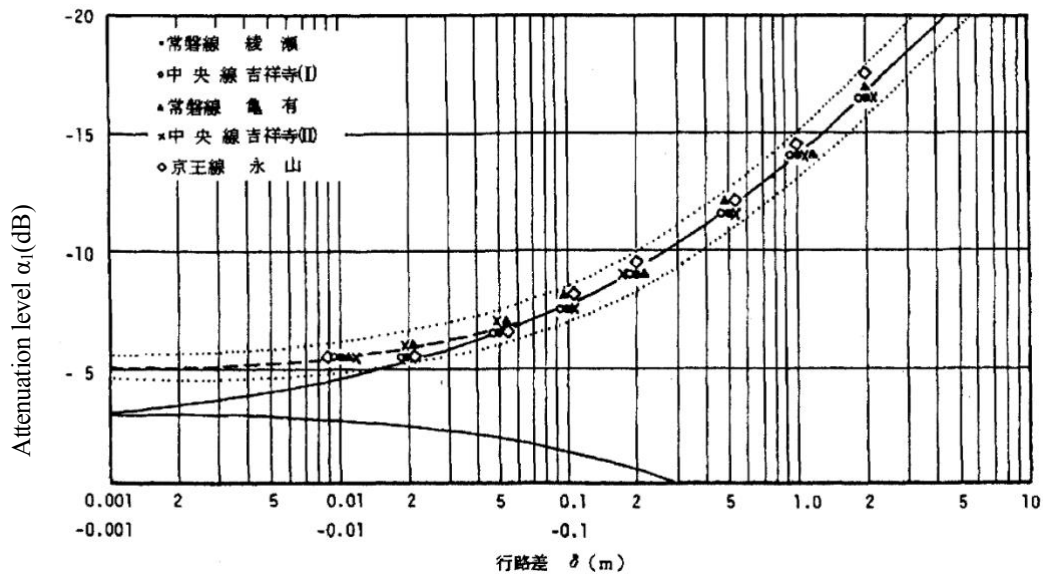
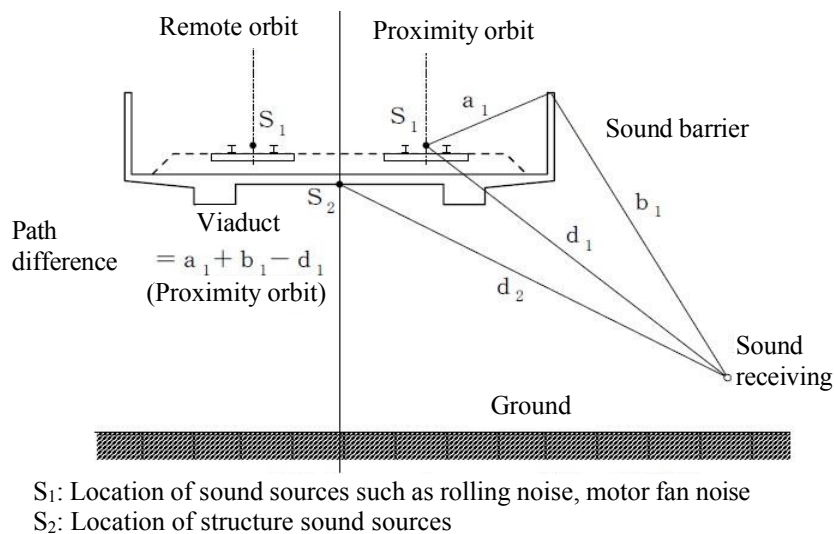


Figure 4.4.12 Arrangement of Sound Source, Sound Receiving Point and Explanation of Path Difference

371. The effect of sound diffraction (α_1) when the sound propagation path is blocked by noise barrier or other structures can be evaluated by using the chart presented below. The relationship of the effect of sound diffraction and path difference is shown in Figure 4.4.13 below.



Source: INCE-Japan Prediction Model for Noise of Conventional Railway, 1996

Figure 4.4.13 Relationship between the barrier attenuation effect and the path difference of a noise barriers

372. If the noise barrier has no sound-absorbing material, the effect of the sound barrier will be smaller than the value α_1 obtained from the above figure due to the multiple reflections between the vehicles traveling on the proximity orbit and the noise barrier as shown in **Figure 4.4.14**. Generally, for a noise barrier with a height of 1 to 2 m, the increase in level due to multiple reflections is approximately 2 dB. Therefore, in the case of a noise barrier without sound absorbing material, $\alpha = \alpha_1 + 2$ dB should be adopted as the correction value representing the effect of the sound barrier on the noise of trains

running on the track on the side of the noise barrier. For sound-absorbing noise barrier, $\alpha=\alpha_1$ is used. When a train runs on a track far from the noise barrier on the sound-receiving point side, $\alpha=\alpha_1$ is assumed, regardless of the presence or absence of sound-absorbing material on the noise barrier.

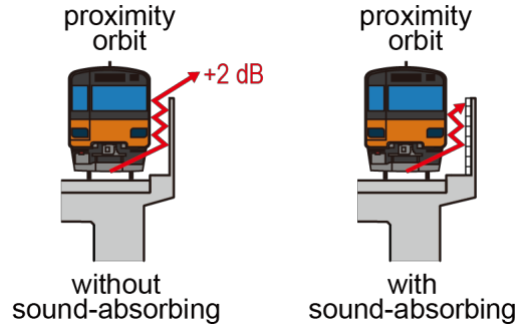


Figure 4.4.14 Concept of multiple reflections between train and noise barrier wall

Structure sound from vibration on concrete viaduct

373. Structure sound from vibration on concrete viaduct can be calculated using the formula below.

$$L_{Amax}(S) = PWL(S) - 5 - 10 \log_{10} d_2 + 10 \log_{10} \left[\frac{\frac{s}{2d_2}}{1 + \left(\frac{s}{2d_2}\right)^2} + \tan^{-1} \frac{s}{2d_2} \right] + \Delta L_C$$

Where, $L_{Amax}(S)$: maximum value of noise level of structure sound (dB)

$PWL(S)$: Sound power level of structure sound (dB)

$$PWL(S) = 85 + 20 \log_{10} \left(\frac{v}{100} \right)$$

d_1 : Distance of the sound receiving point from the center of the underside of the structure (m)

s : Length of linear source (m)

v : Train velocity (km/h)

ΔL_C : Correction value

$$\text{In case of } r < 4h \quad \Delta L_C = 0$$

$$\text{In case of } r > 4h \quad \Delta L_C = -10 \log_{10} \left(\frac{r}{4h} \right)$$

r : Horizontal distance between center of viaduct and sound receiving point (m)

h : Height of viaduct underside from ground (m)

Motor fan sound

374. Motor fan sound can be calculated using the formula below.

$$L_{Amax}(M) = PWL(M) - 5 - 10 \log_{10} d_1 + 10 \log_{10} \left[\frac{\frac{s}{2d_1}}{1 + \left(\frac{s}{2d_1}\right)^2} + \tan^{-1} \frac{s}{2d_1} \right] + \alpha_1$$

Where, $L_{Amax}(M)$: maximum value of noise level of motor fan sound (dB)

$PWL(M)$: Sound power level of motor fan sound (dB)

$$PWL(M) = 60 \log_{10} \left(\frac{nv}{100} \right) + \log_{10} \left(\frac{S_M}{S} \right) + 67$$

Where, d_I :	Distance between center of run orbit and sound receiving point (m)
s :	Length of linear source (m)
v :	Train velocity (km/h)
α_I :	Effect of sound diffraction (dB)

Calculation of noise levels for three types of noise

375. The noise level $L(L_{Amax}, L_{AE})$ of a single vehicle running at the sound receiving point is expressed by the decibel sum of the noise levels of the 3 types of noise as follows.

$$L_{Amax} = 10 \log_{10} \left(10^{\frac{L_{Amax}(R)}{10}} + 10^{\frac{L_{Amax}(S)}{10}} + 10^{\frac{L_{Amax}(M)}{10}} \right)$$

$$L_{AE} = 10 \log_{10} \left(10^{\frac{L_{AE}(R)}{10}} + 10^{\frac{L_{AE}(S)}{10}} + 10^{\frac{L_{AE}(M)}{10}} \right)$$

Equivalent continuous A-weighted sound pressure Level

376. Equivalent continuous A-weighted sound pressure Level L_{Aeq} of the noise at the observation time T (s) is defined based on the formula below.

$$L_{Aeq,T} = 10 \log_{10} \left(\frac{1}{T} \sum 10^{\frac{L_{AE}(n)}{10}} \right)$$

$$= \overline{L_{AE}} + 10 \log_{10} \left(\frac{N}{T} \right)$$

Where, $L_{AE}(n)$:	Sound exposure level of the nth train running in time T (dB)
$\overline{L_{AE}}$:	Power averaged sound exposure level for all trains during the observation time (dB)
N :	Number of trains during the observation time
T :	Observation time (s)

Synthesis of sound pressure Level

377. Operation noise generated from different box girders or piers should be synthesized (e.g. section 07 (Solis-Blumentritt (SB) Section). The formula for combining noise levels is as follows.

$$L = 10 \log_{10} \left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \dots + 10^{\frac{L_n}{10}} \right)$$

Where, L :	Synthesized sound pressure level
$L_1, L_2, \dots, L_n$:	Sound pressure level of the sound source

378. It should be noted that this prediction method, which is widely used in Japan and abroad, tends to be several dB higher.

2) Predictive condition

Prediction points

379. The Prediction cross-sections were set at 0 km 280 for SB Section and 0 km 840 for Blumentritt-Tutuban (BT) Section, the points of highest impact from operating trains where the height of the viaduct is the lowest in the project area as shown in **Figure 4.4.15** below. The prediction points are 1.2 m in height at 0, 10, 20, 30, 40, 50, 100, 200, 300 m from the edge of ROW as shown in **Figure 4.4.16**.

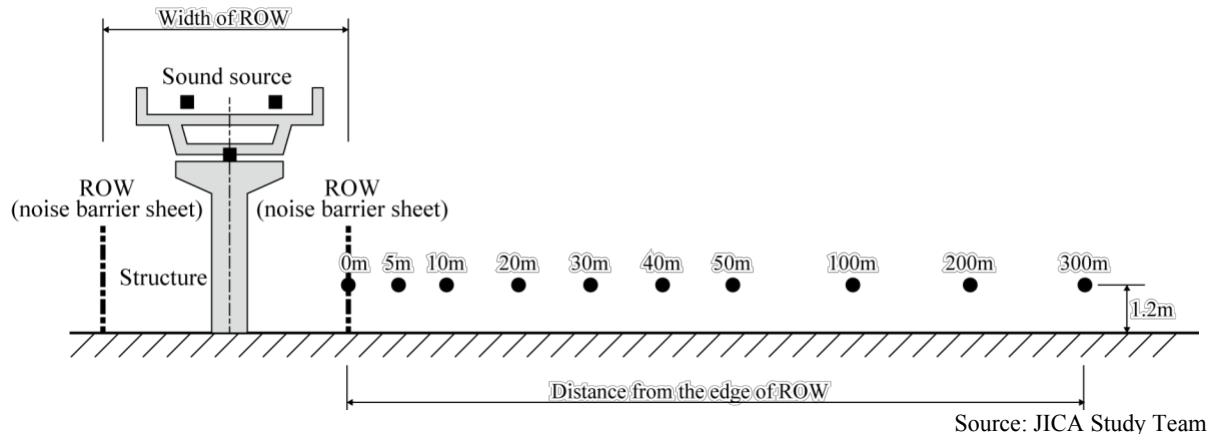


Figure 4.4.15 Prediction Point of Operation Noise

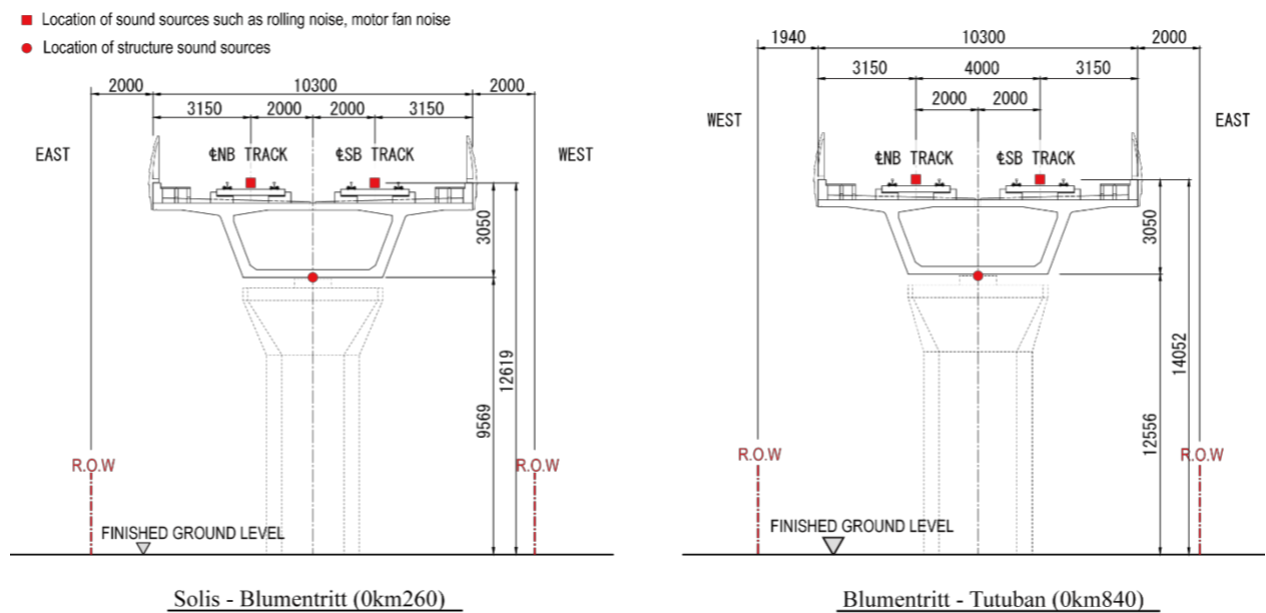


Figure 4.4.16 Cross-Section Prediction

Predictive condition

380. The structural conditions and train specifications considered in this prediction is shown in Table 4.4.31 below.

Table 4.4.31 Predictive condition (structural conditions and train characteristics)

Structural conditions	Railway structure	
	Truck structure	Slab track
	Rail type	Long rail
Train characteristics	Train classification	Commuter train
	Train length	160 m (20 m x 8 car-train)
	Design speed	approx. 50 km/h

Source: JICA Study Team

Total number of operating trains

381. Total number of operational trains in this prediction are shown **Table 4.4.32** and **Table 4.4.33** below.

Table 4.4.32 Total Number of Operated Trains (SB Section)

Operation Year	Time Slice	North bound (Blumentritt to Solis)	South bound (Solis to Blumentritt)
2023-2040	Day (7:00 to 22:00)	118	118
	Night (22:00 to 7:00)	38	38
2040-	Day (7:00 to 22:00)	131	129
	Night (22:00 to 7:00)	44	46

Source: JICA Study Team

Table 4.4.33 Total Number of Operated Trains (BT Section)

Operation Year	Time Slice	North bound (Blumentritt to Tutuban)	South bound (Tutuban to Blumentritt)
Before 2025	Day (7:00 to 22:00)	15	15
	Night (22:00 to 7:00)	4	4
After 2026	Day (7:00 to 22:00)	19	18
	Night (22:00 to 7:00)	4	5

Source: JICA Study Team

3) Sensitive Receptors

382. There are 28 key single-point receptors identified to represent key clusters along the SBT Section ranging from land uses of residential and institutional types as shown in **Figure 4.4.17** and **Table 4.4.44**.

(2) Results and Discussion

1) Solis - Blumentritt

383. **Table 4.4.34** to **Table 4.4.38** present the predicted operational noise level without noise barrier and with noise barrier.

384. Without noise barrier, the predicted noise level exceeds Japanese guideline value within 50 m from edge of ROW. On the other hand, with noise barrier, the predicted noise level is lower than without noise barrier. Higher noise barriers will result in lower noise levels. However, even with a 3.0-m noise barrier in place, nighttime noise levels on the ROW still do not meet Japanese standards.

Table 4.4.34 Prediction of Operation Noise Level (Without Noise Barrier) (SB Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
2023-2040	Day 7:00 to 22:00	60	60	60	60	60	59	56	50	45	60	75
	Night 22:00 to 7:00	57	58	58	58	57	57	53	47	43	55	66
2040-	Day 7:00 to 22:00	61	61	61	61	60	60	56	50	46	60	75
	Night 22:00 to 7:00	58	58	59	58	58	57	54	48	43	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.35 Prediction of Operation Noise Level (With 1.5-m Noise Barrier) (SB Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
2023-2040	Day 7:00 to 22:00	59	57	57	57	56	56	52	46	41	60	75
	Night 22:00 to 7:00	57	55	54	54	54	53	49	43	39	55	66
2040-	Day 7:00 to 22:00	60	58	57	57	57	56	52	46	42	60	75
	Night 22:00 to 7:00	57	55	55	55	54	54	50	44	39	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.36 Prediction of Operation Noise Level (With 2.0-m Noise Barrier) (SB Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
2023-2040	Day 7:00 to 22:00	59	57	56	56	55	55	51	45	40	60	75
	Night 22:00 to 7:00	56	54	53	53	52	52	48	42	37	55	66
2040-	Day 7:00 to 22:00	59	57	56	56	56	55	51	45	41	60	75
	Night 22:00 to 7:00	57	55	54	54	53	53	49	43	38	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.37 Prediction of Operation Noise Level (With 2.5-m Noise Barrier) (SB Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
2023-2040	Day 7:00 to 22:00	59	56	55	55	54	53	50	44	39	60	75
	Night 22:00 to 7:00	56	53	52	52	51	51	47	41	36	55	66
2040-	Day 7:00 to 22:00	59	57	56	55	54	54	50	44	40	60	75
	Night 22:00 to 7:00	57	54	53	53	52	51	48	42	37	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.38 Prediction of Operation Noise Level (With 3.0-m Noise Barrier) (SB Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
2023-2040	Day 7:00 to 22:00	59	56	54	54	53	52	49	43	38	60	75
	Night 22:00 to 7:00	56	53	52	51	50	50	46	40	36	55	66
2040-	Day 7:00 to 22:00	59	56	54	54	53	52	49	43	38	60	75

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
	Night 22:00 to 7:00	56	53	52	51	50	50	46	40	36	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

2) Blumentritt - Tutuban

385. Table 4.4.39 to Table 4.4.43 present the predicted noise level without noise barrier and with noise barrier. Without noise barrier, the predicted noise level meets Japanese and WBG noise guideline values. This low value is assumed to be due to the low number of trains on this section and the relatively high noise source.

Table 4.4.39 Prediction of Operation Noise Level (Without noise barrier) (BT Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
Before 2025	Day 7:00 to 22:00	51	51	51	51	51	50	47	41	36	60	75
	Night 22:00 to 7:00	48	47	48	47	47	47	43	37	33	55	66
After 2026	Day 7:00 to 22:00	52	52	52	52	52	51	48	42	37	60	75
	Night 22:00 to 7:00	49	48	49	48	48	48	44	38	34	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.40 Prediction of Operation Noise Level (With 1.5-m Noise Barrier) (BT Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
Before 2025	Day 7:00 to 22:00	51	48	48	47	47	46	43	37	32	60	75
	Night 22:00 to 7:00	47	45	44	44	43	43	39	33	29	55	66
After 2026	Day 7:00 to 22:00	52	49	49	48	48	47	44	38	33	60	75
	Night 22:00 to 7:00	48	46	45	45	44	44	40	34	30	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.41 Prediction of Operation Noise Level (With 2.0-m Noise Barrier) (BT Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
Before 2025	Day 7:00 to 22:00	50	48	47	46	46	45	42	36	31	60	75
	Night 22:00 to 7:00	47	44	43	43	42	42	38	32	28	55	66
After 2026	Day 7:00 to 22:00	51	49	48	47	47	46	43	37	32	60	75
	Night 22:00 to 7:00	48	45	44	44	43	43	39	33	29	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.42 Prediction of Operation Noise Level (With 2.5-m Noise Barrier) (BT Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
Before 2025	Day 7:00 to 22:00	50	47	46	45	45	44	41	35	30	60	75
	Night 22:00 to 7:00	47	44	43	42	41	41	37	31	27	55	66
After 2026	Day 7:00 to 22:00	51	48	47	46	46	45	42	36	31	60	75
	Night 22:00 to 7:00	48	45	44	43	42	42	38	32	28	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

Table 4.4.43 Prediction of Operation Noise Level (With 3.0-m Noise Barrier) (BT Section)

Operation Year	Day/ Night	Distance from ROW (in meters)									Japanese Guideline (L _{Aeq})	WBG-EHS Guideline (L _{Aeq})
		0	10	20	30	40	50	100	200	300		
Before 2025	Day 7:00 to 22:00	50	47	45	45	44	43	40	34	29	60	75
	Night 22:00 to 7:00	47	43	42	41	40	40	36	30	26	55	66
After 2026	Day 7:00 to 22:00	51	48	47	46	45	44	41	35	30	60	75
	Night 22:00 to 7:00	48	44	43	42	41	41	37	31	27	55	66

Note: Pink cells are values that exceed guideline value.

Source: JICA Design Team

3) Distribution of Sensitive Receptors

386. The sensitive receptors identified within 50 m from the edge of the ROW of the project site include residential areas/buildings, schools, health facilities (hospitals/clinics), religious and government institutions as shown in **Figure 4.4.17**. The height and structure of viaduct will be complicated in this area. The sensitive receptors will be affected by operation noise brought about by the height of viaduct structure which might be higher than the height of other surrounding building/sensitive structures. Therefore, in this report, the height and structure of viaduct is divided by section as shown in **Figure 4.4.18** and **Figure 4.4.19**.

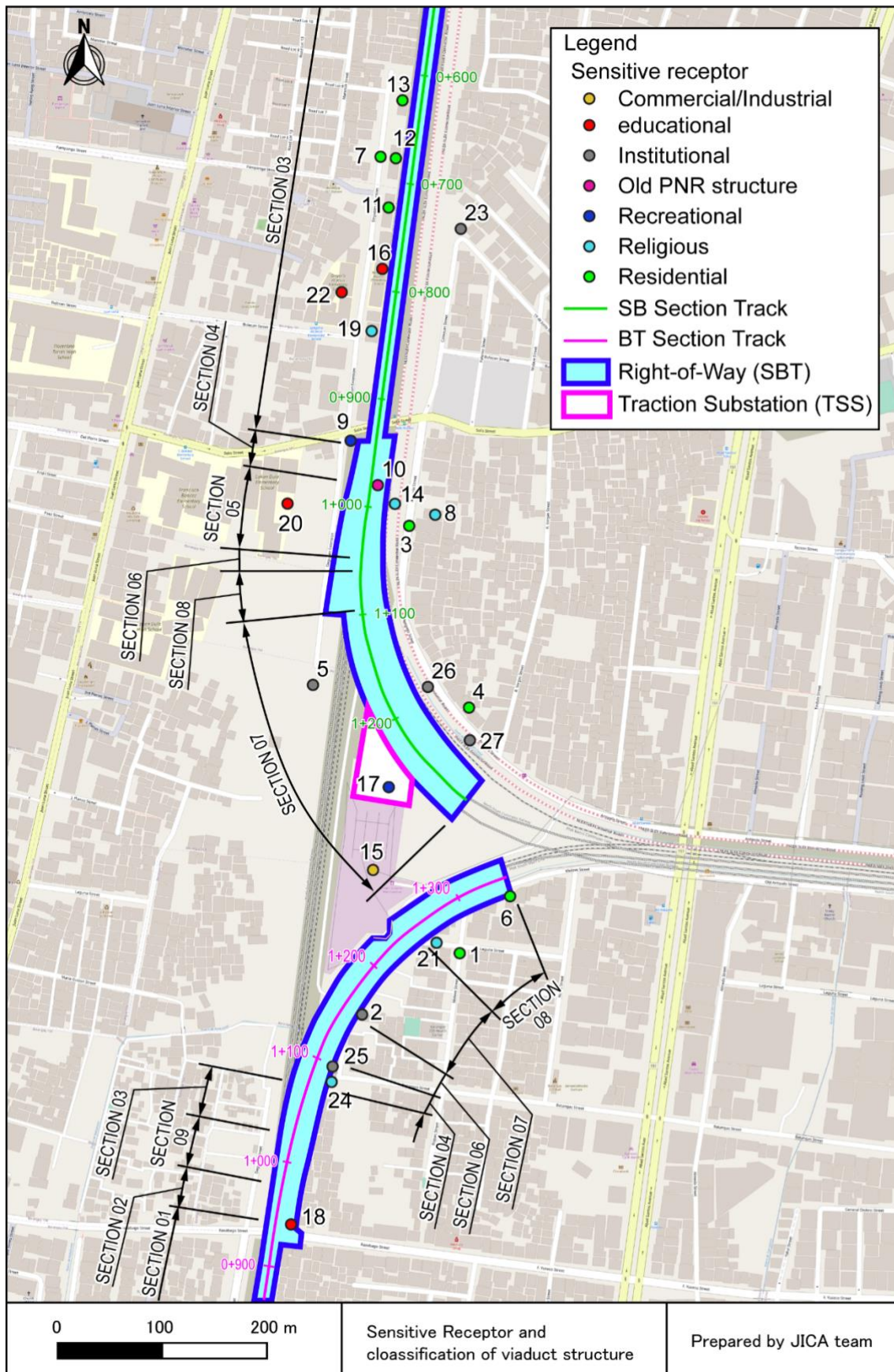
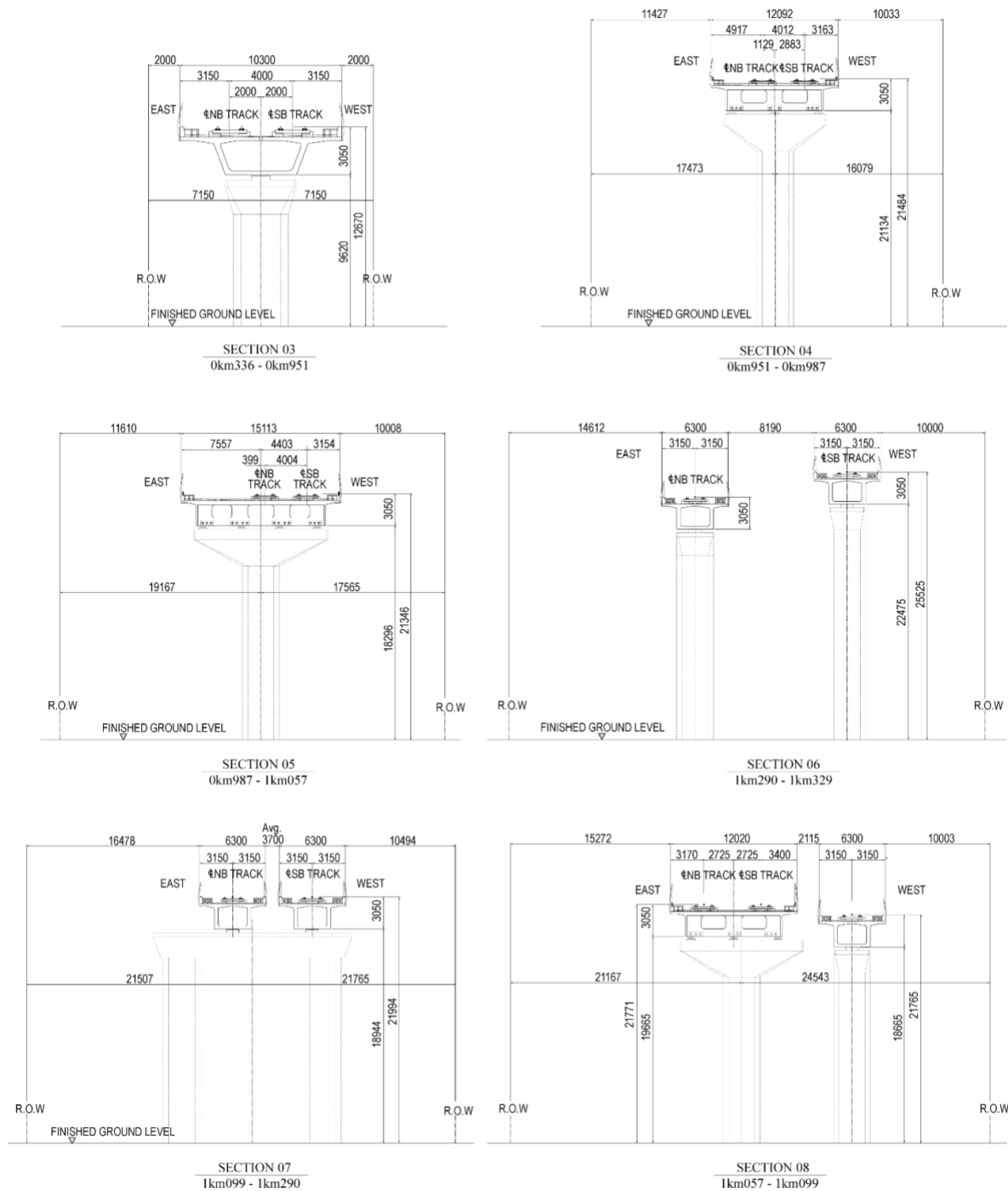


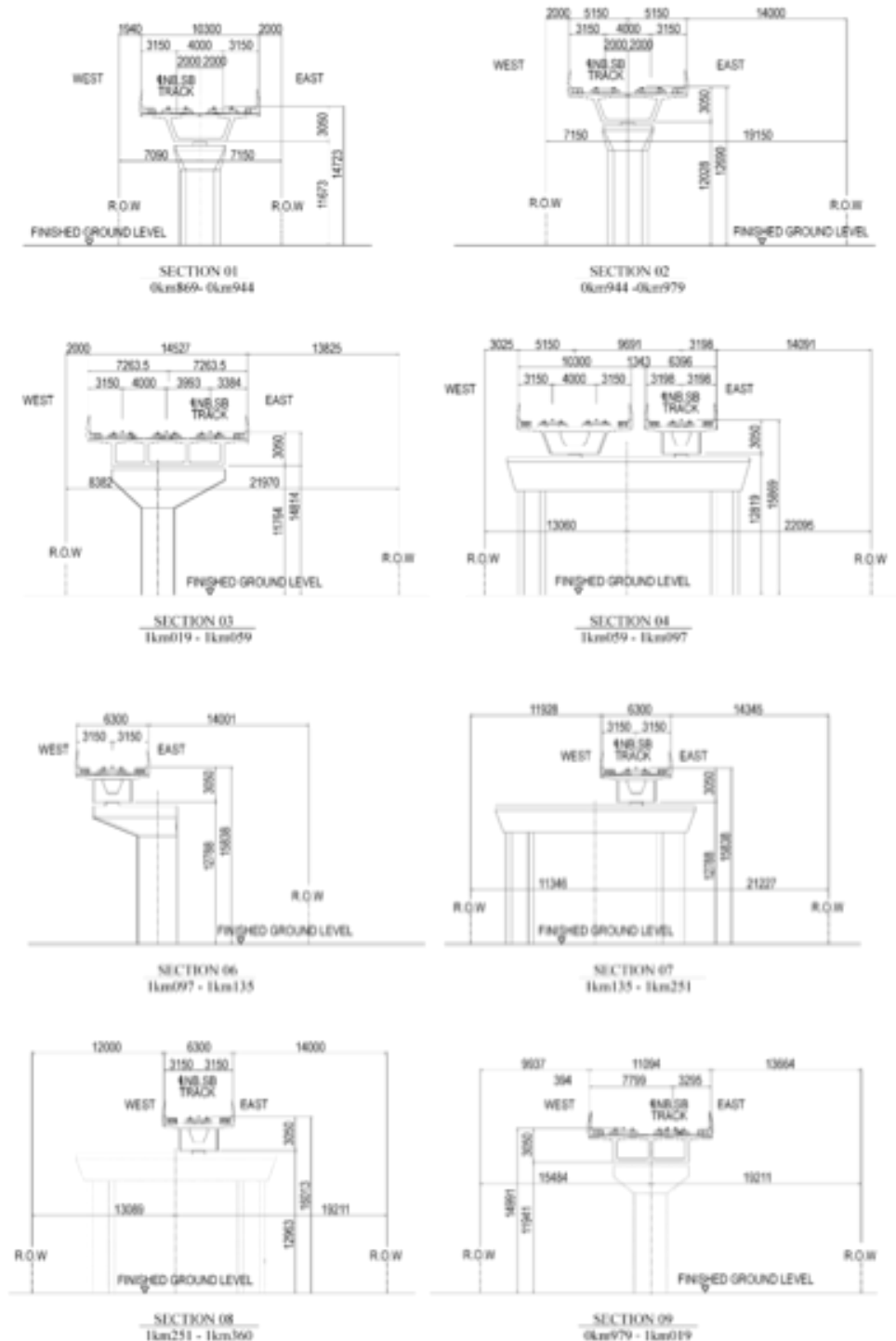
Figure 4.4.17 Distribution of sensitive receptor and classification of viaduct structure

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION



Source: JICA Study Team

Figure 4.4.18 Classification of viaduct structure (Solis - Blumentritt)



Source: JICA Study Team

Figure 4.4.19 Classification of viaduct structure (Blumentritt - Tutuban)

Prediction Results

387. At SB Section, many points without noise barriers exceed both the Japanese and WBG guideline values. On the other hand, with over 1.5 m height noise barrier, operation noise can meet

Japanese and WBG guidelines except for “Melchora Aquino Elementary School” at nighttime. However, this school will not be in operation during nighttime so this will not affect the sensitive receptors. Therefore, at SB Section, if 1.5 m noise barriers are installed, operation noise won’t affect the sensitive receptors around the project area.

388. On the other hand, at BT Section, all points without noise barriers can meet both the Japanese and WBG guidelines. However, if there is a possibility that the type of train operation or operated train may change in the future, 1.5-m noise barrier walls are advised to be installed.

Table 4.4.44 Prediction of Operation Noise Level by Sensitive Receptor Location (SB Section)

No.	Sensitive Receptor and Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Classification of viaduct	Direction from ROW	2023-2040										2040-Onwards										Japanese guideline (LAeq)		WBG guideline (LAeq)	
							NB		1.5 m		2.0 m		2.5 m		3.0 m		NB		1.5 m		2.0 m		2.5 m		3.0 m		D	N	D	N
							D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N				
3	Antipolo St 945	Residential	1+000	35	Section 05	EAST	56	53	53	50	52	50	52	49	51	48	56	54	54	51	53	50	52	50	52	49	60	55	75	66
4	Antipolo St (Kingdom of Glory Christian Family Church)	Residential	1+250	40	Section 07	EAST	58	55	54	51	52	50	51	48	50	48	58	56	54	52	53	50	52	49	51	48	60	55	75	66
5	Our Lady of Lords, Dagupan Ext	Institutional	1+120	30	Section 07	WEST	58	56	54	52	53	51	52	50	52	49	59	56	55	52	54	51	53	50	52	50	60	55	75	66
7	Dagupan Ext	Residential	0+690	23	Section 03	WEST	61	58	57	54	56	53	55	52	54	51	61	59	57	55	56	54	55	53	55	52	60	55	75	66
8	Tondo Christian Church	Religious	1+000	47	Section 05	EAST	55	53	53	50	52	49	51	49	51	48	56	53	53	51	52	50	52	49	51	49	60	55	75	66
9	Solis-Dagupan Basketball Court	Recreational	0+940	10	Section 03	WEST	60	57	57	55	57	54	56	53	56	53	61	58	58	55	57	55	56	54	56	54	60	55	75	66
10	Solis Signal Tower (Casitas)	Old PNR structures	0+977	Within	Section 05	EAST	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	60	55	75	66
11	NHA MRB Dagupan Ext. (Bldg 6)	Residential	0+723	9	Section 03	WEST	60	57	57	55	57	54	56	54	56	53	61	58	58	55	57	55	57	54	56	54	60	55	75	66
12	NHA MRB Dagupan Ext. (Bldg 5)	Residential	0+680	9	Section 03	WEST	60	57	57	55	57	54	56	54	56	53	61	58	58	55	57	55	57	54	56	54	60	55	75	66
13	NHA MRB Dagupan Ext. (Bldg 4)	Residential	0+625	9	Section 03	WEST	60	57	57	55	57	54	56	54	56	53	61	58	58	55	57	55	57	54	56	54	60	55	75	66
14	New Antipolo Chapel	Religious	0+995	9	Section 05	EAST	55	52	54	51	53	51	53	50	53	50	56	53	54	52	54	51	53	51	53	51	60	55	75	66
15	MERALCO Power Grid Station	Commercial/Industrial	1+270	45	Section 07	WEST	58	55	54	51	52	50	51	49	50	48	58	56	54	52	53	50	52	49	51	48	60	55	75	66
16	Melchora Aquino Elementary School	Educational	0+780	7	Section 03	WEST	60	57	58	55	57	54	57	54	56	54	60	58	58	56	57	55	57	55	57	54	60	55	75	66
17	Maria Guizon Basketball Court	Recreational	1+240	Within	Section 07	WEST	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	60	55	75	66

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

No.	Sensitive Receptor and Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Classification of viaduct	Direction from ROW	2023-2040										2040-Onwards										Japanese guideline (LAeq)		WBG guideline (LAeq)	
							NB		1.5 m		2.0 m		2.5 m		3.0 m		NB		1.5 m		2.0 m		2.5 m		3.0 m					
							D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
19	Light of the World Christian Church	Religious	0+840	10	Section 03	WEST	60	57	57	55	57	54	56	53	56	53	61	58	58	55	57	55	56	54	56	54	60	55	75	66
20	Lakan Dula Elementary School	Educational	1+050	51	Section 05	WEST	57	54	53	51	52	50	51	49	50	48	57	55	54	52	53	50	52	49	51	49	60	55	75	66
22	Gregoria de Jesus Elementary School	Educational	0+810	42	Section 03	WEST	60	57	56	53	55	52	54	51	53	50	60	58	57	54	55	53	54	52	53	51	60	55	75	66
23	Brgy 204 (Barangay Hall)	Institutional	0+740	45	Section 03	EAST	60	57	56	53	55	52	54	51	53	50	60	58	56	54	55	53	54	52	53	51	60	55	75	66
26	Barangay (217) Hall	Institutional	1+190	13	Section 07	EAST	59	56	55	52	54	51	53	51	53	50	59	57	55	53	54	52	54	51	53	51	60	55	75	66
27	Barangay (213) Hall	Institutional	1+260	16	Section 07	EAST	59	56	55	52	54	51	53	50	52	50	59	57	55	53	54	52	54	51	53	50	60	55	75	66

Note: Pink cells are values that exceed guideline values.

Source: JICA Study Team

Table 4.4.45 Prediction of Operation Noise Level by Sensitive Receptor Location (BT Section)

No.	Location	Land Use Type	Chainage	Distance from edge of ROW (m)	Classification of viaduct	Direction from ROW	2023-2040										2040-										Japanese guideline (LAeq)		WBG-EHS guideline (LAeq)	
							NB		1.5 m		2.0 m		2.5 m		3.0 m		NB		1.5 m		2.0 m		2.5 m		3.0 m					
							D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N		
1	Molave St. 3124	Residential	1+250	45	Section 08	EAST	50	46	46	42	44	41	43	40	42	39	51	47	47	43	45	42	44	41	43	40	60	55	75	66
2	Barangay 228 Hall	Institutional	1+150	10	Section 07	EAST	52	48	48	44	47	43	46	42	45	42	53	49	49	45	48	44	47	43	46	43	60	55	75	66
6	Old Antipolo St 1124	Residential	1+350	10	Section 08	EAST	51	48	48	44	47	43	46	42	45	42	52	49	49	45	48	44	47	43	46	43	60	55	75	66
18	Manila Day Care Center	Educational	0+950	Within	Section 09	EAST	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	60	55	75	66
21	Harvester's Christian Fellowship Tondo Church	Religious	1+250	11	Section 08	EAST	51	48	48	44	47	43	46	42	45	42	52	49	49	45	48	44	47	43	46	43	60	55	75	66
24	Batangas Dulo Chapel	Religious	1+080	3	Section 04	EAST	51	48	48	45	47	44	47	43	46	43	52	49	49	45	48	45	48	44	47	44	60	55	75	66
25	Barangay (228) Carlo Lopez Multi-Purpose Hall	Institutional	1+080	Within	Section 04	EAST	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	60	55	75	66

Note: Pink cells are values that exceed guideline values.

Source: JICA Study Team

4.4.4 Vibration

389. This section presents the results of the baseline vibration assessment for the SBT Section. Baseline monitoring was conducted to establish typical vibration levels at representative locations within the project site and to identify existing sources of vibration measurements.

4.4.4.1 Scope of Study

(1) Study Area

390. Similar to baseline noise assessment, the Project ROW including the area extending 200 m from the edge of the ROW was considered appropriate for assessing vibration impacts for the works as the area encompasses the closest noise sensitive receptors either side of the rail alignment ROW.

391. The propagation of ground vibration is dependent on the type of activity and attenuation characteristics of the medium that the vibration is travelling through. Vibration impacts associated with civil infrastructure are typically limited to distances of up to approximately 50 m for structural damage and between 100 and 200 m for human disturbance (if there is no blasting). The study area assigned to the assessment of noise impacts is therefore considered adequate for determining impacts from ground vibration during construction and operation of the railway

(2) Vibration Sensitive Receptors

392. The identification and classification of sensitive receptors was undertaken via site investigations and a desktop study using available aerial imagery, land use maps, cadastral layers and building attribute points. The sensitive receptors are shown in **Figure 4.4.20**.

(3) Assessment Criteria

1) Baseline Vibration Criteria

393. The US FTA Manual prescribes criteria to protect human amenity and buildings (structural damage) from vibration produced during the construction and operational stages of transit projects. The human response to vibration and the appropriate criteria depends on the building use and frequency of events. Larger vibrations are generally tolerated if they occur less frequently.

394. The criteria for ground-borne vibration for different land uses and frequency is presented in **Table 4.4.46**. Since most buildings in the project area are residential, the Category 2 criteria are applicable. Event frequency is defined as:

- Frequent: more than 70 events per day
- Occasional: 30 to 70 events per day
- Infrequent: fewer than 30 events per day

Table 4.4.46 Ground-borne Vibration (GBV) Impact Levels

Land Use Category	GBV Impact Levels (VdB re 10 ⁻⁶ mm/0073)		
	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	93	93	93
Category 2: Residences and buildings where people normally sleep.	100	103	108
Category 3: Institutional land uses with primarily daytime use.	103	106	111

2) Construction Vibration Criteria

395. Construction vibration is assessed by both building and structural damage and human perception.

3) Damage Assessment

396. Under the FTA guidelines, building damage is assessed in units of PPV, 7.6m (mm/s) and the Lv at 7.6m (VdB). **Table 4.4.47** shows the building damage criteria for different building categories. Structures close to the SBT Section appear to be a mix of non-engineered timber and masonry buildings (Category III). Therefore, the building damage criterion of PPV 5 mm/s is adopted.

Table 4.4.47 Construction Vibration Damage Criteria

Building Category	Peak Particle Velocity (PPV) (mm/s)	Approximate Lv * (VdB)
I. Reinforced concrete, steel, or timber (no plaster)	13	142
II. Engineered concrete and masonry (no plaster)	8	138
III. Non-engineered timber and masonry buildings	5	134
IV. Buildings extremely susceptible to vibration damage	3	130

Note: *RMS velocity in decibels, VdB re 10^{-6} mm/s

4) Human Perception

397. Since most buildings in the area are used as residential, the Category 2 criteria are chosen in **Table 4.4.46**. Construction work can be intermittent with periods of sustained vibration. A conservative approach is to assume vibration events will be frequent. Therefore, the annoyance vibration criterion is 100 VdB.

5) Operational Vibration Criteria

398. FTA general vibration impact assessment relies on criteria assigned to specific receiver types (Categories) depending on the use of the space, and frequency of vibration and/or ground borne noise events. Impact criteria used in this impact assessment focuses on Category 2 receivers (**Table 4.4.46**).

399. For this assessment, the Solis-Blumentritt section of the line is projected to be used frequently (>70 trains per day) and the Tutuban – Blumentritt section to be used occasionally (30 to 70 trains per day). The FTA manual prescribes a ground borne vibration criterion of 100 VdB for receptors nearby the Solis Blumentritt line and 103 VdB for the Tutuban – Blumentritt section.

4.4.4.2 Baseline Assessment

400. In the absence of local regulations for the measurement and assessment of vibration from transit, vibration monitoring was conducted to establish baseline vibration levels with reference to the US FTA Manual. The measured baseline vibration levels supported the development of vibration criteria applied to the Project.

(1) Methodology

1) Survey Design

401. Vibration monitoring was undertaken to determine typical vibration levels in relation to human sensitivity and the potential for annoyance. Human response to vibration is measured with units of root-mean-squared (RMS) velocity levels, expressed in VdB. Vibration measurements were not used for criteria derivation but are required to quantify the baseline environment in areas adjacent to the project corridor.

402. A Vibron Seismometer connected to a geophone was used to measure regular samples of the vibration velocity level in decibels (VdB) over the 24-hour observation period at each location. Each triaxial geophone was installed at the observation area in an orthogonal arrangement. The geophone has a natural frequency of 4.5 Hz and a sampling frequency of 200 samples per second.

2) Sampling Location

403. Suitable monitoring locations were identified in areas where sensitive receptors could be affected by construction and operational activities associated with the Project. Available aerial images of the area, site investigations, and engagement with key stakeholders and the community were used to refine and prioritize the locations. The high-density residential buildings immediately adjacent to the proposed SBT Section are closest and therefore at the highest risk of being impacted by noise throughout the Project.

404. Ambient vibration monitoring was undertaken at two locations in the project area from the 17 to 19 November 2020 (V1 and V2). **Table 4.4.48** provides a summary of the vibration measurement locations with **Figure 4.4.20** showing the location of the monitoring in context of the surrounding area. Vibration sampling points (V1 and V2) have the same location as noise sampling points as previously presented in.

405. Both sites were located in areas considered to be Category 2 as they are primarily used for residential purposes. The ambient background levels measured at the locations presented have been used to approximate the vibration environment and in turn develop appropriate criteria for these locations where relevant.

Table 4.4.48 Vibration Monitoring Locations

Station Name	Measurement	Barangay	City/Municipality	Coordinates	Date
V1	Noise and Vibration	Barangay 185	Tondo I/II – City of Manila	14.628786 N 120.975485 E	04-05 November 2020
V2	Noise and Vibration	Barangay 228	Tondo I/II – City of Manila	14.621882 N 120.975104 E	05-06 November 2020

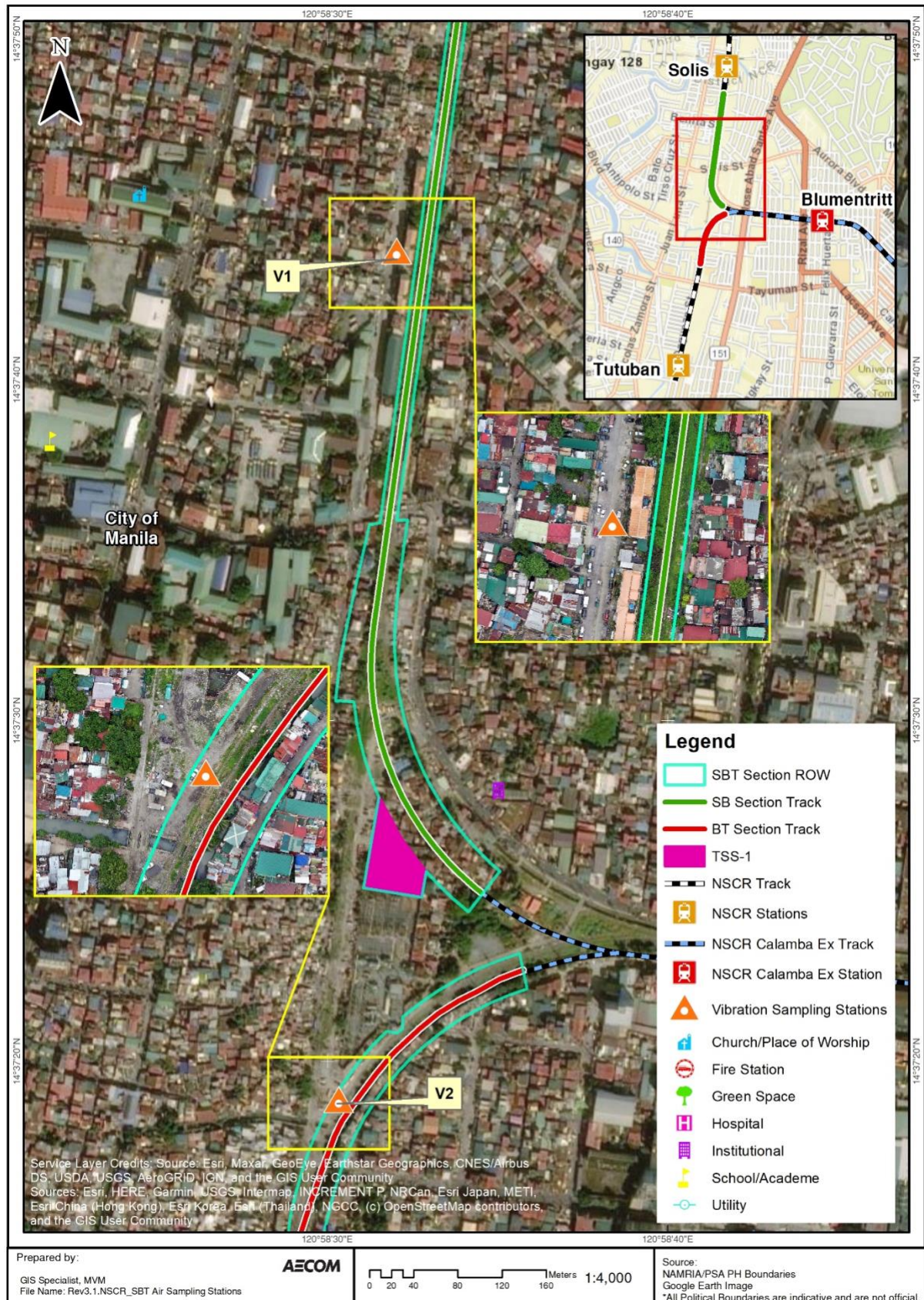


Figure 4.4.20 Vibration Monitoring Stations

(2) Data Assessment

406. The measured vibration levels were compared to FTA criteria for human annoyance for different frequencies of events and land use categories (**Table 4.4.46**) to determine the likelihood of existing vibration impacts. The frequent event criterion (i.e., >70 events per day) of 100 dBV was selected for comparison as it is the more conservative criterion.

(3) Results and Discussion

407. **Table 4.4.49** shows the measured vibration levels in VdB at V1 and V2 measurement sites.

408. In the comparison of measured baseline vibration levels with FTA GBV criteria based on the monitoring site land use, the sampling area was considered to be predominantly Category 2 (residences and buildings where people normally sleep). The results of the vibration monitoring at both locations confirm the measured baseline vibration levels are below the FTA GBV vibration impact criteria to protect people in residential and institutional buildings from annoyance.

409. The sources of vibration are predominantly light vehicles, domestic activity, animals, and train pass-bys. The traffic conditions were light to moderate during the measurement period. During peak hours, with train pass-by events every 10 to 20 minutes the vibration levels increase to 58 VdB. These vibration levels are below the threshold for human perception (65 VdB) and frequent event criterion of 100 dBV. Hence, it is unlikely that receptors exposed to this level of vibration would currently experience annoyance.

Table 4.4.49 Maximum Measured Vibration Levels

Sampling Station	Morning (5am-9am)	Day (9am-6pm)	Evening (6pm-10pm)	Night (10pm-5am)	FTA GBV Criteria	
					Approximate threshold for human perception of vibration	Frequent event criterion for Category 2
V1	57 VdB	57 VdB	58 VdB	54 VdB	65 VdB	100 VdB
V2	57 VdB	54 VdB	54 VdB	55 VdB	65 VdB	100 VdB

Note: Gray highlights depict the recorded peak vibrations.

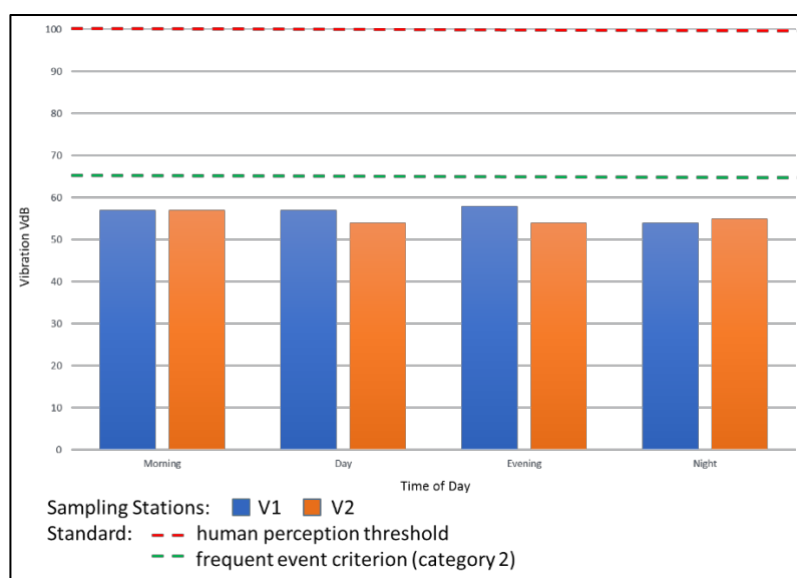


Figure 4.4.21 Measured Vibration Levels Compared with FTA GBV Criteria

4.4.4.3 Construction Vibration Assessment

(1) Prediction Methodology

410. Typical surface construction works with the potential to generate increased levels of vibration include excavation works, piling, and compacting. Vibration impacts from construction are usually described as either levels that cause annoyance or levels where structural damage may occur.

411. Ground-borne vibration levels as a result of equipment operating within the vicinity of sensitive buildings were predicted using several empirical formulae. Like air-borne construction noise, ground-borne vibration propagation is dependent on several factors, including:

- distance between vibration source and receiver
- ground type between source and receiver
- construction vibration sources and their operating speeds/conditions
- receiving building construction type
- nature of occupancy of receiving building.

412. Specific information about the equipment being used, geological conditions and the condition of structures near the proposed construction works is generally limited during preconstruction phases of a project. Consequently, a risk-based approach is adopted at this stage of a project to allow for vibration management measures to be developed for locations, structures or assets that fall within calculated safe working distances. The assessment of vibration-induced impacts during construction has been undertaken by:

- Identifying the locations and distances to occupancies, structures and assets in relation to the construction works.
- Determining the safe working distances for relevant construction activities using relevant guideline values for protecting occupancies and vibration sensitive buildings. The safe working distances have been determined using typical levels of ground vibration and the guideline values documented in the FTA manual.
- Highlighting areas where occupancies, structures and assets fall within the safe working distances.
- Proposing mitigation measures aimed at managing the risk of vibration-induced damage.

(2) Emission source

413. Equipment substitution, pre-construction vibration monitoring, condition surveys and monitoring during works are all documented methods for managing the risk of vibration-induced impacts. For most receptors, the controlling vibration criterion (more stringent) is the human comfort criterion and separate criteria are not normally required in relation to the effect of construction vibration on building contents. The vibration source levels from typical construction equipment and activities are enumerated in the **Table 4.4.50**.

Table 4.4.50 Vibration Source Levels for Construction Equipment

Equipment		PPV at 7.6 m mm/s	Approximate Lv * at 7.6 m
Pile Driver (impact)	Upper range	38.56	112
	Typical	16.36	104
Pile Driver (sonic)	Upper range	18.64	105
	Typical	4.32	93
Clam shovel drop (slurry wall)		5.13	94
Hydromill (slurry wall)	In soil	0.20	66

Equipment		PPV at 7.6 m mm/s	Approximate Lv * at 7.6 m
	In rock	0.43	75
Vibratory Roller		5.53	94
Hoe Ram		2.26	87
Large bulldozer		2.26	87
Caisson drilling		2.26	87
Loaded trucks		1.93	86
Jackhammer		0.89	79
Small bulldozer		0.08	58

Source: Table 7-4 of the FTA Manual

(3) Construction Vibration Assessment Scenarios

414. Construction scenarios have been developed to assess impacts when vibration is expected to be greatest (i.e. worst-case). These worst-case scenarios have been developed based on all fixed and mobile plant equipment operating simultaneously over the relevant assessment period for the following stages:

- Relocation of waterway: Relocation of the channel that runs parallel to the rail alignment. The activity likely to cause the highest level of vibration in this stage is sheet piling.
- Viaduct: Construction of the viaduct piers and raising of the superstructure. Bore piling is the dominant activity.
- Maintenance road: Construction of the maintenance road that runs parallel to the rail alignment and on top of the channel the vibratory roller is the dominant piece of vibratory equipment during this stage.

(4) Results and Discussion

415. The single highest vibration source for each scenario was identified and the PPV at 7.6m (mm/s) and the Lv at 7.6m (VdB) were obtained through either field measurement (sheet piling) or from Table 4.4.24 (Table 7-4 of the FTA manual).

416. Table 4.4.23 shows the reference vibration levels in mm/s and VdB for each dominant equipment item and the required setback distance to comply with the human perception and building damage criteria of 72 VdB and 5 mm/sec respectively.

417. From the vibration source or equipment to the receiver¹², a setback distance of 5 m for building damage is appropriate for piling and 25 m for human perception. The vibratory roller used for the maintenance road requires a setback distance of 8 m for building damage and 40 m for human annoyance.

Table 4.4.51 Construction Vibration Setback Distances for Human Comfort and Building Damage

Construction Scenario	Equipment Activity	Building damage			Human perception		
		Reference	Criteria	Required setback distance	Reference	Criteria	Required setback distance
		PPV at 7.6 m (mm/s)		(m)	Lv at 7.6 m (VdB)		(m)
Relocation of waterway	Sheet piling	2.0	5	5	126	72	25
Viaduct	Bore piling	2.3	5	5	127	72	25
Maintenance Road	Vibratory roller	5.3	5	8	135	72	40

¹² A receiver is a vibration-sensitive building (e.g., residence, hospital, or school) where the vibrations may cause perceptible shaking of the floors, walls, and ceilings and a rumbling sound inside rooms. Not all receivers have the same vibration sensitivity. Consequently, vibration criteria are established for the various types of receivers.

Note: orange highlights depict the reference vibration levels that might exceed the criteria if no setback distance requirements are applied.

418. For most receptors, the controlling vibration criterion (more stringent) is the human comfort criterion and separate criteria are not normally required in relation to the effect of construction vibration on building contents. Construction vibration during the use of heavy machinery (sheet piling, bore piling and vibratory rollers) is expected to be perceptible at distances up to 40 m from each activity. Consideration should be given to the operating schedule such that high levels of vibration only occur during the day where feasible.

4.4.4.4 Operational Vibration Assessment

(1) Prediction Methodology

419. In the absence of relevant local regulations, the General Assessment procedures for predicting and assessing vibration impacts of proposed mass transit projects provided in the US FTA Manual have been adopted for operational vibration assessment of the SBT Section.

(2) Operational Vibration Modelling Scenarios

420. In accordance with the assessment procedure, adjustments have been made to account for the presence of crossovers and elevated transit structures. Tables of source adjustment factors are included in the FTA Manual (refer to Table 6-11 to Table 6-13 in the FTA Manual) to account for these features, the estimated ground environment, receiver building type, train speed, suspension, track condition, and track treatment.

(3) Results and Discussion

421. The FTA manual provides generalized ground surface vibration curves at varying distances to the track centerline at a reference speed of 50 mph (80 km/h). These base vibration levels from this chart are shown in **Table 4.4.52**. Tables of source adjustment factors are included in the FTA manual to allow for features of the train, track, ground environment and receiver building. The predicted vibration is below the lowest impact threshold of 100 VdB for Category 2 at distances of more than 3 m from the rail centerline.

Table 4.4.52 Predicted Operational Vibration

Distance to Rail Centerline (m)	Reference Vibration, Lv, VdB	Adjustments, VdB			Expected Vibration Level, VdB	GBV Criteria for Category 2, VdB
		Speed	Elevated track	Wood frame house		
3	110	-1.9	-10	-5	93	100
5	108	-1.9	-10	-5	91	100
10	104	-1.9	-10	-5	87	100
20	99	-1.9	-10	-5	82	100
40	93	-1.9	-10	-5	76	100
80	85	-1.9	-10	-5	68	100

4.5 THE PEOPLE

4.5.1 Socio-Economic Baseline

422. Socio-economic baseline information for the project-affected persons in direct and indirect impact areas includes the current socio-economic conditions of the host communities in terms of demography; migration pattern; local economy; public utilities, infrastructure and services; occupational and community health and safety; infectious diseases; land use and utilization of local resources; water usage, water rights, and right of commons; historic and cultural heritage; and transportation network.

4.5.1.1 Scope of Study

(1) Study Area

423. The baseline study covered the host city of Manila, and its corresponding regional and national level data, National Capital Region (NCR) or Metro Manila, and Philippines. The study has particular attention to the direct and indirect impact barangays identified (**Section 1.3.3**).

(2) Limitations of the Study

424. Baseline data were gathered and compiled from secondary data sources as indicated in Table 5.4.1 primarily from Philippine Statistics Authority (PSA) website, SBT Section RAP (2021), NSCR Calamba Ex Project EIS (2020), NSCR Project ERPMP (2015) and other reports prepared by JICA Design Team for the Project.

4.5.1.2 Methodology

(1) Baseline Assessment

425. The methodology included: (1) data collection and review from sources as provided in **Table 4.5.1** as well as (2) processing, analysis, cross-checking and validation of baseline information with key stakeholders on engineering, environmental and social considerations.

426. Stakeholder engagement activities were undertaken in accordance with the JICA Guidelines and DAO 2017-15, Guidelines on Public Participation under the PEISS. **Chapter 9** (Public Consultation Documentation) provides the list and detailed discussions of the stakeholder engagement activities conducted.

(2) Sources of Baseline Data

427. **Table 4.5.1** presents the references and/or sources of socio-economic baseline information relevant to the host city of Manila.

Table 4.5.1 Sources of Socio-Economic Baseline Data

Source		Information
Document	Provider	
DD RAP Reports for the SB Section and BT Section	DOTr, JDT	• Affected Households and Population • Affected Livelihood • Affected Structures and Trees • Resettlement Preference • Livelihood Assistance Preference
DD EIS Report for NSCR Calamba Extension		• Manila City Profile • Transportation Network • Traffic Impact Assessment
Census of Population and Housing	PSA	

Source		Information
Document	Provider	
Family Income and Expenditure Survey		• Population • Projected Population • Growth Rate • Number of Households • Gender and Age Distribution • Literacy Rates • Educational Attainment • Vital Statistics • Migration Profile • Main source of water supply • GRDP Growth Rates by Industrial Origin at Current Prices (%)
National Health Facility Registry Website	DOH	• Health facilities
Crime Statistics Data	PNP	• Crime rates

4.5.1.3 Demography

428. The demographic characteristics of the Project are presented at the local, regional and/or national level based on best available data.

(1) Population Profile

429. The population and household data of the Philippines, NCR, and City of Manila are shown in **Table 4.5.2**. These are based on the census conducted in 2010, 2015, and 2020 as published by the PSA. As of 2020, Manila's population accounts for 14.0 % of the regional population despite of 16 other cities/municipalities in the region. Extremely high population density can be seen from Manila's rate at 73,920 persons/km² which is more than 3 times of the regional average of 21,765. However, the city's annual population growth rate is lower than the national and regional average.

Table 4.5.2 Demographic Characteristics of the Host LGU

LGU	Land Area (km ²)	Total Population			Annual Growth Rate ('15-'20)	Population Density (person/km ²)
		2010	2015	2020		
Philippines	300,000	92,335,113	100,979,303	109,033,245	1.63	363
NCR	619.5	11,855,975	12,877,253	13,484,462	0.97	21,765
Manila	24.9	1,652,171	1,780,148	1,846,513	0.77	73,920

Source: Philippine Statistics Authority

430. Based on the RAP Reports for the SB Section and BT Section (2021), **Table 4.5.3** shows that there are 841 project-affected persons (PAPs) who will be directly affected. The PAPs include households (HH), households with businesses, businesses only, institutions and those whose impact is on their property only. Of this total, there are 696 project-affected households (PAHs) estimated residing within the affected area of the project ROW and the total number of affected household members is 2,540. Among the PAHs, 669 were interviewed while 27 were not interviewed.

Table 4.5.3 Project-Affected Persons and Households by Barangay

Bara- ngay	Residing within the ROW				Non-Residing within the ROW					PAPs		HH Popu- lation
	HH only	HH with affected business	No	%	Business owners	Insti- tution	PAP whose impact is on property only	No	%	No	%	
SB	353	37	390	100	19	0	58	77	100	467	100	1,444
164	14	4	18	4.6	0	0	3	3	3.9	21	4.5	62

Bara- ngay	Residing within the ROW				Non-Residing within the ROW					PAPs		HH Popu- lation
	HH only	HH with affected business	No	%	Business owners	Insti- tution	PAP whose impact is on property only	No	%	No	%	
165	76	13	89	22.8	8	0	14	22	28.6	111	23.8	345
217	237	18	255	65.4	11	0	40	51	66.2	306	65.5	931
218	26	2	28	7.2	0	0	1	1	1.3	29	6.2	106
BT	288	18	306	100	3	4	61	68	100	374	100	1,096
155	2	1	3	1.0	0	0	7	7	10.3	10	2.7	18
159	22	5	27	8.8	0	0	23	23	33.8	50	13.4	111
221	81	5	86	28.1	0	3	23	23	33.8	109	29.1	272
227	3	0	3	1.0	0	0	3	3	4.4	6	1.6	8
228	180	7	187	61.1	3	1	5	9	13.2	196	52.4	687
Total	641	55	696	82.8	22	4	119	145	17.2	841	33.1	2540

Source: JICA Design Team

(2) Gender and Age Profile

431. **Table 4.5.4** summarizes the gender and age profile of Manila City as of 2015 census. The gender distribution is almost equal at 49.2% for males and 50.7% for females. The age group 15-64 accounts for 67.4% of the total population, making only 32.6% of the population fall under the category of dependents (children and retirement age).

Table 4.5.4 Gender and Age Profile of Manila City

LGU	Population (2015)	Gender Distribution				Age Groups					
		Male		Female		0-14		15-64		65 and above	
		No	%	No	%	No	%	No	%	No	%
Manila	1,780,148	876,687	49.2	876,687	50.7	598,272	28.6	1,110,381	67.4	71,495	4.0

Source: 2015 Census of Population, Philippine Statistics Authority

432. Based on the RAP survey data (**Table 4.5.5**), of the 2,540-household population affected by the Project, the gender distribution is almost equal with 1,279 males (50.4%) and 1,261 females (49.6%). The average household size for the barangays ranges from three to six, Barangay 155 with the highest average (6).

Table 4.5.5 Gender Profile of HH Population by Barangay

Barangay	Interviewed PAHs	Population by Gender				Total	Ave. HH Size
		Male	%	Female	%		
SB	372	715	49.5	729	50.5	1,444	4
164	17	31	50.0	31	50.0	62	4
165	83	180	52.2	165	47.8	345	4
217	245	449	48.2	482	51.8	931	4
218	27	55	51.9	51	48.1	106	4
BT	297	564	51.5	532	48.5	1,096	3
155	3	9	50.0	9	50.0	18	6
159	24	53	47.7	58	52.3	111	5
221	81	143	52.6	129	47.4	272	3
227	3	3	37.5	5	62.5	8	3
228	186	356	51.8	331	48.2	687	4

Barangay	Interviewed PAHs	Population by Gender				Total	Ave. HH Size
		Male	%	Female	%		
Total	669	1279	50.4%	1261	49.6%	2540	4

Source: JICA Design Team

433. Among the age groups used for the SES, the age group 21-40 had the most population for both SB (470) and BT (376), followed by age group 41-59. These figures show that majority of the affected population fall under the age groups considered to be part of the labor force.

Table 4.5.6 Age Distribution Profile of HH Population

Section	Gender	Age Distribution of Household Members									Total	%
		<1	1-6	7-12	13-16	17-20	21-40	41-59	60 >	NR		
SB	Male	3	77	92	47	69	235	122	63	9	717	49.7
	Female	6	82	70	60	61	235	139	70	4	727	50.4
	Total	9	159	162	107	130	470	261	133	13	1444	100
BT	Male	3	88	74	43	48	192	82	46	1	564	51.5
	Female	3	60	69	42	42	184	73	33	7	532	48.5
	Total	6	148	143	85	90	376	155	85	8	1096	100
Total	Male	6	165	166	90	117	427	204	109	10	1281	50.4
	Female	9	142	139	102	103	419	212	103	11	1259	49.6
	Total	15	307	305	192	220	846	416	212	21	2540	100

Source: JICA Design Team

(3) Literacy and Educational Attainment

434. Basic or simple literacy is the ability of a person to read and write with understanding a simple message in any language or dialect, as defined by PSA. In 2015, almost all (99.8%) of Manila population for 10 years old and over have basic literacy.

Table 4.5.7 Literacy Rates of Household Population 10 Years Old and Over

LGU	Household Population			Literates and Literacy Rate					
	Total	Male	Female	Total		Male		Female	
				No.	%	No.	%	No.	%
Philippines	79,317,452	39,882,640	39,434,812	69,498,417	87.6	34,768,675	87.2	34,729,740	88.1
Manila	1,412,632	684,683	727,949	1,410,170	99.8	683,427	99.8	726,743	99.8

Note: Literacy rates (percentages) for Philippines were only computed using number of literate population and total household population for 10 years old and over

Source: Philippine Statistics Authority (2015)

435. **Table 4.5.8** presents the highest educational attainment of Manila City residents for 5 years old and above. Majority of the population (39.2%) have attained high school education, followed by elementary (20.5%), academic degree holder (18.6%), and college under-graduate (17.7%). Based on this data, all population 5 years old and over have attained at least pre-school and none received no education at all.

Table 4.5.8 Educational Attainment of 5 Years Old and Above of Manila City

Educational Attainment	No	%
Pre-School	34,132	2.2
Elementary	318,354	20.5
High School	609,088	39.2
Post-Secondary	28,476	1.8
College Under-graduate	274,021	17.7
Academic Degree Holder	288,127	18.6

Educational Attainment	No	%
Total Population 5 yrs <	1,552,198	100

Source: Philippine Statistics Authority (2015)

436. **Table 4.5.9** shows the distribution of educational attainment among project-affected household population (2021). High school graduate has the largest population (26.3%), followed by high school level (20.0%), and college level (16.1%). It can be noted that 125 PAPs (4.9%) responded none or did not receive education, which is a substantial difference with the 2015 PSA data wherein all population 5 years and over have attained at least pre-school level.

Table 4.5.9 Educational Attainment Profile of HH Population

Educational Attainment	SB			BT			Total			
	M	F	Total	M	F	Total	M	F	Total	%
Pre-school	0	0	0	21	13	34	21	13	34	1.3
Elementary Level	27	35	62	100	84	184	127	119	246	9.7
Elementary Graduate	17	18	35	22	16	38	39	34	73	2.9
High School Level	176	79	255	126	127	253	302	206	508	20.0
High School Graduate	261	175	436	108	123	231	369	298	667	26.3
Vocational/Technical	59	14	73	17	12	29	76	26	102	4.0
College Level	192	113	305	54	51	105	246	164	410	16.1
College Graduate	159	111	270	48	47	95	207	158	365	14.4
Advanced College/ University Degree	1	6	7	1	0	1	2	6	8	0.3
SPED	0	0	0	0	2	2	0	2	2	0.1
None	1	0	1	67	57	124	68	57	125	4.9
Total	893	551	1,444	564	532	1096	1457	1083	2540	100

Source: JICA Design Team

(4) Vulnerable Groups

437. Vulnerable groups refer to households who are living below poverty threshold, a household headed by the elderly or a solo-parent, or a household with a person with a disability (PWD), very ill, or mentally challenged. These households are targeted for special assistance to ensure that they are equipped to rehabilitate themselves from the effects of displacement.

438. **Table 4.5.10** lists the 269 vulnerable households identified in the RAP survey (2021). A total of 185 households or 27.7% of the total households have single vulnerability while, while 84 (12.6%) have multiple forms or a combination of vulnerabilities. For instance, a household belonging to the ABC group is below the poverty threshold and is headed by an elderly who is a solo parent with dependent/s.

Table 4.5.10 PAHs with Vulnerability

Section	Households with 1 Vulnerability					Households with more than 1 Vulnerability												Total
	A	B	C	D	Total	AB	AC	AD	BC	BD	CD	ABC	ABD	ACD	BCD	ABC D	Total	
SB	27	33	34	8	102	5	7	1	18	4	6	5	1	2	2	1	52	154
BT	30	30	20	3	83	9	6	1	9	1	4	0	0	1	1	0	32	115
Total	57	63	54	11	185	14	13	2	27	5	10	5	1	3	3	1	84	269
SB	Business unit																	62
	Business owners/ PAP																	56

Section	Households with 1 Vulnerability					Households with more than 1 Vulnerability											Total	
	A	B	C	D	Total	AB	AC	AD	BC	BD	CD	ABC	ABD	ACD	BCD	ABC D		Total
BT	Business unit																	22
	Business owners/ PAP																	21

Note: A - HH below Poverty Threshold ; B- HH headed by solo parents with dependent; C - HH headed by an elderly; D – HH with member who is a PWD

Source: JICA Design Team

439. Aside from the socially and economically vulnerable households, some persons are also physical and emotionally vulnerable during transfer, e.g., babies and toddlers, pregnant women, the elderly, the sick or very ill, and the physically and mentally challenged. **Table 4.5.11** shows the number of PAPs which require assistance per category and per section (2021). These categories total to 453 PAPs which is equivalent to 17.8% of the total affected persons. A large portion accounts for the 215 elderlies and 177 babies/toddlers.

Table 4.5.11 PAPs Requiring Special Assistance During Transfer

Category	SB		BT		Total	
	No of Persons	% of total PAPs	No of Persons	% of total PAPs	No of Persons	% of total PAPs
Baby/Toddler	92	34.6	85	45.5	177	39.1
Elderly	134	50.4	81	43.3	215	47.5
Pregnant	6	2.3	9	4.8	15	3.3
Physically disabled	17	6.4	8	4.3	25	5.5
Mentally challenged	10	3.8	3	1.6	13	2.9
Sick/Very Ill	7	2.6	1	0.5	8	1.8
Total	266	100	187	100	453	100.0

Source: JICA Design Team

440. **Table 4.5.12** summarizes the households that require additional assistance before, during, and after moving from the place of origin to the resettlement site or replacement property (2021). Households with these members were identified to be informed of the relocation process. The aforementioned tables show that these 453 vulnerable persons are from 322 households: 50 households having more than two vulnerable persons and 272 households having one vulnerable person.

Table 4.5.12 Households Requiring Special Assistance During Transfer per Barangay

Barangay	HH with Multiple vulnerable PAPs during transfer	HH with 1 vulnerable PAP during transfer	Total
SB	34	152	186
BT	16	120	136
Total	50	272	322

Source: JICA Design Team

441. **Table 4.5.13** shows the poverty threshold and incidence and food thresholds and subsistence incidence in Philippines, NCR, and Manila City. The incidence of poverty and subsistence in Manila City are lower than the regional average of NCR and national average.

Table 4.5.13 Per Capita Poverty Threshold and Poverty Incidence

Region / Province	Per Capita Poverty Threshold (in PhP)	Poverty Incidence (%)	Per Capita Food Threshold (in PhP)	Subsistence Incidence (%)
Philippines	25,813	12.1	18,126	3.4
NCR	28,682	1.4	20,029	0.2

Region / Province	Per Capita Poverty Threshold (in PhP)	Poverty Incidence (%)	Per Capita Food Threshold (in PhP)	Subsistence Incidence (%)
Manila City	28,682	1.9	20,029	0.5

Source: Philippine Statistics Authority, 2018

442. **Table 4.5.14** shows data from the RAP survey (2021) for the PAHs' status vis-à-vis poverty threshold. Majority (76.2%) of the households are above the threshold while only 13.3% fall below the poverty threshold. Despite being non-land owners, 73.9% of NLOs are categorized as above property threshold.

Table 4.5.14 Households Above and Below Poverty Threshold by Tenure Status per Barangay

Section		Below Poverty Threshold			Above Poverty Threshold			No response	TOTAL
		LO	NLO	Subtotal	LO	NLO	Subtotal		
SB	Total	5	44	49	40	65	305	18	372
	%	1.3	11.8	13.2	10.8	17.5	82.0	4.9	100
BT	Total	2	45	47	18	187	205	45	297
	%	0.7	15.2	15.8	6.1	63.0	69.0	15.2	100
Total	Total	7	89	96	58	252	510	63	669
	%	1.0	13.3	14.3	8.7	37.7	76.2	9.4	100.0

Note: LO: Landowner; NLO: Non-landowner ; Total excludes no response

Source: JICA Design Team

(5) Ethnic Minorities and Indigenous Peoples

443. There are no identified indigenous people nor existing and potential ancestral domain in both Solis-Blumentritt and Blumentritt-Tutuban sections.

4.5.1.4 Migration Pattern

(1) In-Migration

444. In-migration refers to a form of geographical spatial mobility of people involving a change in usual residence within a country (region, province, city/ municipality) during a specified period of observation for economic, social, political, or cultural reasons (Siegel and Swanson, 2004 localized to the Philippine setting).

445. **Table 4.5.15** summarizes the in-migration profile of the host LGU in 2000 and 2010. This data represents the migration from another city/municipality, province, and country. Data for both years show that change in residence within the city is very common among Manila residents. This is followed by migration from another province with consistent rate at 4.0%.

Table 4.5.15 In-Migration in Manila City

Type of In-migration	Migrant Population	% of Total Migrants
2000		
Total	1,390,467	100.0
Within the city	1,240,641	89.2
From another city	6,657	0.5
From another province	58,296	4.2
From another country	4,932	0.4
2010		
Total	1,480,508	100.0
Within the city	1,409,934	95.2

Type of In-migration	Migrant Population	% of Total Migrants
From another city	9,434	0.6
From another province	58,923	4.0
From another country	2,005	0.1

Source: 2000 & 2010 Census of Population and Housing, Philippine Statistics Authority

(2) Displacement/Involuntary Resettlement

446. The overall NSCR Project ROW will traverse ten barangays of the City of Manila. This has a substantial impact for the people who are living along the SBT Section/ Project ROW. The acquisition of 11,383 m² in a densely populated area will result to the displacement of all project-affected persons (2,622). The area and population computes to three persons per square meter (3persons/m²) density. This will result to possible loss of livelihood, transferring of schools for students, change in culture, destruction of community.

447. Physical and economic displacement, if unmitigated, may increase severe economic, social, and environmental risks, such as: dismantling of production systems; impoverishment among the population due to loss of income; reduced employment opportunities for the relocated population; and, harm to cultural heritage and identity.

448. Based on the Project's RAP (2021), and as shown in **Table 4.5.16**, the Project will affect 688 households with a total population of 2,622. Of the affected households, 277 belongs to the vulnerable group. Aside from the households, including 79 business owners will be affected and 87 employees.

Table 4.5.16 Summary of Affected PAPs

Types of loss and affected persons	Unit of Measure	SB	BT	Total
Total Affected Households	Households	372	316	688
Household Population	Persons	1,444	1,178	2,622
Vulnerable groups	Households	154	123	277
Business employees	Persons	62	25	87
Business owners	Persons	56	23	79

Source: JICA Design Team

449. PAPs' preference for resettlement were asked as part of the RAP (**Table 4.5.17**) (2021). Majority of the affected households prefer to be relocated in a resettlement site within the same barangay or city (63.2%), and to be within Metro Manila (15.0 %) while 17.7% prefer to be in another province or region.

Table 4.5.17 Preferred Resettlement Location of Affected Households

Preferred Location for Resettlement Site	SB				BT				Total			
	LO	NLO	Total	%	LO	NLO	Total	%	LO	NLO	Total	%
Same Barangay	8	44	52	14.0	4	28	32	10.1	12	72	84	12.2
Within same city	26	169	195	52.4	13	139	156	49.4	43	308	351	51.0
Within Metro Manila City/Municipality within the same region	6	36	42	11.4	6	52	61	19.3	15	88	103	15.0
City/Municipality in other Province/Region	8	60	68	18.4	2	52	54	17.1	10	112	122	17.7
No Response	1	14	15	4.0	0	13	13	4.1	1	27	28	4.1
Total	49	323	372	100.0	32	284	316	100.0	81	607	688	100.0

Note: For BT Section, one of the preferred location is

Source: JICA Design Team

450. As part of the Project's commitment, livelihood restoration assistance will be offered to PAPs as well. **Table 4.5.18** shows the PAPs' preference on the type of assistance they would like to receive. Out of 717 responses, 292 were for financial assistance, followed by other types of assistance (191), and employment in any sector.

Table 4.5.18 Preferred Livelihood Restoration Assistance

Livelihood Restoration/ Assistance	Household		HH with Business		Business		Farm with Business	Non-resident Landowner	Institution	Total
	SB	BT	SB	BT	SB	BT	SB	SB	BT	
Job/ employment within the current sector	69	67	3	1	0	0	0	0	1	141
Any job/ employment	67	88	6	2	1	1	0	0	0	165
Financial Assistance	112	149	12	8	5	4	1	0	1	292
Replacement land/business structure	23	6	22	10	10	4	1	1	1	78
Vocational Skills Training	5	6	0	0	0	0	0	0	1	12
Others	116	67	3	1	3	0	0	0	1	191
No response	5	7	1	1	0	0	0	0	0	14
Total (N)	335	298	37	18	18	5	1	1	4	717

Note: Multiple Response

Source: JICA Design Team

4.5.1.5 Local Economy

(1) GRDP, Income Classification and Economic Activities

451. For NCR, the sector with the highest average gross regional domestic product (GRDP) growth rate is the service sector. The region has zero activities under mining and quarrying, and lowest growth rate for fishing.

Table 4.5.19 Gross Regional Domestic Product Growth Rates at Current Prices

INDUSTRY/YEAR	13-14	14-15	15-16	16-17	17-18
NCR					
I. AGRICULTURE, HUNTING, FORESTRY & FISHING	20.1	19.5	3.0	1.5	-1.7
a. Agriculture and Forestry	20.6	19.7	3.0	1.5	-1.8
b. Fishing	-13.0	1.4	-2.0	3.7	10.0
II. INDUSTRY SECTOR	5.7	7.4	4.2	2.1	6.3
a. Mining and Quarrying	-	-	-	-	-
b. Manufacturing	7.8	6.2	6.7	5.7	0.7
c. Construction	-1.5	8.0	-0.3	-14.1	23.4
d. Electricity, Gas and Water Supply	7.2	11.2	0.4	6.6	11.7
III. SERVICE SECTOR	9.7	8.1	10.6	10.3	9.0
a. Transportation, Storage & Communication	8.2	11.5	10.3	4.9	7.9
b. Trade and Repair of Motor Vehicles, Motorcycles, Personal and Household Goods	8.7	7.4	9.9	11.1	8.7
c. Financial Intermediation	10.3	6.7	9.2	11.3	11.6
d. Real Estate, Renting & Business Activities	16.1	11.2	14.1	10.3	5.5
e. Public Administration & Defense; Compulsory Social Security	2.1	1.5	13.1	14.6	21.3
f. Other Services	6.3	7.4	7.2	7.6	8.1
GROSS DOMESTIC PRODUCT	9.0	7.9	9.5	8.9	8.6

Source: Philippine Statistics Authority, 2013 to 2018

452. The Department of Finance - Department Order No. 23-08 dated 29 July 2008 prescribed the re-classification of income brackets for provinces, cities and municipalities in the Philippines. Among others, this serves as basis for the determination of the financial capability of LGUs to provide in full or in part the funding requirements of development projects and other priority needs in their locality.

453. **Table 4.5.20** shows the economic profile of the host LGU in terms of income classification and major economic activities. Aside from manufacturing, the common economic activities in Manila are service-related industries such as leisure, tourism, and amenities.

Table 4.5.20 Income Classification and Main Economic Activities of Host LGUs

LGU	Income Class	Main Economic Activities	Industries/estates	Shopping Malls	Tourism Areas
Manila	1st class 12,832,646	Manufacturing - Textile, food, personal products, chemical/pharmaceutical, rubber/plastic Services – leisure, amenities	None	Robinsons Place Manila	Intramuros Rizal Park

(2) Labor Force and Employment

454. Municipal or city level data on labor and employment are not available. The regional data on labor force and employment rate for 2020 in comparison with Philippine data are presented in **Table 4.5.21**. Based on the 2021 Labor Force Survey (LFS) of PSA, 87.7% of the economically active population aged 15 years and over in NCR are employed.

455. The region recorded an unemployment rate of 12.3% in April 2020, which is 5.3% lower than the national unemployment rate. Underemployed persons, defined as employed persons who expressed the desire to have additional hours of work in their present job or to have additional job or have a new job with longer working hours, were estimated at 10.2% of the total employed persons in the region. This is much lower compared to the national underemployment rate of 18.9%.

Table 4.5.21 Labor Force and Employment Rate

Labor Force and Employment Indicator	April 2020	
	Philippines	NCR
Population 15 Years Old and Over ('000)	73,722	9,944
Labor Force Participation Rate (%)	55.7	54.2
Employment Rate (%)	82.4	87.7
Unemployment Rate (%)	17.6	12.3
Underemployment Rate (%)	18.9	10.2

Source: Philippine Statistics Authority, Labor Force Survey April 2020

(3) Income and Expenditure

456. Based on the Family Income and Expenditures Survey of the Philippine Statistics Authority in 2000, Manila's average family income and average family expenditure have been below the national average from year 1991 to 2000. Among the cities in NCR, Manila is at 9th place out of 16 cities for the average income.

Table 4.5.22 Family Income and Expenditure in 1991, 1997 and 2000 (Current Prices)

Area	No. of Families			Average Family Income			Average Family Expenditure		
	1991	1997	2000	1991	1997	2000	1991	1997	2000
Philippines	11,975,441	14,192,467	15,269,655	65,186	123,168	144,039	51,991	99,637	118,002
NCR	1,644,390	1,991,987	2,188,675	138,256	270,993	300,304	105,731	217,840	244,240
Manila	370,668	418,043	329,638	123,615	194,445	256,152	99,904	163,896	195,084

Source: PSA 2000 Family Income and Expenditures Survey, Volume II, Final Report

457. **Table 4.5.23** shows the monthly household income from all sources of the PAHs. The sources include employment, enterprise or business, remittances, rent, livestock, among others. The largest portion (37.4%) accounts for the Php10,000-19,999 household income range, followed by Php9,999 and below (18.3),

Table 4.5.23 Monthly Household Income from All Sources per Barangay

Section	Php 9,999 and below		Php 10,000 - 19,999		Php 20,000 - 29,999		Php 30,000 - 39,999		Php 40,000 - 49,999		Php 50,000 and above		No response		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
SB	61	10.8	140	31.3	73	27.7	34	13.3	14	3.6	32	13.3	18	4.8	372
BT	65	20.6	117	37.0	40	12.7	26	8.2	8	2.5	9	2.8	51	16.1	316
Total	126	18.3	257	37.4	113	16.4	60	8.7	22	3.2	41	6.0	69	10.0	688

Source: JICA Design Team

458. **Table 4.5.24** shows that 1,154 household members contribute to household income, which translates to an average of 1-2 members per household. Majority of household income is derived from wages (62.9%), followed by income from enterprises/self-employment (27.8%), and income from remittances (9%).

Table 4.5.24 Primary Source of Household Income of PAHs

Section		Wage-based	Enterprise-based/ self-employment	Remittance-based	Others	Total
SB	Total	385	168	59	0	612
	%	62.9	27.5	9.6	0.0	100
BT	Total	341	153	45	3	542
	%	62.9	28.2	8.3	0.6	100
Total	Total	726	321	104	3	1154
	%	62.9	27.8	9.0	0.3	100

Source: JICA Design Team

4.5.1.6 Public Utilities, Infrastructure and Services

(1) Power Supply

459. Based on 2015 PSA data, 98.4% of households in NCR use electricity for lighting. Manila City's power supply is distributed 24/7 by Manila Electrical Company (MERALCO), along with 34 other cities and 75 municipalities. Bulk of its supply is sourced from National Power Corporation (NPC).

Table 4.5.25 Sources Used for Lighting

Area	No of HH	Type of Source Used for Lighting								
		Electricity	Kerosene	Liquefied Petroleum Gas	Oil	Solar Panel	Solar Lamp	Others	None	Not Reported
Philippines	22,969,666	20,320,665	1,930,072	53,825	7,957	218,498	313,732	94,883	26,262	3,3672
	%	88.5	8.4	0.2	0.0	1.0	1.4	0.4	0.1	0.1
NCR	3,095,484	3,047,198	18,906	10,213	234	2,086	2,674	7,764	3,244	3,165
	%	98.4	0.6	0.3	0.0	0.1	0.1	0.3	0.1	0.1

Source: Philippine Statistics Authority, 2015

460. **Table 4.5.26** presents information on MERALCO's profile. As of 2015, MERALCO's total number of connections is 5,781,845. The largest instance of simultaneous power usage, also known as

peak demand, for MERALCO is 6,298 MW. The combined capacity of its substations is 17,198 MVA with four substations located in ng Manila (Paco),

Table 4.5.26 Power Supply Distribution Profile

Combined Capacity	Peak demand	No.	Residential	Commercial	Industrial	Others	Total
17,198 MVA	6,298 MW	Connections	5,295,458	472,322	9,570	4,495	5,781,845
		Sales (MWh)	11,116,664	12,535,211	5,253,633	188,221	29,093,729

Note: Figures for peak demand, number of connections, and volume of sales are based on the total distribution of power utilities (including non-project LGUs).

Source: Distribution Development Plan 2016-2025 & Distribution Utilities Profile, Department of Energy (DOE)

461. Project affected utility facilities are owned by MERALCO and the National Grid Corporation of the Philippines (NGCP). These include utility poles and power lines.

(2) Water Supply

462. There are two major Level III water supply service providers in Manila contracted by the Manila Waterworks and Sewerage System (MWSS), namely: (1) Maynilad Water Services, Inc. (Maynilad); (2) Manila Water Company, Inc. (MWC). Generally, a level III water supply facility has a source, a reservoir, a piped distribution network with adequate treatment facility and household taps. **Table 4.5.27** presents information on the total average water production and consumption of Level III water suppliers. The location of the Project is serviced by Maynilad. Maynilad water supply facilities affected by the Project include pipes, water lines, and drainage canal.

Table 4.5.27 Water Distribution Profile of MWSS

Water Service Provider	Monthly Production (m3 / month)	No. of connection				Average water consumption (m3 / month)			
		Domestic	Government	Commercial/ Industrial	Bulk	Domestic	Government	Commercial	Bulk
MWSS-MWSI	58,164,243.33	1,205,169	0	60,341	0	32,571,933.30	0.00	7,561,341	0.00
MWSS-MWCI	43,617,426.13	922,578	0	53,743	0	29,223,641.40	0.00	9,159,648.80	0.00

Note:

1. Average monthly water consumption for MWSI was estimated based on annual water use of 697,970,000 m³ with 56.0% domestic use, 13.0% commercial/ industrial use and 31.0% non-revenue water.
2. Average monthly water consumption for MWC was estimated based on annual water use of 523,408,503 m³ with 67.0% domestic use, 21.0% commercial/industrial use and 12.0% non-revenue water.

Source: Philippine Water Districts Average Production and Consumption Data, 2019;
Philippine Water Utilities Data Book, 2015

463. **Table 4.5.28** shows the water sources for cooking and drinking of the host LGU. Majority of Manila residents source their water from piped connection, followed by sourced from community faucet shared with the community.

Table 4.5.28 Access to Water of PAFs

LGU	Piped Connection	Shared with Neighbor (Community Faucet)	Deep well	Shallow Well	Buy from Water Vendors	Others	N/R	Total
Manila	2,687	1,334	25	1	235	269	27	4,578

Source: Philippine Statistics Authority, 2015

464. As shown in **Table 4.5.29**, most PAFs identified in the RAP Survey have access to water primarily through their own metered connection (48.0%), followed by those using shared communal faucet (41.7%). Few households buy water from vendors (7.7%) and source water from deep wells (1.0%).

Table 4.5.29 Primary Water Source by Tenure Status

Water Connection	SB			BT			Total			
	LO	NLO	Total	LO	NLO	Total	LO	NLO	Total	%
Own Metered connection	40	175	215	18	97	115	58	272	330	48.0
Shared with neighbor or communal faucet	7	128	135	11	141	152	18	269	287	41.7
Deep well	1	0	1	0	6	6	1	6	7	1.0
Buying from water vendors	0	18	18	1	34	35	1	52	53	7.7
Others	1	2	3	2	5	7	3	7	10	1.5
No Response	0	0	0	0	1	1	0	1	1	0.1
Total	49	323	372	32	284	316	81	607	688	100

Note: LO: Land owner; NLO: Non-Land owner

Source: JICA Design Team

(3) Sewerage Management

465. Local government units and some establishments and institutions are also mandated by Philippine laws to provide separate treatment facilities. The Local Government Code and DILG MC 2019-62 mandate that the barangay and municipality/city provide facilities for sewage and septage system, while establishments and institutions enumerated in DENR-AO 2016-08 which produce effluents that exceed environmental standards are required to have their own sewage treatment plants.

466. As of 2018, the region has only met 14 % of its required number of sewerage treatment plants to accommodate wastewater from its 15 million inhabitants¹³. Metropolitan Manila Waterworks and Sewerage System (MWSS) is the government body in charge of water supply, and sewage and septage treatment for NCR and Rizal. Part of its concessionaires' responsibilities (Manila Water for east and Maynilad for west) is to provide sewerage and septage facilities for its respective coverage areas. Maynilad sewerage facilities affected by the Project include entrance posts, sewer lines, and drainage canal.

(4) Solid Waste Management

467. The main laws governing solid waste management in the Philippines are the Local Government Code (RA7160) and Ecological Solid Waste Management Act of 2000 (RA9003). RA7160 mandates the local government to provide for the collection of solid waste – biodegradable, compostable, and

¹³ <https://news.abs-cbn.com/news/03/21/18/metro-sewerage-problem-10-times-worse-than-boracays-mwss>

reusable materials to be collected by the barangay, non-recyclable materials and special wastes to be collected by the municipality or city. RA9003, on the other hand, primarily mandates the following: (1) that the LGU prepare its own 10-year Solid Waste Management (SWM) Plan, (2) mandatory segregation of solid waste at source, (3) and all open dumps be shut down or converted into controlled dumps. psy

468. According to 2010 PSA data, 11 out of 12 households in the affected LGUs usually dispose of their waste through the collection by garbage trucks. Despite the garbage collection, there are still households that practice prohibited disposal methods such as dumping and burning as shown on **Table 4.5.30**.

Table 4.5.30 Usual Manner of Garbage Disposal in the Host LGUs

LGU	HHs	Usual Manner of Garbage Disposal (%)						
		Picked up by garbage truck	Dumping in individual pit (not burned)	Burning	Composting	Burying	Fed to animals	Others
Manila	435,154	96.6	2.0	0.2	0.1	0.1	0.2	0.7

Source: 2010 Census of Population and Housing, Philippine Statistics Authority

469. The 2016 Local Government Unit Solid Waste Management Compliance and Audit Report (LGU-SWM-SCMAR) computed the projected volume of solid waste generation of the affected LGUs from 2016 to 2020. Despite of San Pedro's low count of population compared with other LGUs, it has the highest waste generation to population ratio (see **Table 4.5.31**).

Table 4.5.31 Solid Waste Generation by LGU 2016-2020 (tons per year)

LGU	Population	2015	2016	2017	2018	2019	2020
Manila	1,780,148	396,350.0	399,442.0	402,558.1	405,698.6	408,863.5	412,053.2

Source: Revised LGU-SWM-SCMAR, 2016

470. **Table 4.5.32** briefly describes the solid waste management of the host LGUs for garbage collection, material recovery facilities (MRFs) and its locations for disposal. Based on the table, all LGUs had engaged in a contract for the collection of waste from households. These are then transferred to MRFs for segregation, recycling, and composting. After which, remaining waste that cannot be recycled nor composted, also known as residual waste, are brought to engineered sanitary landfills. All the project-affected cities in NCR dispose their residual waste in Rizal Provincial Sanitary Landfill, while project-affected cities in Laguna dispose in landfills located within the same province.

Table 4.5.32 Waste Management Services of LGUs

LGU	Garbage collection	MRF	Disposal
Manila	Leonel Waste Management	Vitas Transfer Station	Tanza Facility, Navotas; Rodriguez Facility, Marikina

Source: Solid Waste Management Plan

(5) Educational facilities

471. **Table 4.5.33** presents the existing and affected educational facilities in the host LGUs traversed by the Project categorized by facility ownership and educational level. Further, the directly and indirectly (within 50 m from proposed alignment) affected educational institutions are indicated below. The locality with the greatest number of existing schools from primary to tertiary level is Manila.

Table 4.5.33 Educational Institutions in Host LGUs

LGU	Type of Institution	Primary	Secondary	Tertiary	Affected Educational Facilities	
					Within the Project ROW	Outside the Project ROW but within 50 m from the centerline of the alignment
Manila	public	81	44	6	None	Lakandula Elementary School
	private	149	146	75		
	private	103	59	16		

Note:

Based on Republic Act No. 10533, otherwise known as the “Enhanced Basic Education Act of 2013, the Department of Education (DepEd) is mandated to implement the new basic education curriculum, the K-to-12 Program, which further categorizes secondary education to Junior High School (Grades 7-10) and Senior High school (Grades 11 and 12). Currently, the program is still in transition period (2016-2021). As such, presented data do not yet reflect more specific details on high school (secondary education) categories.

The public tertiary level or higher education institutions (HEIs) include state universities and colleges (SUCs) and local universities and colleges (LUCs).

Source: DepEd Masterlist accessed on April 2019, CHED 2018

(6) Health Facilities

472. In the delivery of public health services, the Department of Health (DOH) serves as the steward of national policies, plans, standards, and regulations on health, while the LGUs are responsible in managing and providing direct health services at the local level. DOH provides technical assistance, capacity building and advisory services to LGUs that directly deliver public health services. Specific campaigns and dedicated national programs such as National TB Control Program are coordinated between the LGU and DOH.

473. **Table 4.5.34** presents the existing health facilities in the host LGUs which include the Barangay Health Stations (BHS), Rural Health Units (RHUs), hospitals and other health facilities such as birthing homes, infirmary and medical clinics and laboratories.

474. Although there are Barangay Health Stations in the municipalities, most of these lack the equipment and supply to serve the population. Hospitals nearest to the project area are Tondo Hospital and Chinese General Hospital and Medical Center.

Table 4.5.34 Health Facilities in Host LGUs

LGU	Barangay Health Station	Rural Health Unit	Hospital					Others
			Level 1	Level 2	Level 3	Unspecified	Total	
Manila	1	64	8	2	17	5	32	1

Source: DOH National Health Facility Registry

(7) Peace and Order (Protective Services)

475. **Table 4.5.35** below shows the different bodies responsible for maintaining the peace and order in the local government units (LGUs) as well as available information on stations and personnel. For each city or municipality, facilities for police, fire protection, and jail management are mandated through the Department of Interior and Local Government. The police (PNP) are tasked to implement anti-criminality activities, the jail management (BJMP) is mandated to direct, supervise and control the operation of all district, city and municipal jails, while the BFP oversees administration and management of fire emergency services which include fire prevention and firefighting. Apart from this, LGUs each have their own office for implementing public order and safety measures.

476. The Philippine National Police (PNP), under the DILG, is mandated to have one police station, also called by police as headquarters (HQ), per LGU. The minimum ratio of police officers to civilians based on Philippine standard is 1:2,000. The data presented in the table below were gathered from

LGUs' CLUPs. Common staff and equipment for PNP stations are police personnel (commissioned and non-commissioned), mobile patrol units, and motorcycle units.

Table 4.5.35 Police and Fire Service Facilities

LGU	PNP		BFP	
	Stations	Staff and Equipment	Stations	Staff and Equipment
Manila	Manila HQ 11 Stations 40 Substations 170 Outposts	2,984 Police Personnel - 441 Traffic	Central Fire Station 15 Stations	335 Fire Fighters

Source: City/ Municipal Planning and Development Offices, collected January 2019

(8) Open Space and Recreational Area

477. **Table 4.5.36** presents the current open space allocation as well as existing sports and recreational facilities in Manila. Generally, open space are areas reserved exclusively for parks, playgrounds, recreational uses and other similar facilities and amenities.

Table 4.5.36 Open Space Allocation and Sports/Recreational Facilities

LGU	Open Space (as of 2019)		Sports and Recreational Facilities (as of 2016)	
	Land Area Allocated for Open Space (Ha)	% of Total Land Area	Type	No.
Manila	140.40	3.7	City Parks & Plazas	53
			City Playgrounds and Sports Complex	80
			Skate Parks	2

Source: 3-Year Comprehensive Development Plan 2016-2019, Collected data on January 2019;
<https://newsinfo.inquirer.net/1133654/metro-manilas-green-spaces-continue-to-shrink>, Accessed on January 2022

478. There will also be 856 m² of public road which will be converted to Project ROW. This will result to less public space and realignment of the Old Antipolo Street which is presently located within PROW. Loss of access is further discussed in **Section 4.5.1.12**.

(9) Affected Public Infrastructure

479. The Project will affect barangay facilities which include a clinic, chapel, barangay halls, grotto, and a basketball covered court, which will be relocated and converted as part of the Project ROW.

Table 4.5.37 Affected Public Social Infrastructure

Location	Affected Social Infrastructure	
	No.	Type
Barangay 217	2	• Clinic • Chapel
Barangay 221	2	• Multi-purpose Hall • Brgy Hall
Barangay 228	2	• Grotto • Basketball Covered Court

Source: JICA Design Team

4.5.1.7 Public Health and Safety

(1) Morbidity and Mortality Statistics

480. Morbidity refers to the number of illnesses by a given population within a period of time while mortality refers to the number of deaths within a period of time. **Table 4.5.38** and **Table 4.5.39** presents

the rates of morbidity (2010) and mortality (2018) and their respective leading causes. Diarrhea and bronchitis are common for the leading causes of morbidity while pneumonia and diseases of the heart are the most leading causes of mortality.

481. Pneumonia, heart diseases, cancer, and diabetes are the most common causes of death in the country. Heart disease is the leading cause of death in the Philippines, and it is also the second leading cause of death in Manila City. According to the Department of Health's 2019 Philippine Health Statistics, most deaths from the top cause of mortality were unattended by medical officials during their illnesses. Death without medical attention may be indicative of the country's unaffordable healthcare costs.

482. Due to expected worker migration that will be brought by the project, host and nearby communities may be exposed to higher levels communicable and viral diseases putting the vulnerable groups such as women, elders, children, and sick individuals more at risk.

Table 4.5.38 Leading Causes of Mortality in the City of Manila

Item	First	Second	Third	Fourth	Fifth
Disease	Diseases of the heart	Cancer	Pneumonia	Cerebro vascular disease	Tuberculosis
Number of deaths per 100,000	222.3	152.9	132.9	84.6	61.4

Source: 2018 Philippine Health Statistics, DOH

Table 4.5.39 Leading Causes of Morbidity in the Philippines

Item	First	Second	Third	Fourth	Fifth
Disease	Acute Respiratory Infection	Acute Respiratory Infection and Pneumonia	Bronchitis	Hypertension	Acute Water Diarrhea
Number of deaths per 100,000	1,371.3	623.5	373.5	367.4	347.3

Source: DOH

(2) Sanitation Profile

1) Access to Sanitary Toilet Facilities

483. According to the results of the 2015 Census of Population and Housing of the Philippine Statistics Authority, majority (95.1%) of all households in Manila City had sanitary toilets. The rest of the households used pail system and others (2.0%), closed pit (0.8%) and open pit (0.7%) while another 1.4 percent reported to have no toilet facility.

484. In comparison to the regional data of NCR and national data of the Philippines, Manila has lower percentage distribution of household exclusively using water sealed septic tank. Poor sanitary condition resulting from lack of sanitary toilet facilities will pose health risks to the local community. According to the World Health Organization (WHO), diarrhea remains the main challenge for poor sanitary condition despite being largely preventable.

Table 4.5.40 Percentage Distribution of Toilet Facility used by Households

LGU	Toilet Facility							
	Water-sealed (sewer septic tank)		Water-sealed (other depository)		Closed Pit	Open Pit	Pail system and others	None
	Used exclusively by household	Shared with other households	Used exclusively by household	Shared with other households				
Philippines	73.8	9.1	4.9	2.1	3.9	2.0	0.8	3.5

LGU	Toilet Facility							
	Water-sealed (sewer septic tank)		Water-sealed (other depository)		Closed Pit	Open Pit	Pail system and others	None
	Used exclusively by household	Shared with other households	Used exclusively by household	Shared with other households				
NCR	84.9	12.3	1.0	1.0	0.3	0.1	0.2	0.2
Manila	71.7	17.0	3.3	3.1	0.8	0.7	2.0	1.4

Source: Philippine Statistics Authority, 2015

2) Access to Clean Water

485. Residents of Manila City mainly rely on bottled water as a source of supply for drinking water and own use faucet connected to water system for cooking. **Table 4.5.41** shows the water sources for cooking and drinking for Manila, NCR, and Philippines. Similar with Manila, NCR and the Philippines have bottled water as the most popular source for drinking water, and own use faucet for cooking.

486. Diseases linked to lack of safe water are Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio.

Table 4.5.41 Percentage Distribution of Sources of Water Supply for Drinking and Cooking

Water Supply	Philippines		NCR		Manila	
	Drinking	Cooking	Drinking	Cooking	Drinking	Cooking
Number of households	22,969,666		3,095,484		435,154	
Own use faucet community water system	26.2	43.4	46.8	79.8	43.3	80.0
Shared faucet community water system	13.0	15.3	11.0	14.2	12.1	16.0
Own use tubed/piped deep well	6.0	8.6	0.4	0.7	0.2	0.3
Shared tubed/piped deep well	12.1	14.3	0.6	1.1	0.2	0.3
Tubed/piped shallow well	1.9	2.4	0.0	0.1	0.0	0.0
Dug well	4.4	5.3	0.0	0.1	0.0	0.0
Protected spring river stream etc	4.4	4.1	0.3	0.0	0.1	0.1
Unprotected spring river stream etc	1.5	1.5	0.0	0.0	0.0	0.0
Lake river rain and others	0.8	0.9	0.0	0.0	0.0	0.0
Peddler	2.3	1.6	2.0	1.3	2.6	2.1
Bottled Water	27.2	2.5	38.5	2.6	41.2	1.2
Others	0.2	0.1	0.4	0.1	0.2	0.0

Source: Census of Population, Special Report on Housing Characteristics, Philippine Statistics Authority, 2015

(3) Public Security

487. According to data from the Philippine National Police for the period of January to May 2018, NCR has crime efficiency rates of 44.0% for index crimes (**Table 4.5.42**) and 70.7% for non-index crimes (**Table 4.5.43**). Index crimes against persons include murder, homicide, rape, and physical injuries. Index crimes against property include robbery and theft.

Table 4.5.42 Regional Index Crime Rates

Region	Against persons	Against property	Total	Solved	Efficiency (%)
NCR	2201	3693	5894	3181	43.9 or 44.0

Source Philippine National Police, 2019

Table 4.5.43 Regional Non-Index Crime Rates

Region	Reckless Imprudence Resulting in			Violation of special laws	Other non-index crimes	Total	Solved	Efficiency (%)
	Homicide	Physical Injuries	Damage to property					
NCR	149	5,903	31,064	9,091	4145	50,352	39,787	70.7

Note: POI Index Crimes: Murder, Homicide, Physical Injuries, Rape, Robbery, Carnapping, Theft, Eight (8) Special Complex Crime (composite crimes). POI Non-Index Crimes: violation of Special Laws and Revised Penal Code (RPC) that are NOT categorized as index crimes excluding Reckless Imprudence, Vehicular Incidents, and Other Quasi-Offenses under the provision of RPC

Source: Philippine National Police, 2019

(4) Hazards of Infectious Diseases

1) HIV/AIDS

488. With the increase of reported HIV/AIDS cases by 55,171 from January 2015 to March 2020, the Philippines has become the country with the fastest growing HIV/AIDS epidemic in Asia and the Pacific. The Philippines has become one of eight countries that account for more than 90.0% of new HIV infections in the region. (Joint United Nations Program on HIV/AIDS). NCR (19,367 cases /35.0 %), Region 4A (8,996 cases /16.0%) and Region III (5,604 cases /10.0 %) are the top three regions with reported cases of HIV/AIDS.

2) COVID-19 and Similar Diseases

489. In year 2020 was the start of the global pandemic Novel Coronavirus Disease 2019 (COVID-19). Based on the Department of Health's (DOH) tracker as of December 6, 2021, among the 13,548 active cases in the country, 2,815 (20.7%) are from NCR. Despite this, NCR has had a total of 847,269 (30.5%) recoveries.

Table 4.5.44 Cases of Covid-19 and Human Immunodeficiency Virus (HIV) Infections

LGU	Cases of COVID-19 (as of 06 December 2021)			HIV Infections		
	Active Cases	Recoveries	Deaths	Jan-Mar 2020	Jan 2015 -Mar 2020	Jan 1984 – Mar 2020
Philippines	13,548	2,772,107	49,499	2,818	55,171	77,625
NCR	2,815	847,279	10,842	852	19,367	29,425

Source: DOH Epidemiology Bureau; DOH NCov Tracker

490. Due to expected worker migration that will be brought by the project, host and nearby communities may be exposed to higher levels communicable and viral diseases putting the vulnerable groups such as women, elders, children, and sick individuals more at risk.

4.5.1.8 Occupational Health and Safety

491. Occupational Health and Safety (OHS) pertains to health, safety, and welfare issues in one's workplace. **Table 4.5.45** presents the occupational injuries by majority industry in the Philippines for 2013 and 2015. Manufacturing has the highest number of recorded injuries Repair of Computers and Personal and Household Goods; Other Personal Service Activities have the lowest. For construction activities which is the main activity of the project, it is comprised of 4.0 % of the total number of cases for all the industries. According to a study of Arunkumar (2018) published on International Journal of Engineering Science and Computing, the main causes of worksite injuries are failure to follow safety rules, ignorance of PPE (Personal Protective Equipment), space congestion, improper use of safety items, and improper equipment.

Table 4.5.45 Cases of Occupational Injuries With and Without Workdays Lost by Major Industry Group, Philippines

Major Industry Group	2013			2015		
	Total	With Workdays Lost	Without Workdays Lost	Total	With Workdays Lost	Without Workdays Lost
All Industries	49,118	20,702	28,416	50,961	17,859	33,102
Agriculture, Forestry and Fishing	3,770	2,846	924	3,236	1,877	1,358
Mining and Quarrying	789	136	653	528	59	468
Manufacturing	23,641	10,126	13,515	25,667	8,602	17,065
Electricity, Gas, Steam and Air Conditioning Supply	838	399	439	684	408	276
Water Supply; Sewerage, Waste Management and Remediation Activities	514	184	330	248	115	133
Construction	2,115	525	1,590	2,115	715	1,399
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	5,734	2,155	3,579	5,799	2,045	3,754
Transportation and Storage	1,628	1,163	465	2,452	1,037	1,415
Accommodation and Food Service Activities	4,487	1,199	3,288	4,995	1,015	3,979
Information and Communications	163	42	121	135	45	89
Financial and Insurance Activities	495	363	132	341	283	58
Real Estate Activities	309	80	229	149	44	105
Professional, Scientific and Technical Activities	316	119	197	159	54	105
Administrative and Support Service Activities	2,490	868	1,622	1,303	669	633
Education except Public Education	932	156	776	1,591	310	1,281
Human Health and Social Work Activities except Public Health Activities	645	288	357	750	270	481
Arts, Entertainment and Recreation	156	12	144	674	250	424
Repair of Computers and Personal and Household Goods; Other Personal Service Activities	136	59	77	96	41	55

Source: SMDI Consultants, 2013 & 2015

4.5.1.9 Land Use and Utilization of Local Resources

492. Based on the City Land Use Plan of Manila City, the project's location is surrounded by high density residential, medium intensity commercial, and general public open space. The ROW will be traversing along the boundaries of these areas, majority of which are already categorized as government owned. **Table 4.5.46** summarizes the land distribution for the Project ROW. The Total Affected Area is 42,535.89 m², while the Estimated Project Land Take is 45,799.93 m². The existing government ROW totals to 34,608.34 m² while the land for acquisition including government and private lands totals to 11,191.59 m².

Table 4.5.46 Summary of ROW Land Use and Required Land Acquisition

Category	SB	BT	Total
Total Affected Area	27,849.89	14,686.0	42,535.89
Total Project Land Take	28,915.96	16,883.97	45,799.93
Privately Owned	8,469.3	284.8	8,754.1
PNR Land	-	12,017.56	12,017.56
LGU Owned	284.0	-	284.0
Government Owned	19,966.16	2,383.65	22,349.81
Existing Government ROW	20,162.66	14,445.68	34,608.34
PNR ROW	18,777.17	12,017.56	30,794.73
Road Lot / Road ROW	1,385.49	2,428.12	3,813.61
For Acquisition	8,753.3	2,438.29	11,191.59
Government Land	-	1,742.09	1,742.09
Residential	6,607.5	696.2	7,303.7

Category	SB	BT	Total
Commercial	-	-	-
Unclassified	2,145.8	-	2,145.8

Note: Discrepancy in totals of government owned and non-government owned versus total affected area is due to conversion of whole land parcels for partially but severely affected lots

Source: JICA Design Team

493. Apart from this, a portion of the NLEx-SLEx Connector Road Project of the DPWH will be overlapping with the Solis-Blumentritt section of the Project (1.04km), but this will not cause conflict as there is an ongoing coordination between the Project and DPWH for project design compatibility, site validation, ROW acquisition, and RAP policies.

4.5.1.10 Water Usage, Water Rights, and Rights of the Common

494. Two bodies of water can be located within the project area: Antipolo Creek and South Antipolo Canal. Based on the results of the water sampling activities, both have high levels of organic pollution which are associated with sewage and waste disposal from surrounding establishments and residents. As per interview with locals and observation during field survey, the water bodies are used for drainage, and disposal of human excreta. With the low water quality, the residents do not harvest water from these waters.

4.5.1.11 Historic and Cultural Heritage

495. The NSCR Project EPRMP (2015), NSCR Calamba Ex EIS (2020), and available information from the Philippine Registry of Cultural Property (PRECUP), and the repository of all information pertaining to cultural properties in the Philippines deemed significant to the country's cultural heritage, as established by the National Commission for Culture and the Arts (NCCA) through Article V Section 14 of Republic Act 10066 or the National Cultural Heritage Act of 2009), were used as reference to identify cultural heritage sites in proximity (within 1.5 km from Project ROW) to the project site (**Figure 4.5.5**). The identified historical sites and structures in the project area can be grouped into two: 1) sites and buildings that are registered under the abovementioned international and national law and local ordinances; and 2) sites and buildings that have yet to be registered but meet the qualification requirements to be registered.

(1) Designated Historic and Cultural Sites and Structures

496. At the international level, the NCCA, together with the National Historical Commission of the Philippines (NHCP), closely collaborate with the United Nations Educational Scientific and Cultural Organization (UNESCO) National Commission of the Philippines in ensuring the conservation and management of world heritage sites in the Philippines as per RA 10066. A cultural property declared as a World Heritage Site is a natural or man-made site, area, or structure recognized as being of outstanding international importance and therefore as deserving special protection. The cultural property that fall under Grade Level I category, particularly as a World Heritage Site, nearest to the SBT section is the San Agustin Church, a 16th-century baroque church located in Intramuros, Manila, approximately 3.3 km from the Project. The church is not within the standard distance of 0.10 km to be affected by vibration coming from the Project.

497. At the national and local level, the NHCP, in collaboration with other cultural agencies, declares historic sites and structures in the country based on their demonstrable historical significance, age (at least 50 years old), and authenticity (70.0 %) in accordance with NHCP Guideline on the Identification, Classification, and Recognition of Historic Sites and Structures in the Philippines (2011) under the National Cultural Heritage Act of 2009 or RA 10066 (2009). **Table 4.5.47** presents these historic and cultural sites and structures within 1.5 km from the Project. The cultural properties within 1.5 km from the SBT section totals to 15 structures. The structure closest to the Project ROW is the historical marker for the birthplace of Emilio Jacinto (a Filipino General during the Philippine Revolution) in Saint Joseph

Parish Church, located approximately 0.21 km from the edge of the Project ROW. None of these sites and structures are within the standard distance of 0.10 km to be affected by vibration coming from the Project.

498. Although the identified national and local cultural properties are far from/outside the Project ROW, these structures may be situated in proximity to temporary facilities (construction yards) and access routes during construction that must be identified prior to construction.

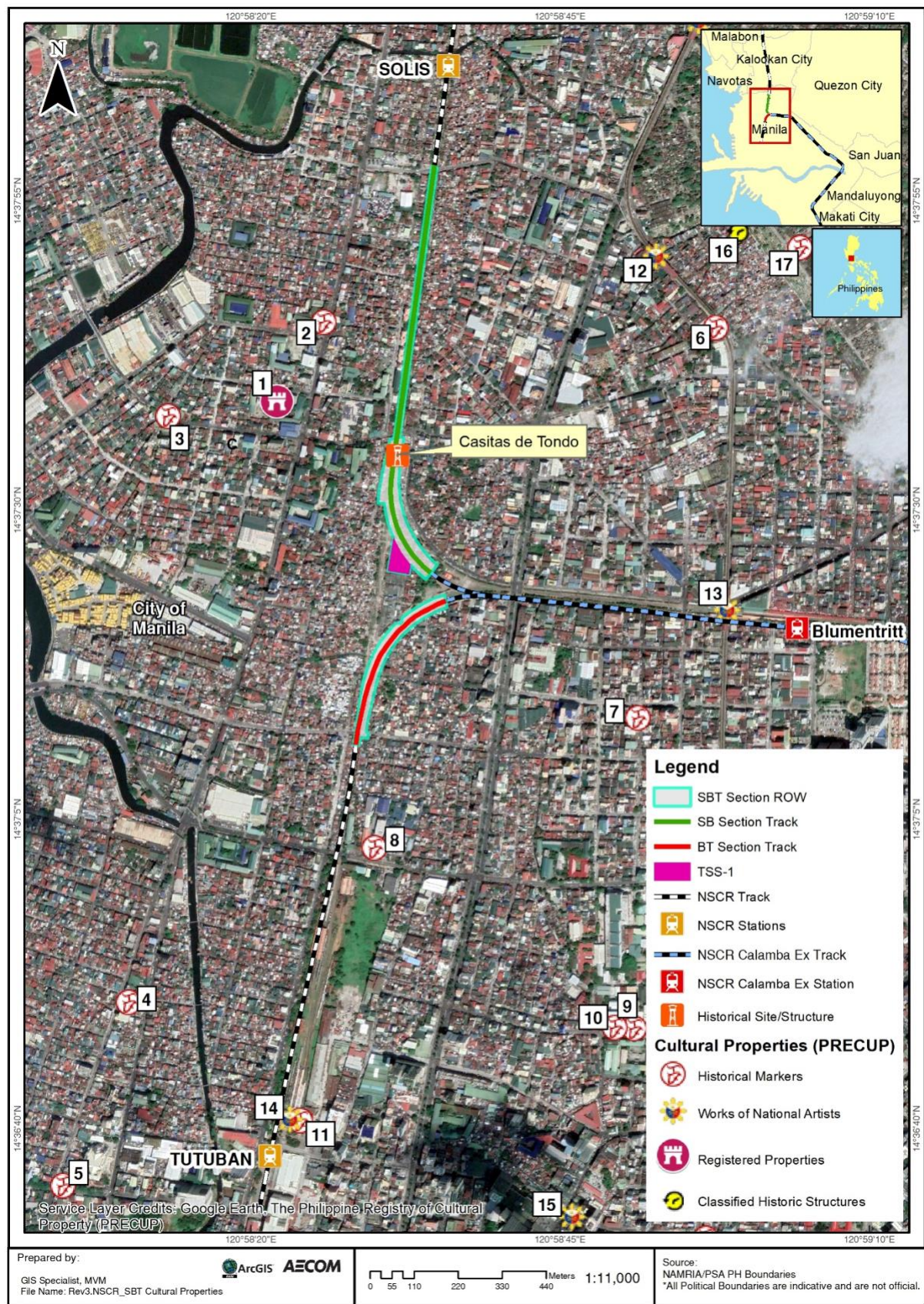


Figure 4.5.1 Cultural Heritage Sites Within and in the Vicinity of the Project Site

Table 4.5.47 Cultural Heritage Sites Within and in the Vicinity of the Project Site

Key	Name	Cultural Property Classification	Year Established/ Installed	Authority	Remarks	Approx. Distance from edge of ROW
Local Registered Property						
1	Manila West High School (Renamed as Florentino Torres High School)	Grade III (Registered Property of the City of Manila)	1925	Local (Manila LGU)	One of the oldest public schools in Metro Manila (established in 1925); included in PRECUP map and further classified as tangible-immovable	0.29km
Historical Markers by NHCP						
2	Saint Joseph Parish Church	Grade III (Historical Marker)	1975	National (NHCP, NCCA)	Birthplace of Emilio Jacinto, the “Brains of the Philippine Revolution”; marker installed by NHCP	0.21km
3	Vicente L. del Fierro	Grade III (Historical Marker)	1984	National (NHCP, NCCA)	Historical marker for Vicente L. del Fierro who was a distinguished journalist; marker installed by NHCP	0.55km
4	Iglesia Evangelica Metodista en Las Islas Filipinas	Grade III (Historical Marker)	1984	National (NHCP, NCCA)	Historical marker for first local evangelical church in the Philippines, established in 1909; marker installed by NHCP	0.83km
5	Honorio Lopez Monument	Grade III (Historical Marker)	2010	National (NHCP, NCCA)	Monument for Honorio Lopez located in Plaza Moriones, who was a playwright and revolutionary; marker installed by NHCP	1.29km
6	2875 Rizal Avenue	Grade III (Historical Marker)	1991	National (NHCP, NCCA)	Historical marker for Honorio Lopez, who was a playwright and 7revolutionary; marker installed by NHCP	0.73km
7	Severino Reyes	Grade III (Historical Marker)	1969	National (NHCP, NCCA)	Historical marker for Severino Reyes, a Filipino writer and playwright; marker installed by NHCP	0.64km
8	Manila Cathedral School	Grade III (Historical Marker)	1979	National (NHCP, NCCA) (for verification)	Historical marker for Rosa Sevilla de Alvero who established Instituto de Mujeres, the first secular school for girls; Manila Cathedral is listed as important cultural property; marker installed by NHCP.	0.27km
9	Bureau of Health	Grade III (Historical Marker)	1950	National (NHCP, NCCA) (for verification)	Began as the Board of Health for the City of Manila, occupying part of the Palacio del Segundo Cabo in 1898	0.97km
10	San Lazaro Hospital	Grade III (Historical Marker)	1952	National (NHCP, NCCA)	Historical marker for one of the oldest hospitals in the Philippines; marker installed by NHCP	0.93km
11	Ang Pampangulong Kotse ng Tren	Grade III (Historical Marker)	1984	National (NHCP, NCCA)	Built by the Manila Railroad Company for the President of the Philippines; first used by President Quezon; marker installed by NHCP	0.95km
Works of National Artists						
12	Metrorail Transit System Stations for LRT1, circa 1980s	Grade III (Work of National Artists)	1984	National (NCCA)	Considered as one of the major works of Francisco T. Manosa; Francisco Mañosa was declared as National Artist for Architecture and Allied Arts by NCCA in 2018.	0.55km

Key	Name	Cultural Property Classification	Year Established/ Installed	Authority	Remarks	Approx. Distance from edge of ROW
13	Metrorail Transit System Stations for LRT1, circa 1980s (1)	Grade III (Work of National Artists)	1984	National (NCCA)	Considered as one of the major works of Francisco T. Manosa; Francisco Mañosa was declared as National Artist for Architecture and Allied Arts by NCCA in 2018.	0.71km
14	Philippine National Railway Executive Building	Grade III (Work of National Artists)	1996	National (NCCA) (for verification)	Work of Ildefonso P. Santos. Ildefonso Santos was recognized as National Artist for Architecture in 2006.	0.95km
15	Broadview Towers A&B	Grade III (Work of National Artists)	Not Indicated	National (NCCA)	Work of Ildefonso P. Santos. Ildefonso Santos was recognized as National Artist for Architecture in 2006.	1.29km

(2) Potential Cultural Heritage (Casitas de Tondo)

499. The NSCR Project conducted on-site investigations on October 17, 2016 along the proposed railway alignment and identified five old PNR stations and the Casitas de Tondo, also known as Solis Signal Tower, as a matter of concern for conservation.

500. The Casitas de Tondo is located in Solis Street and part of the PNR Solis Station. The structure was constructed in 1891 (i.e. 127 years old). At present, a caretaker resides in a temporary shelter beside the structure. Rail skates and rickshaws run along the line; PNR still uses this line to travel to the Caloocan depot. No other old PNR structures were identified within the Project ROW as per the review of available secondary information.

501. The Casitas de Tondo has an existing ground level of 0.89 m and flood level of 1.5 m. At the time of the assessment, the structure was recommended to be elevated at floor level of approximately 0.6 m to avoid the flood level and for future adaptive re-use, and to be to be relocated, elevated, and restored. During DD stage of the NSCR Malolos-Tutuban Project, the Casitas de Tondo was part of the inventory of old PNR structures that were surveyed and assessed for cultural and historical value. Along with other structures, proposed actions were brought up to the cultural agencies (CAs) for assessment, evaluation and approval. However, the relocation site for the Casita de Tondo was not yet proposed during DD stage due to the future development of freight rail, south line, and expressway. Only until the alignments of said projects was certain when the relocation site was finalized. A series of consultations with the CAs took place and the structure was decided on 7 December 2018 to be relocated and to be incorporated in the design of the Tutuban Station of the NSCR Project. The summary of meetings conducted for Casitas de Tondo is provided in **Table 4.5.48**. At present, the DOTr has already invited firms to submit proposals for the conservation works of Casitas de Tondo; three firms have already submitted their bid.

Table 4.5.48 Summary of Meetings Conducted for Casitas de Tondo

Date	Particulars	Agreement
March 24, 2017	Meeting among NHCP, SMEC, DOTr, and JDT	NHCP requested DOTr to provide them a copy of the preservation plan of Casitas de Tondo to NHCP.
December 7, 2018	NHCP Approval Letter	NHCP approved the relocation of Casitas de Tondo but requested DOTr to provide the detailed architectural and structural plans, specifications, and methodology for the process of dismantling and reconstruction of the Casitas de Tondo
March 6, 2020	Meeting among DOTr, PNR, NMP, NHCP, NSTren, and TDJV	NHCP instructed that all cultural agencies should be given all documentations (TOR, conservation management plan and other relevant docs) before doing any steps and should be approved first. NHCP also advised DOTr to send a letter to expedite the creation of a technical working group (TWG) that will cater to DOTr railway projects.
February 10, 2021	NHCP Concurrence Letter	NHCP concurred on the TOR for the Procurement of Services for the Conservation Works of Casitas de Tondo.
April 26, 2021	PNR Concurrence Letter	PNR concurred on the CMP work schedules and TORs.
July 15, 2021	NHCP and NMP concurrence and recommendation to DOTr	NHCP and NMP concurred to the request to extract brick box culverts to be affected by the NSCR Project. NHCP advised to document before, during and after the work and to use retrieved materials for museum exhibits and for restoration of old PNR stations. NHCP further recommended continuous documentation of unearthed structures and coordination with NHCP and other cultural agencies. NMP recommended to extract the remnants systematically, carefully, and retrieved materials be stored properly.



Figure 4.5.2 Proposed Relocation Site of Casitas de Tondo

4.5.1.12 Transportation Network

(1) Inter-region Networks

502. Air: The Manila International Airport (MIA), located in Pasay City, is accessible to the project-affected cities through Epifanio Delos Santos Avenue (EDSA) and South Luzon Expressway (SLEX). The MIA, with four terminals, is currently the largest airport operating in the Philippines. Two of its terminals, terminal 2 and 4, cater only to domestic flights while terminals 1 and 3 cater to both domestic and international flights. As of 2018, the airport serviced 36 airlines which made a total of 72,897 arriving domestic flights, 72,984 departing domestic flights, 56,854 arriving international flights, and 56,963 departing international flights.

503. Highways: The major roads that provide access to the project area are Rizal Avenue and Radial Road 10 (R-10). Rizal Avenue, formerly called as the Manila North Road, is located approximately 300m from the Eastern end of the project area. It is a portion of Radial Road 9 (R-9) which serves as the connecting road from Manila to La Union province in the Northern part of Luzon. A portion of LRT1 runs along the Rizal Avenue catering for nine (9) of its stations. R10 is located approximately 1.7km west of the project area, which connects Manila to Navotas City.

504. Railways: There are three existing rail transport systems with stations in the affected LGUs: PNR South Line, Light Rail Transit (LRT) Lines 1 and 2. The PNR is a railway company owned by the Philippine Government that operates a commuter line service in Metro Manila and another line to the Bicol Region. The Metro Manila line, also known as Metro Commuter Line, has two train routes: Tutuban-Alabang (South) and Gov. Pascual-FTI (North). The South line has a total of 17 stations with an estimated travel time of two hours while the North line has a total of 18 stations. In 2010, PNR carries 8,000 passengers daily through its commuter line service. The ten (10) PNR South Line stations located in Manila City are Solis, Tutuban, Blumentritt, Laong Laan, España, Santa Mesa, Pandacan, Paco, San Andres, and Vito Cruz.

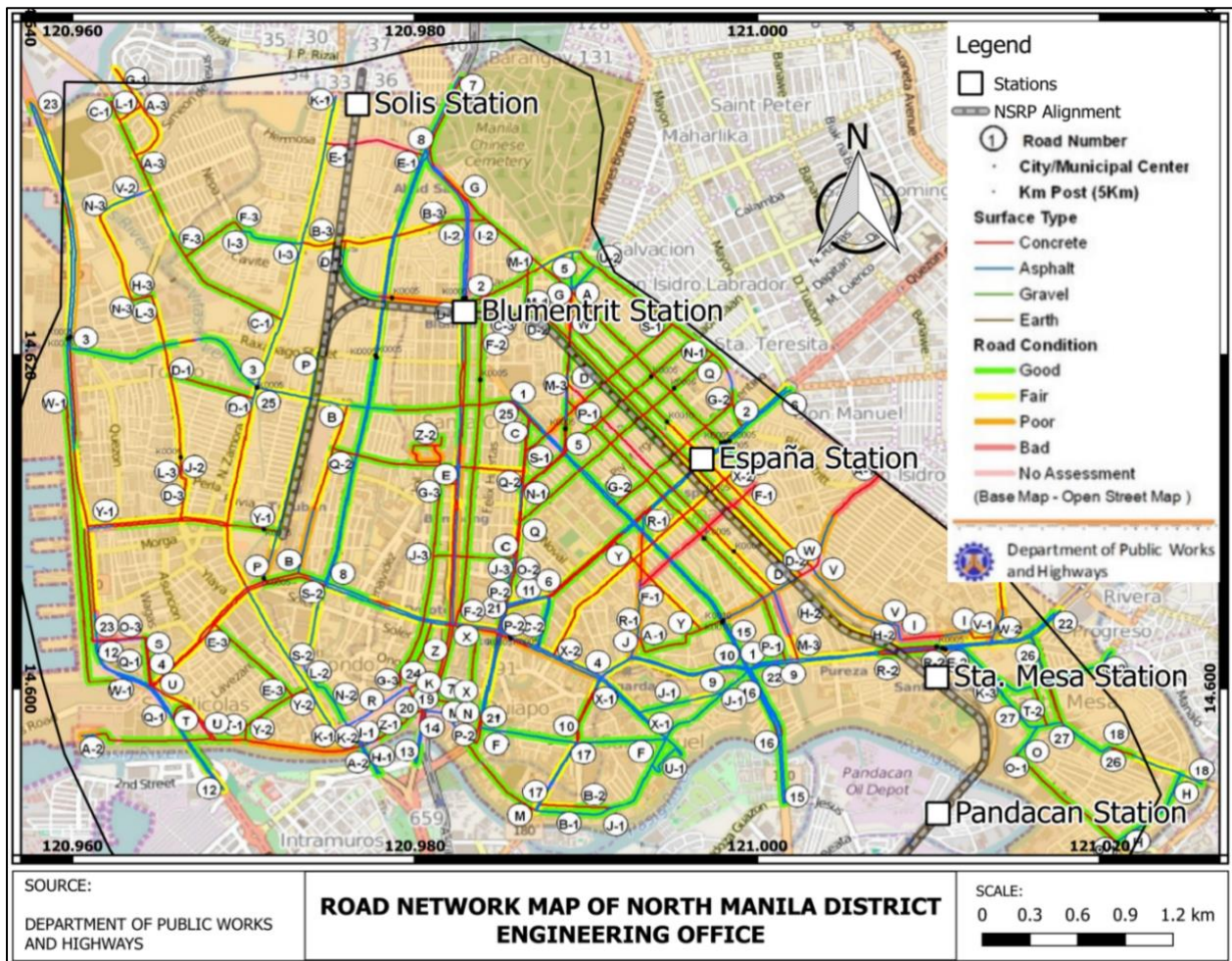
505. Light Rail Transit Line 1 (LRT1) originally operates from Taft Avenue to Monumento with eighteen (18) stations, twelve (12) of which are in Manila City, namely: R. Papa, Abad Santos, Blumentritt, Tayuman, Bambang, Doroteo Jose, Carriedo, Central Terminal, United Nations, Pedro Gil, Quirino, and Vito Cruz. In October 2010, its north extension project began commercial operations up to Roosevelt with two (2) additional stations. In 2011, LRT1 has an average total daily passenger boarding of 435,121.

506. Light Rail Transit Line 2 (LRT 2), with an average daily ridership of 180,000 passengers, runs along the R-6 Corridor and is connected to Doroteo Jose Station of LRT1 through LRT2 Recto Station. Four (4) out of thirteen (13) stations of LRT2 are in Manila, namely: Sta. Mesa, Pureza, Legarda, and at its end, Recto Station.

507. In addition to the three existing rail transport systems, in the near future, the Project will also be connected to the NSCR Calamba Extension, which connects Metro Manila to the Province of Laguna. The NSCR Calamba Extension is also envisioned to be seamlessly connected with the Metro Manila Subway Project (MMSP) at the Senate Station, providing easy and convenient rail transfer of passengers between the two transport projects.

1) Local network

508. The DPWH classified the national road into three (3), namely: Primary, Secondary and Tertiary. National Primary Roads include roads that directly connect major cities (at least around 100,000 people). National Secondary Roads include roads that directly connect cities to national primary roads, except in metropolitan area and roads that directly connects major ports and ferry terminals to national primary road, among others. National Tertiary Roads are the existing roads under DPWH which perform a local function. **Figure 4.5.3** presents the national road classification.



Source: DPWH¹⁴

Figure 4.5.3 Road Network of North Manila District

509. The entire road network in Manila City is composed of about 770 km of roads, less than 3.0% of which remains unpaved. Roads and street are administratively classified as national and local. The total number of city streets in Manila is 1,580 with a total length of 553.07 km and occupying a total area of 3,644,000 square meters. The total number of national roads is 258 with a total length of 240.5 km and occupying a total area of 3,162,000 square meters.

510. Major modes of land public transport in Manila are bus, taxi, FX, jeepney, and tricycle while informal land transport systems are *kalesa*, pedicab and *kuliglig*. The PNR and the LRTA operate the railway systems in Manila. The PNR has six (6) terminals or stations within Manila, which includes Blumentritt, España, Laong Laan, Pandacan, Pedro Gil, and Tutuban. The LRT-1 (Yellow Line) that runs along the length of Taft Avenue (R-2) and Rizal Avenue (R-9), and the LRT-2 (Purple Line) that runs along Ramon Magsaysay Blvd (R-6) are the only mass rail rapid transit lines traversing Manila. As the chief seaport of the Philippines, the Port of Manila along Manila Bay served as the city's main entry/exit point accessible via passenger/ cruise ships, while the Pasig River can be traversed via ferry service.

¹⁴ http://www.dpwh.gov.ph/dpwh/atlas/2015%20DPWH%20Road%20Data/Road%20Data%202015/north_manila.htm (04/24/18)



511. According to Origin Destination Matrix (O-D), Manila ranks second to the top generators of trips, accounting for about 11.0% of the total Trip Origins and about 12.0% of Trip Destinations within the sixteen (16) zones considered.

(2) Potentially Affected Access Points

The Project will directly affect road and public access. None of existing bridge nor terminals for each transportation mode will be affected by the Project.

512. **Table 4.5.49** summarizes the inventory of roads to be traversed by the Project based on the topographic survey conducted by the JICA Design Team. Three roads will be traversed by the Project.

Table 4.5.49 Roads to be traversed by the Project

LGU	Number of Roads to be Traversed			Major Roads and Railways to be Traversed
	<9m width	>10m width	Total	
Manila	0	3	3	Solis Street, Old Antipolo Street, Yuseco Street

Source: JICA Design Team

513. To provide access to PAPs, especially during the construction phase of the project, the Old Antipolo Street will be realigned, and additional access road will be provided to access the MERALCO substation.

514. Old Antipolo Street is an existing street in Barangay 228 located within the PROW. The street is connected to Batangas Street via Laguna Street. The location of Old Antipolo Street within the PROW will overlap with the construction space required for the viaduct erection. Old Antipolo Street will be relocated within the NSCR Calamba-Ex ROW by connecting it to the existing Yuseco Street. A 2.0-m offset within the PROW will be provided to allow residents to access their houses. This public access will be secured and opened to residents by a contractor selected for this section's construction works.

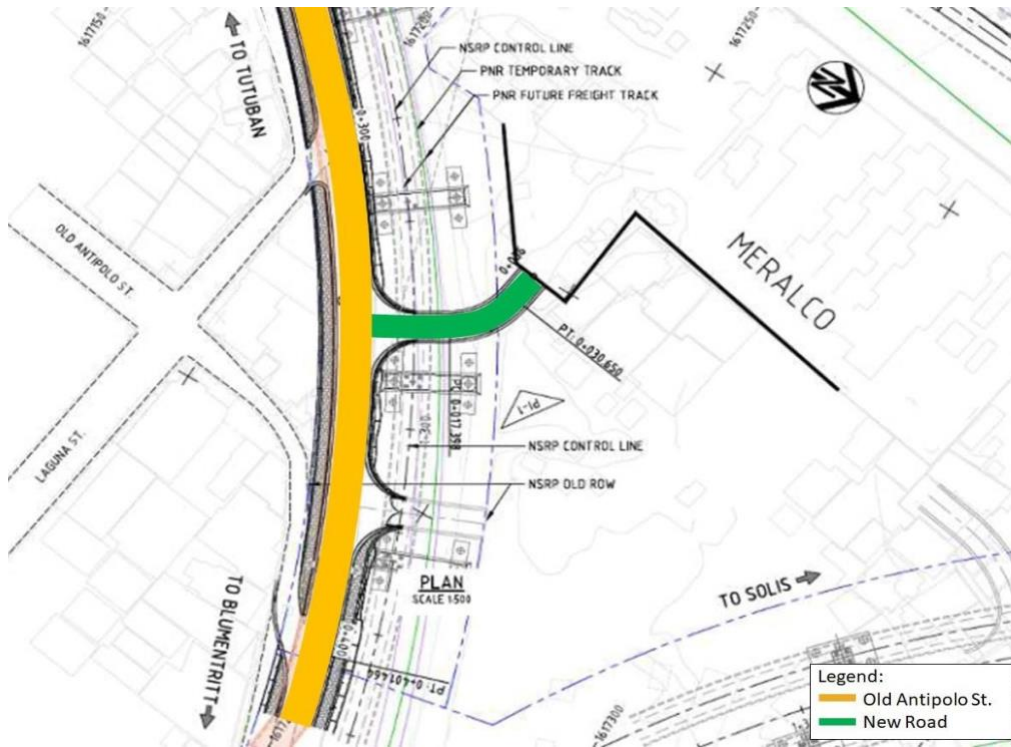


Source: JICA Design Team

Figure 4.5.4 Realignment of Old Antipolo Street

515. The realignment of Old Antipolo Street will also require the relocation of the Old Antipolo Open Canal. The structure of the new canal will be designed as a box culvert, and the new relocated and improved Old Antipolo Street will be allocated on the box culvert canal. The carriageway of the Old Antipolo Street will be 6.1-meters wide.

516. Additional access roads will be constructed to access the Solis-Blumentritt-Tutuban Triangle area and MERALCO substation, as shown in **Figure 4.5.5**.



Source: JICA Design Team

Figure 4.5.5 Access Roads for MERALCO Substation and Triangle Area

(3) Existing Traffic Conditions

517. The Solis-Blumentritt (SB) Section of the Project was formerly under the NSCR Calamba Ex Project. During the DD phase, a Traffic Impact Assessment (TIA) (2019) was done to determine the existing traffic conditions of the road networks adjacent to the NSCR Calamba Ex Project and the future impacts during construction and operation. Earlier to this, a TIA was also conducted for the NSCR Project (2017). However, the Blumentritt-Tutuban (BT) Section was not yet covered in the projections.

518. The SBT Section is traversed by Hermosa Street and Solis Street to its north and Raxabago Street or Yuseco Street to its south. The existing roads that run parallel to SBT Section are Antipolo Street to its northeast and Old Antipolo Street to its southeast. Hermosa Street is covered by Area 1 of the NSCR Project and NSCR Calamba Ex Project. Solis Street is covered by Area 1 of NSCR Project. **Table 4.5.50** tabulates the characteristics of roads covered by the TIA.

Table 4.5.50 Road Inventory and Characteristics

Project	Location	Code	Area	Pavement Type	Terrain	Surface Type	No. of Lanes (Max)
NSCR Calamba Ex Project	Juan Luna St/ Hermosa St.	W1	1	Rigid	Flat	-	2-4
	Abad Santos Ave/ Hermosa St.	E1	1	Rigid	Flat	-	6-8
NSCR Project	Solis St./ New Antipolo St.	6	1	Rigid	Flat	Concrete	1
	Solis St./ Dagupan St.	7	1	Rigid	Flat	Concrete (mostly), asphalt	1-2
	Hermosa St./ Dagupan St.	8	1	Rigid	Flat	Concrete (mostly), asphalt	1-2

Source: SDMI Consultants, Inc.

519. Based on the NSCR Calamba Ex Project TIA, Hermosa Street had unsignalized intersection with Juan Luna Street and signalized intersection with Abad Santos Avenue. Hermosa/ Juan Luna (Survey Station W1) had a weekday traffic volume of 20,110 and a weekend traffic volume of 21,662. Hermosa/ Abad Santos (Survey Station E1) had a weekday traffic volume of 59,926 and a weekend traffic volume of 64,069.

520. For NSCR Project, the intersection between Hermosa Street and Dagupan Street is unsignalized while the intersections of Solis Street with New Antipolo Street and Dagupan Street were also unsignalized. Solis/ New Antipolo (Survey Station 6) had a weekday traffic volume of 16,150 and a weekend traffic volume of 20,824. Solis/ Dagupan (Survey Station 7) had a weekday traffic volume of 20,132 and a weekend traffic volume of 20,179. Hermosa/ Dagupan (Survey Station 8) had a weekday traffic volume of 8,824 and a weekend traffic volume of 9,312.

521. For both NSCR Calamba Ex Project and NSCR Project alignments, the afternoon peak hour is 5:00 PM to 6:00 PM which is the same for both weekday and weekend traffic profile. On the other hand, weekday morning peak hour is 7:00 AM to 8:00 AM while weekend morning peak hour is 8:00 AM to 9:00 AM. The weekday morning peak hour from 7:00 AM to 8:00 AM was used as the peak hour for both studies and served as the basis for the capacity analyses. Based on the travel time and delay survey, the travel speed for both projects averages between 10.0 to 20.0 kph.

522. The observed causes of delays and impedances in traffic flow and movement are as follows:

- Lack of designated bus and jeepney stops
- Inappropriate on-street loading and unloading of passengers
- Signalized intersections function as unsignalized and manned by traffic enforcers during congested periods
- Uncontrolled intersection with non-optimized or non-operational signal timing or no traffic lights
- Improperly or illegally stationed and parked tricycles, pedicabs or vehicles occupying road lanes (e.g. road lane used as tricycle terminal)
- Slow-moving vehicles due to narrow streets and vehicle size
- Presence of vendors and pedestrians occupying portions of roads

1) Current Level of Service

523. The delays and current level of service (LOS)¹⁵ are illustrated in **Table 4.5.51**. Acceptable LOS are from A to D, while LOS from E and F are considered as beyond capacities.

Table 4.5.51 Current Capacity Analysis

Project	Location	Code	Area	Un-Optimized Condition			Optimized Condition		
				LOS	Delay (sec/veh)	Queue Length (m)	LOS	Delay (sec/veh)	Queue Length (m)
NSCR Calamba Ex Project	Juan Luna St/ Hermosa St.	W1	1	C	15.92	34.32	-	-	-
	Abad Santos Ave/ Hermosa St.	E1	1	F	431.35	1048.14	C	32.63	106.00
NSCR Project	Solis St./ New Antipolo St.	6	1	E	38.7	156.45	-	-	-
	Solis St./ Dagupan St.	7	1	F	50.7	189.95	-	-	-
	Hermosa St./ Dagupan St.	8	1	A	9.0	8.94	-	-	-

Source: SDMI Consultants, Inc.

¹⁵ Levels of Service Criteria for Intersections, Highway Capacity Manual 6th Edition

524. Based on NSCR Calamba Ex Project TIA, the unoptimized condition of the intersection of Hermosa Street and Abad Santos Avenue is already beyond capacity as characterized by LOS F which indicates forced or congested flow at low speeds with long queues and delays. Signal optimization performed for this intersection resulted in an improvement in delay and LOS from F to C. LOS C is characterized by stable flow zone wherein drivers are restricted in selecting their speed.

525. As to the NSCR Project, the unoptimized condition of the intersection of Solis Street-New Antipolo Street and Solis Street-Dagupan Street are already beyond capacities as characterized by LOS E and F. LOS E is characterized by traffic volumes near or at capacity and flow is unstable with momentary stoppages while LOS F indicates forced or congested flow at low speeds with long queues and delays. The Hermosa Street- Dagupan Street intersection still has free flowing traffic conditions with no restrictions on maneuvering or operating speeds, low traffic volumes and high speeds as characterized by LOS A. The Solis Street intersections were not covered by the signal optimization.

(4) Future Traffic Conditions

526. Two horizon years are considered in the assessment of future capacity under NSCR Calamba Ex Project and NSCR Project: the year 2020 for construction period and the year 2025 for operation period. Similar to existing traffic conditions, road capacities are analyzed mainly based on their LOS and the capacity to carry additional vehicle volumes without being congested. Acceptable LOS are from A to D, while LOS from E and F are considered as beyond their capacities.

527. This section is limited to the results of NSCR Calamba Ex Project as it covers the evaluation for both construction and operation. Traffic volumes were projected to 2020 using the growth rate factor 0.9576 for construction period and to 2025 using the regional growth rate factor 0.9067 for operation period.

1) Construction Period

528. Both survey stations for Hermosa Street-Juan Luna Street (W1) and Hermosa Street-Abad Santos Avenue (E1) are projected to have delay reduction. As to LOS, E1 remained at the same level while W1 decreased from C to B.

Table 4.5.52 LOS Analysis for Construction Period

Project	Location	Code	Area	2020		2020 Optimized	
				LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
NSCR Calamba Ex Project	Juan Luna St/ Hermosa St.	W1	1	B	14.97	-	-
	Abad Santos Ave/ Hermosa St.	E1	1	F	407.22	C	31.62

Source: SDMI Consultants, Inc.

529. In addition to this general traffic during construction period, the railway construction will bring additional traffic volume in the form of trucks carrying soil fills, facilities, construction wastes among others, concrete mixers, coasters for workers and others. These construction-related vehicles will be plying to and from the location or near the location of the railway stations.

2) Operation Period

530. Both survey stations for Hermosa Street-Juan Luna Street (W1) and Hermosa Street-Abad Santos Avenue (E1) are projected to have delay reduction compared to the 2020 traffic conditions. As to LOS, E1 remained at LOS F optimized to LOS C. W1 remained at LOS B with no optimization.

Table 4.5.53 LOS Analysis for Operation Period

Project	Location	Code	Area	2025		2025 Optimized	
				LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
NSCR Calamba Ex Project	Juan Luna St/ Hermosa St.	W1	1	B	14.97	-	-
	Abad Santos Ave/ Hermosa St.	E1	1	F	407.22	C	31.62

Source: SDMI Consultants, Inc.

531. Aside from the growth of general traffic, the traffic conditions during this period will also be affected by the generation of feeder transportation to/from the railway stations and the shift in mode usage from existing public and private modes to the rail mode.

5 PREDICTION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

5.1 OVERVIEW OF IMPACT ASSESSMENT

532. This chapter presents the potential impacts associated with the development of the SBT Section and the mitigating measures to avoid or minimize the adverse impacts and the enhancement measures to maintain or improve positive impacts. The project impacts identified include direct, indirect and cumulative impacts. The assessment of these impacts has considered the nature, design and development phases of the SBT Section (**Chapter 2**) as well as other ongoing projects in the same area as SBT Section.

533. The environmental aspects of the impact assessment include soil quality and contamination, terrestrial ecology, and geologic hazards for land impacts; surface water quality and flooding for water impacts; and, climatology, ambient air quality, noise and vibration for air impacts which are mainly based on baseline survey for SBT Section (**Chapter 4**). The social aspects for assessing impacts on people comprise public participation and information disclosure; involuntary resettlement, land acquisition and utilization; local economy, employment and livelihood; in-migration; cultural/lifestyle change; vulnerable groups, gender issues and children's rights; cultural heritage, public utilities and infrastructure, occupational and community health and safety; and, public access and traffic management based on relevant references and/or sources of secondary and primary socio-economic baseline information especially from Resettlement Action Plan (RAP) and previous EIA Reports¹.

534. The project impacts and mitigating measures are based on good construction practice and expert knowledge. The impacts are assessed for significance in terms of nature, magnitude, occurrence, permanence, duration, and geographic extent, and rated as: A+/-: significant positive / negative impact is expected; B+/-: moderate positive / negative impact is expected; C+/-: minor (negligible) positive / negative impact is expected; D: extent of impact is unknown. The impact significance is based on expert judgment considering the criteria listed above, and the complexity and cost of mitigation. Project impacts exceeding national or international standard limits also indicate significant impacts.

535. The development phases discussed in the impact assessment include pre-construction, construction and operation phases. Prior to construction, additional baseline surveys on soil quality and contamination, terrestrial ecology, surface water quality, air quality, noise and vibration are to be conducted to improve impact assessment and mitigation once the location of temporary construction facilities outside the Project ROW including but not limited to construction yards, camps and access routes are identified. Table summaries on potential impacts and mitigating measures are provided and include abandonment phase.

5.2 THE LAND

5.2.1 Soil Quality and Contamination

536. The potential impacts of the development of the SBT Section on soil quality and the mitigating measures for the identified impacts are provided below and summarized in **Table 5.2.1**. Results of the soil sampling conducted were discussed in detail in **Section 4.2**.

¹ EPRMP for NSCR, Volume 1, Main Report Draft, March 2015, DOTC and EIS for NSCR Calamba Extension Project, Volume 1: Main Report, Updated Report, January 2020, DOTr

5.2.1.1 Pre-Construction/ Construction Phase

(1) Soil Erosion and Contamination due to Generation of Excess Soil for Disposal During Earthworks

1) Potential Impacts

537. During construction, the earthworks for the SBT Section will generate approximately 19,500 cubic meters (m³) of excess soil. The excess soil will come from construction of viaduct pile and pile cap, building and substation, and drainage and roads. About 600 m³ of excess soil will be used for construction and remaining 18,900 m³ will be disposed. The excess soil for disposal will be also referred to as spoils. The spoils from earthworks may be considered as non-hazardous waste as the baseline metal concentrations of soil in the SBT Section are below the DAO 2013-22 hazardous waste standards based on the conducted toxicity characteristic leaching procedure (TCLP). As such, the spoils can be used for site development or land improvement. However, the spoils cannot be used for planting nor agriculture because of exceedances with Bureau of Soils and Water Management (BSWM) Soil Fertility Standards. Also, pile spoils comprise sand and gravel that are not suitable for agricultural use by virtue of fertility.

538. If unmanaged, these spoils can cause sedimentation and siltation of nearby waterways. Siltation of waterways may further cause temporary flooding affecting the livelihood of the affected communities (i.e., challenges to access their area causing difficulty to go to work or loss of potential clients/consumers) and their health and safety (i.e., prone to diseases brought about by exposure to unclean water or stagnant water). This indirect impact may be compounded by climate-induced flooding.

2) Mitigation

539. To manage spoils and prevent siltation, the Contractor will have to first identify a Spoil Disposal Area (SDA) where the generated spoils will be disposed of. Areas to be avoided in siting the SDA are as follows:

- irrigated rice fields,
- areas with slopes of more than 25 degrees,
- areas where geological structure is unfavorable to stability,
- areas on slopes that are subjected to stream erosions,
- areas identified to be protected or as special status habitats,
- areas within 100 m from waterbodies or drainage line, whether permanent or seasonal,
- areas where adequate health and safety procedures are not in place,
- areas of groundwater discharge, sources of drinking or irrigation water and
- areas where permanent stabilization of disposal spoils will be difficult.

540. The Contractor will then prepare an Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and Spoil Management Plan (SMP) as part of the Construction Environmental Management and Monitoring Plan (CEMMP) to provide detailed information on handling, transporting and disposing spoils generated during construction. Under the SMP, the Contractor will identify haul routes, truck queuing and parking procedures to control dust and to prevent mud-tracking during the transport of surplus soil for disposal. The disposal of surplus soil will be documented and controlled through regular inspection/monitoring of the SDA. Appropriate engineering interventions may also be employed to control potential soil erosion in the SDA. The SMP will also cover excavation planning in consideration of weather conditions.

541. During construction, clearing and excavation activities will be scheduled in a speedy manner during dry season and excavation activities will be minimized during wet season. During earthworks,

stable cut and fill slopes will be maintained at all times while areas with ground disturbance will be minimized by immediately instituting stabilization measures or engineering interventions such as slope protection and drainage systems with sedimentation/erosion pond and temporary ditches around work areas to collect sediments from erosion or use of bunds and silt fences to protect watercourses from soil run-off.

542. Construction materials and excavated materials including excess soil or spoils will be placed in appropriate staging site or spoils area with adequate containment away from waterways. For stockpiles of excavated soils, the height limit will not be more than 2 m. As best practice, spoils will be hauled out as soon as excavated. All spoils will be removed and disposed prior to rains. For deeper excavations, wet soils may be encountered due to intersections to the groundwater table. In case of excavated wet/damp soils, they will be stockpiled in designated staging areas and dried prior to transport.

543. For stockpiles of sand and gravel for construction, fences will be installed and storage time will be reduced in work areas to minimize sediment transport during heavy rains. During excavation works, the sides of the excavation will have adequate bracing, double steel sheet piles in the construction area will be driven near soil surface water sources, and bentonite or polymer slurry will be used for bored piles to prevent soil erosion or soft soil displacement and to stabilize uncased borings in loose soils.

544. The construction areas and road surfaces will be regularly cleaned and cleared from scattered construction materials and scraps to avoid obstruction of natural flow especially during wet season. For long-term storage throughout the rainy season, soil storage heaps will be graded to flat tops and covered or vegetated with soil stabilizing grasses.

(2) Soil Contamination due to Generation of Solid Wastes

1) Potential Impacts

545. Solid wastes generated during construction activities may affect the soil quality of the project site without proper handling and disposal. Lime or cement may cause soil hardening and increase soil pH. Given the current land use and flood susceptibility, soil hardening may occur and affect the permeability of the soil leading to surface runoff and severe flooding during the rainy season.

2) Mitigation

546. To manage the solid wastes generated during clearing, demolition and construction activities, the Contractor will prepare and implement a Solid Waste Management Plan (SWMP) in accordance with Republic Act No. (RA) 9003 (Ecological Solid Waste Management Act of 2000) and RA 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990). The SWMP will detail the placement of waste bins for different types of waste – recyclable, biodegradable, and hazardous waste, waste segregation, regular transport and disposal of wastes, and reuse of excess construction materials. As part of the SWMP, daily site clean-up and recycling procedures will be established to minimize the production of wastes to be treated or eliminated. Temporary solid waste disposal areas within construction sites will also be identified and demarcated with clear instructions on specific waste materials to be accommodated. Waste bins of 75-liter capacity shall be placed in work areas (i.e., one every 80 square meters) covered and labelled properly for segregated storage of solid wastes, including hazardous wastes. A Materials Recovery Facility (MRF) will be established to process the segregated wastes. An accredited waste hauler of the Department of Environment and Natural Resources (DENR) or the local government unit (LGU) will dispose the non-recyclable wastes into a sanitary landfill (SLF). Management of debris from vegetation removal and tree cutting will follow DENR Administrative Order (DAO) No. 2001-34. General healthcare wastes such as disposable face masks will be collected in a separate container and will be labelled properly prior to disposal. Should there be medical waste (i.e., infectious, pathological, hazardous waste and sharps), these waste will be disposed according to RA 6969 and relevant Department of Health (DOH) guidelines. Solid wastes will not be buried anywhere

within the project site or any adjoining land; all such materials will be removed from the site. The different types of wastes to be generated during the different project phases are listed below.

- Vegetation debris, cut trees, shrubs
- Surplus soil
- Demolition waste
- Building waste
- Tires
- General waste (e.g. food scraps, other putrescible wastes, toiletries, and office waste)
- Recyclables
- General healthcare waste (e.g., disposable face masks and other COVID prevention related litter are not considered as medical waste)

547. Information, education and communication (IEC) campaign and community awareness initiatives on waste management, including installation of signages prohibiting improper waste disposal, shall be conducted in partnership with the LGU to promote proper solid waste management. As the Contractor will conduct regular soil quality monitoring, results will be disclosed to the public.

(3) Soil Contamination due to Accidental Spills of Oil, Lubricants or Other Chemicals and Generation of Hazardous Wastes

1) Potential Impacts

548. Oil and lubricants used in construction machinery and heavy equipment, and other chemicals used during construction activities may spill onto the surrounding environment causing soil contamination. The accidental spills may percolate deep in the soil and further impact groundwater due to shallow groundwater table. Exposure to hazardous wastes and contaminated soil and groundwater through dermal contact and ingestion may cause health impacts especially to workers engaged in excavation activities and exposed to contaminated areas leading to serious illnesses and loss of livelihood.

2) Mitigation

549. To manage hazardous wastes and prevent spills during construction activities, the Contractor will prepare and implement a Hazardous Waste Management Plan (HWMP) including a Spills Prevention, Management and Emergency Response Plan (SPMERP) to ensure safe and effective material handling and transport operations as well as Occupational and Community Health and Safety Management Plan (OCHSMP) to ensure public health and safety from accidental spills of oil, lubricants or other chemicals and generation of hazardous wastes. All construction personnel who will be involved with the use of hazardous materials will undergo safety trainings. Spill containment kits will also be provided in the construction sites.

550. The machineries and heavy equipment to be mobilized during construction will be under regular load capacity testing, fuel and leak check-up, and maintenance per manufacturer specification to ensure good working conditions prior to use. With the heavy use of machineries and equipment during construction, the Contractor is required to designate an area where fuel refilling, repairs and other maintenance works will be done. The designated maintenance area should be paved and equipped with perimeter sump drainage system to catch oil spills. Other methods to collect leakage and catch oil spills include the use of containers, drip trays or spill pads especially for heavy equipment unable to travel to the designated maintenance area. In addition, heavy equipment operators are required to be certified and competent for heavy equipment use and to undergo safety training along with other construction workers. Working conditions should comply with RA 11058, DOLE Department Order No. (DO) 198 – 2018 and DO 13 ‘Guidelines governing occupational safety and health in the construction industry’.

551. Oil and grease traps will be provided in wash bays and in areas where chemicals, oils and lubricants are present to prevent soil contamination. Hazardous wastes and materials will be stored in an impermeable area with a secondary containment. Regular inspection of storage conditions will be conducted for damage checks and immediate repairs to prevent leaks and spills. The use of unapproved toxic materials will be prohibited in the construction sites. Appropriate permits (i.e., Permit to Transport (PTT), Hazardous Waste Manifest) will be secured from DENR prior to disposal of any hazardous waste. The Contractor will ensure that DENR-accredited transporter and treater will transport, treat, and dispose hazardous wastes following RA 6969 while a licensed contractor will dispose non-recyclable wastes.

552. The Contractor shall regularly monitor and inspect handling of chemicals and hazardous substances including storage conditions to check for damages so that needed can be done immediately to prevent leaks, spills and other related emergencies from occurring. Result of monitoring shall be disclosed to the public. Public involvement and information dissemination activities will also be undertaken to cover topics on health and environmental hazards.

553. In case of spill, contaminated areas will be isolated to stop and contain any releases followed by immediate clean up and disposal of contaminated soil in accordance with national regulations and the HWMP. Local authorities may be contacted for appropriate response such measurement and evaluation of extent of contamination and conduct of detoxification activities.

(4) Human Health Impacts associated with Incidental Ingestion and Dermal Contact of Contaminated Soil

1) Potential Impacts

554. Arsenic concentrations in all soil samples were detected above the US EPA carcinogenic screening level² as discussed in **Section 4.2.3.2**. Arsenic concentrations are attributed as naturally occurring background concentrations since there is low potential for spillage of substances containing arsenic in the sampling locations based on observed current land use. Arsenic are generally present in all soils in concentrations ranging from 0.1 to 40 mg/kg³. Although screening levels are commonly lower than naturally occurring background concentrations, due to exceedance of arsenic concentration to US EPA screening levels, potential human health impacts are anticipated if nearby communities and construction workers are chronically exposed to arsenic, whether short term or long term, via incidental ingestion^{4,5} and dermal contact of dust particles particularly if soils are disturbed during excavation and construction activities.

2) Mitigation

555. In cases as the above, US EPA recommends further assessment and site investigations. As such, the DOTr and/or the Contractor will conduct additional testing or detailed soil contamination survey prior to construction to characterize background concentrations of chemicals in soil and verify extent of soil contamination.

556. Based on the level of impacts detected during the additional sampling prior to construction, necessary actions will be decided for consideration in the preparation of a Soil Contamination Management Plan (SCMP) that will include procedures on how to handle excavated soil and/or spoils

² United States Environmental Protection Agency. (2020, May 21). Regional Screening Levels (RSLs) - Generic Tables (November 2020) for Composite Worker Soil [Dataset]. <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>

³ National Research Council (US) Committee on Medical and Biological Effects of Environmental Pollutants. (1977). Arsenic: Medical and Biologic Effects of Environmental Pollutants. National Academies Press (US)

⁴ United States Environmental Protection Agency. (n.d.). Exposure Assessment Tools by Media - Soil and Dust. US EPA. <https://www.epa.gov/expobox/exposure-assessment-tools-media-soil-and-dust>

⁵ Washington State Department of Health. (1999, January). Hazards of Short-Term Exposure to Arsenic Contaminated Soil.

based on the levels of impacts detected. If results exceed limits, excavated soil will be handled as contaminated soil in compliance with RA 6969.

557. The SCMP will be strictly implemented. Continuous periodic sampling or regular monitoring of soil quality parameters will be conducted throughout the excavation and construction activities. If soil quality parameters exceed any of the adopted criteria, contaminated soils will not be allowed to be used for planting and agriculture. An EMB-accredited waste hauler will immediately dispose the contaminated soils.

As to potential human health impacts due to exposure to contaminated soil through incidental ingestion and dermal contact, the Contractor will prepare and implement an OCHSMP and/or SCMP including Contact Management Plan (CMP) with proper handling procedures with proposed contents indicated in **Annex E-1**. The SCMP should also cover the following detailed mitigating measures specific for contaminated soil caused by the project:

- Information dissemination plan for local residents, stakeholders and relevant agencies (e.g. IEC for nearby communities and workers on potential hazards associated with soil ingestion and dermal contact).
- Decontamination plan in coordination with DENR including but not limited to:
 - Marking of the contaminated area clearly and access control among the construction workers and personnel in case of soil contamination.
 - Allocation of decontamination area
 - Implementation of appropriate cleaning practices among the construction workers and personnel such as frequent hand washing with soap and water, avoidance of touching face and eating using bare hands and work gloves
 - Proper hazardous waste handling and disposal
- Mitigation plan for exposure including but not limited to:
 - Training of construction workers on the potential hazards associated with soil ingestion and dermal contact and proper wearing of personnel protective equipment (PPE).
 - Provision of PPE such as but not limited to face mask, face shield, hard hat, goggles, gloves, safety boots.
- Dust Emission Control Plan (DECP) to minimize dust generation (e.g. water spraying to avoid dust clouds during dry season).
- Monitoring plan for periodic monitoring of soil contamination through soil sampling and visual inspections to assess the mitigation effectiveness against soil contamination and dust generation to reduce health hazards and prevent human exposure and ingestion of particles from disturbed contaminated soils. In case of any detected exceedance, detoxify the affected area in consultation with DENR.

5.2.1.2 Operation Phase

(1) Soil Contamination due to Accidental Spills of Oil, Lubricants, and Generation of Hazardous Wastes

1) Potential Impacts

558. Lubricant leaks and oil spills during train operation may result to soil contamination. Improper handling and disposal of hazardous wastes may further contaminate the soils in the SBT Section and its surroundings. Oil spill and leaks from the use of vehicles and oil-filled equipment such as power transformers, oil-filled reactors, regulators, and circuit breakers during TSS-1 operation and maintenance may also cause soil pollution. As the SBT Section right-of-way (ROW) (Project ROW) is

underlain by recent weathered pyroclastic deposits, the groundwater table is shallow and contaminants leaching into the soil may also impact groundwater.

2) Mitigation

559. To prevent soil contamination, only equipment appropriate for the task and rated properly will be used during operation and maintenance activities. The trains, TSS-1 and other equipment that require the use of oil and lubricant will be regularly maintained to prevent leaks and spills. Maintenance personnel will be trained on procedures related to handling and disposal of hazardous wastes to ensure safety in the workplace and the surrounding environment. Bulk waste oils and lubricants (i.e., 110% of waste volume capacity) will be stored in properly labelled containment areas with signage, fire extinguishers, barricades, and controlled access. Hazardous waste generation shall be monitored and disclosed to the public. Public involvement and information dissemination activities will be undertaken to cover topics on health and environmental hazards.

(2) Human Health Impacts associated with Incidental Ingestion and Dermal Contact of Contaminated Soil

1) Potential Impacts

560. Lubricant leaks, oil spills and hazardous waste generation from operational activities such as use of machineries, equipment and vehicles may contaminate soils. The contaminants from construction and operation phases may percolate deep into the soil and further reach and contaminate groundwater.

561. Soil and groundwater contamination may cause human health impacts through incidental ingestion and dermal contact. However, since groundwater extraction is strictly prohibited throughout Metro Manila, there are no potential groundwater users in the community surrounding the SBT Section. Moreover, the surrounding community will not be exposed to contaminated soil as the SBT Section will be restricted for public use and access. However, the employees of the TSS-1 may be exposed to contaminated soil that can cause health impacts.

2) Mitigation

562. To prevent negative health impacts, the Operator will ensure that SCMP, CMP and/or OCHSMP are also in place during operation and discourage domestic use of groundwater among the nearby barangays. In addition, sampling will be conducted regularly to monitor arsenic levels in soil and disclose results to the public. If concentrations exceed the stated limit, it will be handled as contaminated soil pursuant to RA 6969. Public involvement and information dissemination activities will be undertaken to cover topics on health and environmental hazards.

5.2.1.3 Cumulative Impact Assessment

563. The NLEX-SLEX Connector Road Project of the Department of Public Works and Highways (DPWH) that began construction in May 2019 may contribute to the cumulative impacts of the SBT Section. A portion of the elevated 8-kilometer road project that connects the North Luzon Expressway (NLEX) and South Luzon Expressway (SLEX) will run parallel and share the existing PNR ROW with SBT Section.

564. The amount of solid wastes and excess soils to be generated would be greater if the construction phases of the SBT Section and the NLEX-SLEX Connector Road project overlap. In the implementation of the SWMP and SMP during construction, the NSCR Project Management Office (PMO) with support from the Contractor will coordinate with the NLEX-SLEX Connector Project PMO and the LGU to harmonize spoil and solid waste management strategies. In addition, with both projects using machineries and heavy equipment, sources of lubricant leaks and oil spills may disturb and contaminate

the soil if unmanaged. The same mitigation measures as discussed in **Section 5.2.1** are deemed sufficient to address the issues.

Table 5.2.1 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Soil Quality and Contamination

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Soil erosion and contamination due to generated excess soil or spoils	✓	✓	X	✓	B-	• Design slope protection/ soil erosion control to prevent or minimize slope failure during construction based on the results of the geohazard assessment and geotechnical investigation • Limit the removal of vegetation cover and topsoil to what is necessary for the works by marking up the vegetation removal area on site • Designate the spoil disposal area (SDA) where no future slides are to take place and be washed off in watercourses • Avoid locating the SDA on (1) irrigated rice fields, (2) slopes of more than 25 degrees, (3) where geological structure is unfavorable to stability, (4) on slopes that are subjected to stream erosions, (5) on areas identified to be protected or are special status habitats, (6) within 100 m from waterbodies or drainage line, whether permanent or seasonal, (7) on areas where adequate health and safety procedures are not in place, (8) areas of groundwater discharge, sources of drinking or irrigation water and (9) areas where permanent stabilization of disposal spoils will be difficult • Implement the Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and sedimentation and Spoil Management Plan (SMP) to properly handle, transport and dispose spoils (including identification of haul routes, truck queuing and parking procedures for dust control and mud-tracking prevention) • Minimize ground subsidence, maintain stable cut and fill slopes at all times and install engineering interventions such as slope protection and drainage systems with sedimentation/erosion pond and temporary ditches around work areas to collect sediments from erosion or use bunds and silt fences to protect watercourses from soil run-off during the wet season • Schedule clearing and excavation activities in a speedy manner during dry season and minimize excavation during wet season • Place construction materials and excavated materials including excess soil/ spoils on appropriate staging site or spoils area with adequate containment away from waterways • For stockpiles of excavated soil, cover and limit at height up to 2 m and install silt traps, deviation channels, mounting, barriers or trenches around the stockpiles. For spoils, immediately haul out and remove from the construction site and transport to the disposal site especially prior to expected rains. Ensure wet/damp soils are sufficiently dry prior to transport • For stockpiles of sand and gravel for construction, install fences around and reduce storage time in the work areas to minimize sediment transport during heavy rains • For excavation works, adequately brace the sides of the excavation, drive double steel sheet piles in the construction area near soil surface water sources, and use bentonite or polymer slurry for bored piles to prevent soil erosion or soft soil displacement and to stabilize uncased borings in loose soils

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						- Regularly clean and clear the construction/ demolition areas and road surfaces with scattered dust/excavated/demolished/construction materials and scraps or to avoid obstruction of natural flow especially during the wet season - For construction works during wet season that may require long-term storage, grade soil storage heaps to flat tops and cover or vegetate with soil stabilizing grasses for long-term storage - Monitor visible signs of erosion and implement the Erosion and Sediment Control Plan (ESCP) for the disposal and management of soil
Soil contamination due to generation of solid wastes (including wastes from vegetation clearing and demolition)	X	✓	✓	✓	B-	- Implement the Solid Waste Management Plan (SWMP) - Establish and enforce daily site clean-up procedures - Minimize the production of wastes that must be treated or eliminated - Reuse leftover concrete and metals for suitable alternative projects - Repurpose cut logs and other usable wastes (e.g. convert into school chairs) - Recycle wastes including soil and sort wastes for disposal, designate an appropriate temporary storage area and provide MRF - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and management procedures of the cut logs and/or sustainable practices in disposing vegetation waste - Engage only DENR and LGU-accredited companies in the tree cutting and vegetation removal procedures. Contractors to follow RA 9175 and chainsaws to be used for the tree cutting activities will have a Certificate of Registration from the local DENR - Ensure that collectors undergo the minimum standards and requirements for the collection, transport and handling of solid waste per DAO 2001-34 Rule 10, Section 1 - Provide 75-liter waste bins with covers and label at strategic locations in work areas for segregated storage of different types of solid wastes, including hazardous wastes - Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed - Dispose non-recyclable wastes (trash bags, non-recyclable plastic, glass, non-recyclable paper) to a sanitary landfill by a licensed contractor - Prohibit burning of any type of solid wastes generated during the vegetation removal and tree cutting - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						Conduct soil quality and contamination monitoring and disclose all monitoring results to the public
Soil contamination due to accidental spills of oil, lubricants, or other chemicals and other hazardous wastes	X	✓	✓	✓	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) - Conduct safety induction training for the workers including personnel training on spills removal and emergency response procedures - Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes and ensure that hazardous wastes are the transporter and TSD facility are accredited by the DENR-EMB - Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) - Conduct regular maintenance of all vehicles and machinery - Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials - Establish and maintain an inventory of chemicals and hazardous wastes for documentation and monitoring - Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate spillage protection. If necessary, provide proper roofing and concrete-paved floor with proper chemical-proofing. - Immediately use and remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. - During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks - Properly handle and dispose potential contaminants coming from construction/demolition sites through DENR-accredited hazardous waste haulers. For residual wastes, put inside sacks and other bags that don't leak and bring to residuals containment areas of the LGU - Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 'Guidelines governing occupational safety and health in the construction industry' - Regularly monitor and inspect handling of chemicals and hazardous substances including storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks, spills and other related emergencies from occurring - In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and Hazardous Waste Management Plan (HWMP) or contact the

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities
Due to arsenic concentration, there are potential human health impacts if workers and community are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	✓	✓	✓	✓	B-	• Conduct additional testing prior to construction to verify extent of contamination and to properly manage contaminated soil • Prepare a Soil Contamination Management Plan (SCMP) based on the level of impacts detected during the additional sampling • Implement the Soil Contamination Management Plan (SCMP) / Occupational and Community Health and Safety Management Plan (OCHSMP) which includes a Contact Management Plan with details on proper handling procedures • Clearly mark the contaminated area and control the access through fencing and adequate warning signs • Inform workers and communities on potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil • Provide decontamination area where personnel can clean/sanitize themselves • Encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves • Implement the Dust and Emission Control Plan to minimize dust generation • Conduct water spraying to avoid dust clouds during dry season • Conduct continuous monitoring of arsenic level and disclose results to the public • Conduct regular monitoring of soil contamination or visual inspection to assess effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.2.2 Protected Areas

565. The SBT Section will not traverse any Protected Area (PA) nor Key Biodiversity Area (KBA) designated by international, national or local laws and regulations.

566. Arroceros Forest Park and Manila Bay Beach Resort are extensively modified, dominated by exotic or introduced plants and the presence of various man-made structures. The Ninoy Aquino Parks and Wildlife Center is also vegetated with exotic or introduced plants while wildlife individuals are from confiscations and not originally from the area. Luneta Park is a historic park with designed landscape and exotic planning.

567. The project is located near the East Asian–Australasian Flyway migratory route and the Manila Bay KBA as well as Las Piñas–Parañaque Critical Habitat and Ecotourism Area which is one of the last remaining patches of mangrove in Manila Bay, and provides habitat for wetland birds (both migratory and resident breeders).

5.2.2.1 Pre-Construction/ Construction Phase

(1) Encroachment of Protected Areas and Key Biodiversity Areas

568. During construction, there are no project-related activities will occur in the identified KBA and PAs. These include activities and areas off site (outside SBT Section footprint) that may be needed during construction such as lay down areas or temporary facilities. Considering the habitat status of the PA and distance from the project sites, no direct nor indirect effects were predicted for the PAs.

569. Construction noise level primarily from piling and footing that may cause significant impact is also not expected to reach beyond 150 meters from the edge of ROW or from the noise source (within SBT Section project footprint and vicinity). The animals and human differ in ability to hear frequency levels. Thus the impact on animals cannot be assessed in this study but might have some impact on those animals in breeding and incubating. The dust, during worst case scenario, is not expected to reach more than 100 meters, therefore will not impact even the nearest PAs (i.e., Arroceros and Luneta). Transfer of materials for the project during construction will utilize existing roads and may divert traffic flows along Antipolo Road. However, traffic congestion that may happen in this area during the construction of the SBT Section will be far from the vicinity of PAs and KBAs to cause negative impact to regular flow of traffic to the PAs and KBAs.

570. Evidence from the study of Benitez-Lopez et al.,(2010) shows that the impacts of infrastructure on bird population can extend to distances of over 1 km, and for mammal populations up to about 5 km. Evidence from Marcantonio et al., (2013) , showed that edge impacts of roads on vegetation could range distance from 20 to 200m. The nearest PA (Arroceros Forest Park) is 3.20 km away from the project site. Given these studies on roads and infrastructures (since none is available for trains), the SBT Section the study does not predict any impact any PAs and KBA.

571. During the bird migration season, since the NCR is sandwiched between Manila Bay and Laguna Lake, migratory birds and even resident breeding waterbirds which frequent the said waterbodies may occasionally stop in Manila City either to rest or forage. These migratory birds and resident breeding waterbirds could also stop in Arroceros Forest Park, Manila Bay, and LPPCHEA. Migratory birds may also roam or perch along the Project ROW.

572. For source of food and shelter, migratory birds are likely to stay in quiet sections of Manila Bay including that of Las Pinas -Paranaque Critical Habitat and Ecotourism Area or LPPCHEA, a nationally designated protected area, which is 15.5km away from SBT Section. Small migrating birds (non-waterfowl) that naturally inhabit green spaces are unlikely to settle along the Project ROW. As the SBT

Section is located in a highly urbanized area subject to constant noise and movement, the area is therefore not an area that would attract these migratory birds).

5.2.2.2 Operation Phase

573. During operation of the trains on the SBT section, the increase in train movements is not expected to directly or indirectly affect the nearby KBAs and PAs as the SBT section does not have direct connection or any mechanism of impact on the KBA and PAs. Also no impacts are anticipated for migratory bird travelling the flyway route due to the high buildings around the ROW.

5.2.3 TERRESTRIAL ECOLOGY

574. The potential impacts of the development of the SBT Section on terrestrial ecology and the proposed mitigating measures for the identified impacts is provided below and summarized in **Table 5.2.4**.

Impact Assessment Method

575. Potential impacts were identified and assessed based on construction requirement (i.e., removal of all vegetation in the ROW), baseline study results (i.e., presence of native, endemic, and/or threatened species), size of the Project ROW and its location relative to nearby green spaces, and Project ROW re-vegetation plan during operation.

576. Three impact categories are identified, namely: direct, indirect, and cumulative. Direct impacts from the project include vegetation removal and habitat loss, and threat to important species while indirect impacts from project-related activities include noise and light pollution, dust deposition on leaves, and vehicular strikes on local wildlife. Cumulative impacts are those from the SBT Section combined with the impacts of other surrounding government and private projects (within the 500 m radius) that require vegetation clearing, tree removal/relocation, and/or further reduction of green spaces. All impacts identified are mostly negative with magnitude ranging from low to medium while duration is coincident with the operation life of the SBT Section.

Approach to Mitigation

577. To address potential impacts at various phases of the Project and reduce impacts as far as possible, the mitigation hierarchy was employed. The mitigation hierarchy consists of, in order of application; 1) anticipation and avoidance, 2) minimization or reduction, 3) mitigation, and 4) compensation or offset. WB ESF Guidance Note 1 (GN61) states that mitigation should focus on measures to prevent impacts from occurring in the first place, as opposed to `minimization, mitigation, or compensation. This is not always possible and mitigation measures themselves should be drawn from options that are technically and financially feasible.

578. The SBT Section is within the ROW of the Philippine National Railway (PNR) which is currently operating. At the periphery of the ROW are high density residential areas, medium to high intensity commercial areas, general institution zones (Manila CLUP, 2018). These site conditions provide no option for the realignment and avoidance of the remaining vegetated patches (~ 1.5 ha). To best approach and achieve impact minimization or reduction, and mitigation, coordination among various project stakeholders (e.g., design team, environmental and social assessment team, LGUs, etc.) were conducted. These mitigations will be achieved through collaboration between the proponent's environmental specialists and the design team as the Project progresses. Mitigation identified will be implemented by incorporating them into the Contractor's contract, setting-up a monitoring program, responding to community consultations and stakeholder concerns as the project design progresses, and monitoring the implementation of the mitigation via various monitoring reports (e.g., CMR, SMR, etc.) that will be submitted to the DOTr and DENR-EMB.

5.2.3.1 Pre-Construction/ Construction Phase

(1) Habitat Loss by Vegetation Removal

1) Potential Impacts

579. Prior to the construction of the SBT Section, the ROW will be cleared of all vegetation and the surface debris to 150mm depth removed. The proposed surface finish is crushed rock. The likely maintenance will be to remove vegetative growth on a regular maintenance schedule. Of the total Project area of approximately 4 ha, the 1.5 ha that is vegetated will be removed.

580. The ROW being a highly Modified Habitat suggest the area is not a Critical Habitat. These findings suggest that the SBT Section will not cause any potential impact/s to either Natural Habitat or Critical Habitat as both habitat types (as defined under JICA Guidelines as well as IFC-WB Performance Standard 6) do not exist within the Project ROW.

581. The removal of the vegetation on the site will still cause minor impacts to local birds and bats in terms of loss of shade, nectar, and fruits. Overall the habitat appears to be a transient feeding ground for birds which are likely to be using it as a supplementary area to larger, greener open spaces scattered around the city in golf courses and low rise residential areas. The ROW will be fenced on either side and this will exclude larger mammals like cats it will not exclude smaller mammals (e.g. rodents or reptiles). The ROW does not represent a barrier to birds or bats and no larger mammal of any importance is present so no significant impact on species movement is expected. No contiguous habitat exists on either side of the ROW so no habitat fragmentation is expected.

2) Mitigation

582. The main approach of the project is to avoid cutting of trees or, at least, minimize trees for cutting while maintaining available green spaces and ecological functions in the designated relocation area within the city. The replanting efforts will be done within or outside the City of Manila in coordination with the DENR, as compliance to the conditions of the tree cutting permit to be acquired prior to construction.

583. To follow the process to minimize, replace/rectify, compensate, and enhance, proponent will prepare and implement a pre-clearing plan in close coordination with DENR to carefully consider actions necessary prior to vegetation clearing and provide opportunity to avoid unnecessary vegetation removal and minimize negative impact (i.e., transfer or relocation of important plant species). A pre-clearing plan will include the following:

- Acquisition of all statutory requirements (i.e., tree cutting permit from DENR and PCA) before any vegetation clearing operations;
- 100% inventory of plants that may be affected by vegetation removal;
- Determination of important species that will require relocation;
- Marking of plants allowed to be cut or relocated;
- Demarcation on the ground the limits of vegetation removal prior to any clearing activities to eliminate unnecessary cutting or clearing; and
- Development of relocation procedure, post relocation care and maintenance, and protection.
- Protocols on how to handle and manage potential wildlife that may be encountered during vegetation clearing.
- Relocation/balling-out of endemic and/or threatened trees from the ROW.
- Handling of debris from vegetation clearance and tree cutting.

584. In line with the various orders and memorandums, all the trees removed in the site clearance process will be replaced. A 100% inventory of all trees on site will be made in order to achieve the Tree

Cutting Permit from DENR Regional Office and the Coconut Tree Cutting Permit from PCA. The DOTr or DENR will replace affected planted trees, naturally growing trees and non-surviving relocated plants as required in DMO 2012-02 (uniform replacement ratio of 1:50 for affected planted trees in private lands and forest lands not exclusively established for tree plantations/timber production purposes and 1:100 for affected naturally growing trees). During the inventory, potentially affected wildlife that may be occupying areas marked for vegetation clearing also need to be identified for cataloguing and for turnover to the local DENR for relocation to nearby suitable habitats.

585. Use of hazardous chemicals/herbicides/pesticides for vegetation clearing/removal will be prohibited and will not be allowed in any portion of the ROW. This also aims to protect potential habitats downwind of the ROW where this may impact birds temporarily seeking shelter nearby.

586. The generation of debris from vegetation clearance and tree cutting cannot be avoided during the construction phase. However, this impact can be mitigated through the implementation of RA 9003 and implementing the 5Rs (i.e., Refuse, Reduce, Reuse, Repurpose, and Recycle). Only companies accredited by the DENR or the LGU will be engaged in the tree cutting and vegetation removal procedures. It will be a requirement that all wastes will find a use if possible i.e. leaves from trees can be composted as natural soil improvers and all generated logs will be turned over to the local DENR and converted into furniture for government schools and offices. Note that there will be no burning of any type of solid wastes generated during the vegetation removal and tree cutting.

587. Where possible and practicable in the final detail design, the SBT ROW will be rehabilitated through reintroduction of plants or trees and allowing natural recruitment (i.e., allowing natural growth/propagation from either seeds or spores of existing plants) or through Assisted Natural Regeneration (ANR) where deliberate introduction of plants sourced elsewhere will be made. Since DENR may not allow some trees to be cut, there is a need to coordinate with the DENR and the for the identification and/or selection of relocation site(s). The relocation and replanting sites are selected according to the order of priority: (a) within the project site (e.g., reintroduction within the ROW after construction phase); (b) public land outside the project site but within affected barangays; and (c) public land outside affected barangays but within the City of Manila. DOTr will coordinate with Manila LGU to identify vacant public lands within its jurisdiction that can be used as relocation/ replanting sites, subject to the validation, evaluation and/or approval of DENR. Otherwise, DOTr will utilize the tree planting site(s) outside Manila as recommended and approved by DENR. Furthermore, DOTr will closely coordinate with DENR to ensure that the replanting sites are designated for long term use and legally declared for protection, conservation and enrichment.

588. For replacement plantings to be located outside the project area, the sites being considered include La Mesa Watershed Reservation in Marikina City, NCR and Mt. Balagbag, in San Jose Del Monte, Bulacan. This site is the nearest natural habitat (relative to the ROW) for the recorded endemic and/or threatened trees, and there is land available to receive relocated trees and replacement seedlings. For the long-term management of these sites, the DOTr will follow the guidelines of DMO 2012-02 including the turnover of replacement seedlings to the DENR to perform out-planting, maintenance, and protection of seedlings within suitable National Greening Program (NGP) sites.

589. For replanting sites outside the project footprint, efforts will ensure to achieve positive no net loss and if possible, net gain. A new baseline data will be set equal to or more than the baseline data recorded in the SBT ROW. To illustrate, the Project ROW has recorded at least 15 bird species with a computed Species Diversity of $H' = 3.27$ (high) while there is a total of 123 plant species with at least two being endemic. Thus, replanting sites will need to have biodiversity values equal to or more than that of the Project ROW. Species richness and computed diversity indices will be the main gauge in determining ecological characteristic of the new sites.

590. The establishment and management of the relocation sites and measuring of the net gain in ecological conditions, regular monitoring will be conducted until sites are deemed established and

integrated to the larger ecosystem where they are located. The baseline data and overall ecological conditions in the replanting sites are assumed to improve through time due to outplanted seedlings and DENR management activities. The approach and methods, number of stations/ transects, and parameters to be measured during monitoring are detailed in the EMoP. Additionally, the ratio between native and non-native species will also be monitored as well as the potential increase in the presence of wildlife species brought by habitat improvement in the area. Replanting sites will be maintained and monitored for at least six years or when sites are deemed established or stable. The DOTr will submit monitoring reports to DENR-EMB and JICA and make the reports available to the public and post them via non-restricted websites (e.g., DOTr or a specific project website).

(2) Habitat Degradation by Anthropogenic Activities

1) Potential Impacts

591. The construction of the project will introduce night lighting, noise and dust to the area of the ROW.

592. Noise pollution caused by anthropogenic activities is experienced in the area since it is highly urbanized. The Project ROW is an active train track while nearby city roads are also equally busy 24/7. Intensification of anthropogenic noise through various activities i.e., activities during construction phase, vehicles passing through the project site and peripheries may have effects on the physiology, behavior, reproduction, and long-term survival. Anthropogenic noises can mask and inhibit animal sounds and/or animal audition and it has been shown to affect communication, use of space, and reproduction. It could impact vertebrate animals across habitats (Sordello, et al., 2020)⁶. Some animals exhibit decreased foraging time leading to decrease weight gain, as observed in rats exposed to noise stress for 30 days (Alario et al. 1987)⁷. Excessive background noise may lead to masking wherein the perception of a sound is decreased. This may lead to decrease in the efficacy of acoustic communication. Many animals use acoustic signals to attract and retain mates, settle territorial disputes, promote social bonding, and alert other individuals to predators. Disruption of communication can, therefore, have dramatic impacts on survival and reproduction (Blickley & Patricelli, 2010)⁸. Wildlife species are likely to adapt to disturbances at a certain noise level. The disturbances may be classified as a pulse disturbance (an abrupt change on natural systems). However, with vegetation removal in the ROW, birds will likely evade it due to the absence of cover combined with various anthropogenic disturbances. Birds are highly mobile animals and thus will most likely move to other locations.

593. The project is expected to work 24 hours and the work site will be illuminated. Increase in light pollution in the area during the night can also potentially affect the behavior of animals, alter the circadian cycle (normal distinction of animal between day and night) and cause temporary blindness that can affect the food hunting of some animals especially those hunting during night. The use of powerful night time lighting is also known to attract insects and insect feeding bats. Increase in light pollution in the ROW during night construction can potentially affect the behavior of the lesser Asiatic yellow bat (*Scotophilus kuhlii*) through alteration of its circadian cycle (normal distinction of animal between day and night) and/or it may associate light to food sources. Insects are normally attracted to light and since the lesser Asiatic yellow bat is insectivorous, it may hunt more in areas that are lighted. During night construction in the ROW, lights will be used to illuminate work areas thus, this species may accidentally venture in the project site. The impacts from light pollution are likely to be localized close to the actual work areas, with only limited glare extending into the surroundings. As the ROW is within a highly

⁶ Sordello, R. et al. Evidence of the impact of noise pollution on biodiversity: a systematic map. *Environ Evid* **9**, 20 (2020)

⁷ Alario P, et al. Body weight gain, food intake and adrenal development in chronic noise stressed rats. *Physiol Behav.* 1987;40(1):29-32.

⁸ Blickley, Jessica & Patricelli, Gail. (2010). Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. *Journal of International Wildlife Law and Policy*. 13. 274-292.

urbanized area and the SBT Section of the PNR is an active railway track, it is likely that the local population of this species has already habituated to various light sources including those of passing trains.

594. Dust deposition on vegetation may decrease their palatability on native fauna consuming vegetations (herbivores). In addition, the dust accumulation on leaves may cause or hamper the photosynthesis (a process in plants converting the light energy into sugar for food) thus, reducing the food production for animals that consume plants for food. However, dust is not a significant problem especially during the rainy season as it eventually washes off dust accumulated on leaves and other parts of plants. Dust generated by the Project is expected to be localized within the ROW and is considered to have a negligible effect on terrestrial ecology.

595. It is likely that most wildlife species will habituate to these periodic disturbances and it will only cause temporary disturbance (mainly during construction) and the area will recover during operation.

2) Mitigation

596. For the noise, various vehicles and equipment that may intensify noise will comply with the minimum DENR-EMB standards to lessen the impacts. Additionally, intense producing noise activities will be minimized when birds are most active (i.e., 6:00-8:00 am and 3:30-5:30pm). both sides of the ROW will be fenced (most likely using galvanized sheet) for security reasons and to reduce noise in the adjacent areas.

597. A dusty environment can be controlled through frequent sprinkling of water of at least four times a day or as needed. Moreover, trucks carrying dirt and overfills and/or topsoil in holding areas will be covered (e.g. with tarpaulin) properly to avoid the generation of fugitive dust. Lastly, a speed limit (10 kph) along the access roads will be strictly implemented to minimize fugitive dust.

598. Proper handling protocols for wildlife will be included in the pre-clearing plan and contractors' mitigation such as avoiding construction during nesting season, transfer of wildlife from project ROW to appropriate location in consultation with DENR. If bats and animals disorientated and collide with machinery it will be removed from the project site, placed in a cloth bag, and turned over to the local DENR for release to its natural habitat.

(3) Threat to Existence and/or Loss of Important Local Species

1) Potential Impacts

599. Important local species refer to endemic and/or threatened species, and even some native species. These species are usually associated with forest habitat types including secondary growth but, in this scenario, can be associated with available green spaces surrounded by vast urban areas. Plants and birds (including those that are endemic and/or threatened) that inhabit green spaces could be classified as area-adaptable species which means that they have adjusted to this kind of habitat given its quality and other characteristics.

600. For flora, four threatened vegetation species were recorded during the field survey based on the International Union for Conservation of Nature (IUCN) Red List 2020 and/or DAO 2017-11. These are *Adonidia merillii* (Manila Palm) with one individual, *Pterocarpus indicus* (Narra) with four individuals, *Swietenia macrophylla* (Big Leaf Mahogany) with one individual, and *Ficus ulmifolia* (Is-is) with two individuals. Also, an endemic non threatened plant (*Artocarpus blancoi* or Antipolo) comprised of one individual was recorded. Their presence in the area is mainly attributed to deliberate planting as part of urban greening projects and/or for practical community use. Vegetation clearing and tree cutting will be performed within the ROW. The foreseen impact of the removal of threatened and/or endemic plants

in the ROW is negligible as they represent a very small percentage of available similar species. There is no foreseen effect on the viability of these species locally, nationally, and regionally

601. Big Leaf Mahogany (*Swietenia macrophylla*) is not native nor naturally occurring in the Philippines. However, as a good lumber tree and fast-growing characteristics, this introduced species was commonly used in previous government revegetation activities but with no thorough ecological studies conducted prior to its introduction to the country. Potentially, this species prevents or limits the growth (allelopathic effect) of other plants including those that are native and endemic in areas where it thrives. As such, several local DENR offices recently prohibited the use of invasive alien species such as Big Leaf Mahogany for revegetation programs of government-owned forest lands due to observed negative impacts to various native and endemic species. Thus, the loss of this species is considered rather positive for the local important species.

602. For the fauna, vegetation within the Project ROW serves as temporary shelters for birds (including the endemic forms) hence, their removal may potentially affect their movement patterns. These birds will likely avoid the said area during the pre-construction and construction phases, and transfer to other nearby similar habitats. These recorded birds in the Project ROW are area adaptable as they can thrive despite the presence of various anthropogenic impacts. The three migratory birds found on the site; The Little Egret, Brown Shrike and Barn Swallow are all status Least Concern, (IUCN, 2016-2018). The loss of the site as a feeding and roosting site for migratory birds is considered of Low Significance as the habitat is marginal for these species. The species are likely to transfer to nearby habitats and have no effect on the viability of this species locally, regionally, or nationally.

603. The potential project impacts assessed to the Endemic & Threatened Vegetation and Terrestrial Wildlife Species are summarized below in **Table 5.2.2** and **Table 5.2.3**.

Table 5.2.2 Potential project impacts to Endemic & Threatened Vegetation Species Recorded within SBT Section

Family/ Species	Common Name & Endemicity	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2017- 11			
Arecaceae <i>Adonidia merrillii</i> Becc.	Manila palm (Engl.); Native non- endemic	Vulnerabl e	Other Wildlife Species	ROW will be cleared. This individual will be removed.	Permanent loss of an individual in the ROW. Loss of nectar source for birds.	Negligible This palm is commonly planted along roads all over Manila and nearby green spaces. An individual will be removed in the AOI. It represents a very small percentage of available similar palm for birds and bats. The loss will have no effect on the viability of this species locally, regionally, or nationally.
Leguminosae <i>Pterocarpus indicus</i> Willd.	narra (most dialects); Native non- endemic	Endanger ed	Vulnerable	ROW will be cleared. Four individuals will be removed.	Permanent loss of four individuals in the ROW. Loss of nectar source for birds.	Negligible This tree is a common feature along streets, public cemeteries, schools and universities, and major green spaces in the NCR as well as other provinces. Four individuals will be removed in the AOI. These individuals represent a very small percentage of available population for birds and bats. The loss will have no effect on the viability of this species locally, regionally, or nationally.

Family/ Species	Common Name & Endemicity	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2017- 11			
Moraceae <i>Ficus ulmifolia Lam.</i>	is-is (Neg.); Endemic	Vulnerabl e	Other Wildlife Species	ROW will be cleared. Two individuals will be removed.	Permanent loss of two individuals in the ROW. Loss of nectar and fruit source for birds and bats.	Negligible The Project ROW is not part of this tree's natural habitat. It is commonly seen elsewhere outside its natural habitat since its seeds are dispersed by birds combined with its ability to thrive well even in urban settings. Additionally, local communities use this tree as a source of natural scrubbing pads. Two individuals will be removed in the AOI. They represent a very small percentage of available similar trees for birds and bats. The loss will have no effect on the viability of this species locally, regionally, or nationally.
Meliaceae <i>Swietenia macrophylla King</i>	large-leafed mahogany (Engl.); Exotic or introduced	Vulnerabl e	Other Wildlife Species	ROW will be cleared. This individual will be removed.	Permanent loss of an individual in the ROW. Nearby native and/or endemic plants will be able to grow.	Positive impacts to native and/or endemic plants. As an introduced tree, the Project ROW is not part of its natural habitat. An individual will be removed in the AOI. Its allelopathic effect on surrounding native and/or endemic plants will be removed thus, the positive effect.
Moraceae <i>Artocarpus blancoi (Blanco) Merr.)</i>	antipolo (Tag.); Endemic	Other Wildlife Species	Other Wildlife Species	ROW will be cleared. An individual will be removed.	Permanent loss of an individual in the ROW. Loss of shade and perch for birds.	Negligible This tree is widely distributed and could thrive even in highly disturbed areas, thus its presence in the ROW. An individual will be removed in the AOI. It represents a very small percentage of available similar tree for birds. The loss will have no effect on the viability of this species locally, regionally, or nationally.

**Table 5.2.3 Potential project impacts to Terrestrial Wildlife Species Recorded within SBT
Section**

Species (Common Name)	Distribution Range	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2019-09			
Rhipidura nigritorquis (Philippine pied fantail)	Endemic	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.

Species (Common Name)	Distribution Range	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2019-09			
Picoides maculatus (Philippine pygmy woodpecker)	Endemic	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Pycnonotus goiavier (Yellow-vented bulbul)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Streptopelia tranquebarica (Red turtledove)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Geopelia striata (Zebra dove)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Passer montanus (Eurasian tree sparrow)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed.

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Species (Common Name)	Distribution Range	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2019-09			
					construction is completed.	This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Aplonis panayensis (Asian glossy starling)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Collocalia esculenta (Glossy swiftlet)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Lanius schach (Long-tailed shrike)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Egretta garzetta (little egret)	Migratory	Least Concern	Other Wildlife Species	ROW will be cleared. There are no impacts to this species	The ROW is NOT part of its range.	Negligible The ROW is NOT part its range. No effect on the viability of this species locally, regionally, or nationally.
Artamus leucorhynchus (White-breasted wood-swallow)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas.

Species (Common Name)	Distribution Range	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2019-09			
						Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Lanius cristatus (Brown shrike)	Migratory w/ resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Hirundo rustica (Barn swallow)	Migratory	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Gerygone sulphurea (Golden-bellied flyeater)	Resident breeder	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Cynopterus brachyotis (Short-nosed fruit bat)	Native (non-endemic)	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will move to other green spaces.	This portion of its range will be avoided during construction. Individuals will return when construction is completed.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.
Scotophilus kuhlii	Native (non-endemic)	Least Concern	Other Wildlife Species	ROW will be cleared; recorded individuals will	This portion of its range will be avoided during construction.	Negligible Temporary displacement will occur during construction. It will move to other green spaces during construction and will return

Species (Common Name)	Distribution Range	Conservation Status		Project Effect on Species	Impact of Effect	Significance of Impact
		IUCN 2020	DAO 2019-09			
(Lesser Asiatic yellow bat)				move to other green spaces.	Individuals will return when construction is completed.	to the ROW once construction is completed. This bird is widely distributed and could thrive even in highly disturbed areas. Its temporary displacement has no effect on the viability of this species locally, regionally, or nationally.

2) Mitigation

604. The loss of 1.5 ha of greenspace cannot be avoided. As a highly dense urban area with little if any greenspace there are not any locations nearby to create any offsetting greenspace. Although the potential impacts for the Important Local Species are negligible, mitigation will be applied to reduce impacts further.

605. Prior to construction, the DOTr will develop and implement a pre-clearing plan detailing the management of all endemic and/or threatened species found within the Project ROW from inventory, characterization, relocation or propagation, up to management. Endemic and/or threatened including selected native species will be identified, characterized, and relocated and if not practicable, seeds/wildlings for propagation will be collected/transferred. During the inventory, the endemic and/or threatened species will be resurveyed and minimise cutting as much as possible. Relocation of important species (native, endemics, and/or threatened species) will be undertaken to ensure that said species will continue to survive and the recorded important species are not lost.

(4) Threat to Abundance, Frequency, and Distribution of Important Species

1) Potential Impacts

606. In the Project ROW, majority (i.e., 71% to 77%) of recorded plants are exotic/introduced while endemics are the least (2%) represented. On the other hand, majority of recorded birds are resident breeders (60%) while endemics (13%), introduced (7%), migratory (7%), and both migratory/resident (13%) represent the rest.

607. The total recorded abundance of threatened plant species (eight individuals) and the absence of recorded threatened wildlife / bird species do not represent globally important concentrations of an IUCN Red-listed Endangered ($\geq 0.5\%$ of the global population and ≥ 5 reproductive units⁹) and Vulnerable species. With only 14 endemic individuals (3 plants and 11 wildlife/ birds), the Project ROW cannot be considered as an area that holds $\geq 10\%$ of the global population size and ≥ 10 reproductive units of a species.

608. The significance of the project effects on abundance, frequency, and distribution of these species is to be Low since the number of individuals that will be removed represent a very small percentage of species populations. The removal of these trees from the ROW will have no effect on the viability of said species locally, regionally, or nationally. For endemic birds, they will be affected during the pre-

⁹ The threshold for Criterion 2: Endemic and Restricted-range Species of the IFC Guidance Note 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources. For purposes of this Guidance Note, the term endemic is defined as restricted-range. Restricted range refers to a limited extent of occurrence (EOO).

construction and construction phases. These species will most likely evade the area during said phases and transfer to nearby habitats. This impact is temporary and said birds are most likely to return to the area during the operation phase. The loss of the site does not affect the ability of these species to maintain their populations and the site is a marginal site for the endemic species.

2) Mitigation

609. During the 100% inventory of all trees on site, the endemic and/or threatened species will be resurveyed and minimise cutting as much as possible.

610. For trees that will be cut and/or plants that will be relocated but will not survive, the DOTr will provide replacement seedlings based on DENR MO No. 2012-02. Replacement seedlings will also consider local endemic and/or threatened species recorded during this baseline study. the use of native plants should be considered if green spaces are favored. Native plants especially pioneer species i.e. Alim (*Melanolepis multigalindulosa*), Anabiong (*Trema orientalis*), Hauli (*Ficus septica*), Is-is (*Ficus ulmifolia*), Binunga (*Macaranga tanarius*) etc. are more adaptable in tolerating poor condition soil. Native plants promote the conservation of soil microflora (fungi, bacteria, and endophytes) by enhancing the available nutrient in the soil. The use of native plants will likely recruit other similar plants to grow without human intervention.

611. The relocation and replacement planting site being considered that will be located outside the project area is the La Mesa Watershed Reservation in Quezon City. This site is the nearest natural habitat (relative to the ROW) for the recorded endemic and/or threatened trees, and there is land available to receive relocated trees and replacement seedlings.

612. Important species, once relocated, grown, and allowed to propagate, will increase in abundance, frequency and expand in distribution. This mitigation provides an assurance that important species will not only continue to survive but will improve in terms of abundance, frequency, and distribution as well. The effectiveness of ecological mitigation measures will be monitored as described in “Habitat Loss by Vegetation removal.

613. As the SBT ROW will be restricted, thus, endemic and/or threatened species that may thrive (flora) or relocate (fauna) within the area will be protected from various disturbances. Restricted access to location of threatened and/or endemic species within said areas will be implemented. Collection of plants and wildlife hunting will be strictly prohibited.

5.2.3.2 Operation Phase

(1) Potential Impacts

614. Starting the operation phase, portions of the Project ROW will slowly provide vegetation through natural regeneration. Certain vegetation will be retained and allowed to grow thereby reverting the area to ecological value again, following safe operations. Since the Project ROW will have restricted access, the said green space and all other wildlife species found therein are protected.

615. The threatened and/or endemic plant species recorded during the baseline will be favored to grow along selected areas of the Project ROW. These species are: Manila Palm (*Adonidia merillii*), Narra (*Pterocarpus indicus*), and Is-is (*Ficus ulmifolia*). Although NCR is not part of the natural habitats of these species, their presence in the ROW will further expand their distribution, abundance, and frequency. Although the presence of these plants in the ROW will improve diversity, the area will remain a Modified Habitat since most species are exotic or introduced and the area has been extensively modified in terms of primary ecological functions and species composition.

616. Endemic birds (such as the *Rhipidura nigritorquis* or Philippine pied fantail and *Picoides maculatus* or Philippine pygmy woodpecker) which avoided the area during the pre-construction and

construction phases will slowly return and utilize the green space that has regenerated. Their continued presence in the NCR will improve urban biodiversity. These two endemic species are widespread in distribution, their abundance is common to very common in various habitats that they occupy, and they are highly adapted to the urban environment. Thus, they can thrive even in highly disturbed habitats such as the NCR. In urban settings, they can thrive in green spaces with scattered trees despite the presence of periodic noise, vibration, and dust.

617. Train-wildlife collision is one of the major impacts of train projects on wildlife particularly mammals. Birds and bats are agile and this allows them to evade moving trains and avert potential collisions. The major risk factors in train collisions with wildlife is train speed and, for birds, proximity to a habitual fly route. Species that fly low naturally and weather (high wind and fog) also increase risk of collision. The trains will be travelling at low speed on the SBT section as the sections both contain bends and are close to stations. The high-rise buildings around the railway will also encourage migrating birds to fly at heights greater than the elevated railway. The population of birds and bats in the ROW have likely habituated to the noise, vibration and presence of moving trains. The collision of wildlife with train is expected to be low.

(2) Mitigation

618. There is a need to maintain remaining vegetation and/or allow vegetation that may regenerate (with due consideration of safe operations) within the ROW to provide green spaces and wildlife habitat for local biodiversity. For birds and bats feeding near the railway, the integrated noise barrier will act as a strong visual barrier and force the animals concerned to clear the tracks at a safe height when passing.

619. There is also a need to conduct continuous monitoring of project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate, the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability.

620. In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following:

- Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site;
- Conduct a detailed soil nutrient analysis;
- Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality; and,
- Make necessary adjustment based on the result of soil nutrient analysis and investigation.

5.2.3.3 Cumulative Impact Assessment

621. Cumulative impacts are created when various environmental alterations combine to cause an overall greater level of impact. Various development projects surrounding the SBT Section ROW when combined may produce more intensified disturbances. The proposed NLEX-SLEX Connector Road parallel to SBT Section together with other government projects may result to cumulative impacts to green spaces and urban wildlife. Also, impacts that may be insignificant on their own may be significant when considered together with other actions being undertaken as part of the same project.

Table 5.2.4 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Terrestrial Ecology

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Encroachment of Protected Areas and Key Biodiversity Areas	X	X	X	X	N/A	The SBT Section will not encroach any Protected Areas or KBAs. The nearest Protected Area is the Arroceros Forest Park (LGU-declared Protected Area) located approximately 3.2 km from the project site.
Habitat loss by vegetation removal	✓	✓	X	X	B-	- Prepare and implement a pre-clearing plan including protocols on relocation procedure, post relocation care and maintenance, and protection, handling and management of potential wildlife that may be encountered during vegetation clearing, monitoring and management of planted areas. - Conduct 100% inventory of plants within the ROW - Secure all statutory requirements following DAO 2020-06 relating to vegetation clearing or relocation (i.e. 100% Tree Inventory and Tree Cutting Permit) and RA 8048 (Coconut Preservation Act of 1995) from the DENR and PCA, respectively, before any vegetation clearing operations - Mark plants for cutting and relocation and demarcate the ground the limits of vegetation removal prior to any clearing activities to eliminate unnecessary clearing. - During the inventory, identify the potential wildlife that may be occupying areas marked for vegetation clearing and identifying cataloguing, and turning these over to the local DENR for relocation to nearby suitable habitats. - Prohibition of the use of hazardous chemicals/herbicides/pesticides and burning of plant debris generated for vegetation clearing/removal. - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and management procedures of the cut logs and/or sustainable practices in disposing vegetation waste. Implementation the 5Rs (i.e., Refuse, Reduce, Reuse, Repurpose, and Recycle) of solid waste management in handling plant debris from the Project. Turning over of usable logs to the local DENR office or individual landowners and ensuring their proper transport (i.e., with appropriate transport permit). - Apply 1:50 ratio for replacing affected planted trees in private lands and forest lands not exclusively established for tree plantations/timber production purposes and 1:100 ratio for replacing affected naturally growing trees and non-surviving relocated plants following DENR Memorandum Order 2012-02 - Coordinate with the DENR, PNR and LGU for trees not allowed to be cut and the replanting/relocation areas. Determine and establish tree replanting/ relocation areas according to order of priority: (a) within project site not part of the development within the ROW to create buffer zone and to improve habitat for wildlife, (b) public lands outside the project site within the affected barangays; (c) public lands outside the affected barangays but within the City of Manila. This is where trees will be relocated and/or replacement

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						seedling will be out planted and if practical, will also cater to balled out trees. DOTr will coordinate with Manila LGU to identify vacant public lands within its jurisdiction that can be used as relocation/replanting sites, subject to DENR evaluation and approval. Otherwise, DOTr will utilize the tree planting site/s outside Manila as recommended and approved by DENR. • In close coordination with DENR, ensure that the replanting site/s are designated for long term use and legally declared for protection and conservation • Checking, clearance, and relocation of potential wildlife that may be occupying areas marked for vegetation clearing and identifying cataloguing, and turning these over to the local DENR for relocation to nearby suitable habitats. • Maintenance, protection, and monitoring of relocation and replacement planting sites until sites are deemed established and integrated to the larger ecosystem where they are located to have biodiversity values equal to or more than that of the Project ROW. Monitoring reports to be submit to DENR-EMB and JICA and conduct public disclosure of inventory results, vegetation clearing operations, replanting plan, and the growth of replaced/ replanted trees and ecosystem recovery/ establishment. • Monitor the growth of replaced/ replanted trees and ecosystem recovery/ establishment. In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: • Conduct a detailed soil nutrient analysis and make necessary adjustment based on result of soil nutrient analysis and investigation. • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Replace cut trees and/or non-surviving relocated trees with corresponding number of tree seedlings following DENR MO 2012-02 (usually 1:100 replacement ratio)
Habitat degradation by anthropogenic activities	X	✓	✓	✓	B-	• Undertake the following to reduce noise, vibration and dust impacts: [Noise] • Regular inspection and maintenance of machineries, equipment, and vehicles according to their respective manufacturers' specifications to ensure that they are functioning within their required standards • Minimize intense producing noise activities when birds are most active (i.e., 6-8 am and 3:30-5:30pm) • Contain and monitor the effects from noise pollution coming from vehicles, equipment and nearby facilities. [Dust] • Properly cover overfills, topsoil/ soils, spoils, and construction/demolition materials onsite as well as equipment, trucks and vehicles for the transport of materials to prevent escape of dust • Carry out water sprinkling in access roads and areas with exposed soils or dust-generating materials or equipment at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						- Implementation of speed limit (10 kph) along access roads [Light] - Contain and monitor the effects from source of artificial light at night during operation hours. - Improve vegetation that creates barrier to limit the glare coming from the artificial light. - Concentrate the light on operations using directional light. - Install anti-glare to the source of artificial light to regulate glare. - Direct lighting to minimise spill over - In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the project site and bring back into its natural habitat. [Collision] - Strictly enforce the speed limit for vehicles along the access roads. - Install proper signages to increase awareness and avoid accidents. - Include handling protocols for wildlife in the pre-clearing plan and contractors Mitigation such as Avoid construction during nesting season.
Threat to existence and/or loss of important local species	✓	✓	X	X	B-	- Design, plan and implement the project that will minimize vegetation clearing, alteration of landform particularly in areas adjacent to higher conservation significance (i.e., Antipolo, Is-is, Narra) and in the vicinity of ecological significant areas. - Prepare and implement a Pre-Clearing Plan detailing the management of all endemic and/or threatened species found within the Project ROW from inventory, characterization, relocation or propagation, up to management.
Threat to abundance, frequency, and distribution of important species	✓	✓	X	X	B-	- Conduct 100% inventory of plants and identify all endemic and/or threatened species including selected native species that will be affected by vegetation removal, characterized, and relocated and if not practicable, seeds/wildlings for propagation will be collected/transferred. - Mark plants allowed to be cut or relocated and demarcate the ground with the limits of vegetation removal prior to any clearing activities to eliminate unnecessary clearings. Where possible locally avoid endemic and/or threatened species including selected native species as much as possible from cutting. - Restricting access and conserve vegetation within the ROW to protect remaining threatened and/or endemic species. - Comply with the requirements of DENR MO 2012-02 (with recommendation at 1:100 replacement ratio) and replace seedlings and relocate plants that did not survive. replacement seedlings will also consider local endemic and/or threatened species recorded during this baseline study.

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Increase biodiversity due to retention or provision of urban green spaces along the Project ROW	X	X	✓	✓	C+	- Plant in portions of the alignment where vegetation could thrive to allow plant growth and propagation naturally and/or through Assisted Natural Regeneration (ANR) for aesthetics, vegetation connectivity and wildlife passage - Maintain remaining vegetation and/or vegetation that may regenerate (with due consideration of safe operations) within the ROW to provide green spaces and wildlife habitat for local biodiversity. - Conduct of regular check-ups and maintenance of trains according to the manufacturers' specifications to ensure that they are functioning based on the required standards of DENR-EMB and JICA - Monitor the following and disclose the results to the public: - project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability - the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species - In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis - Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on the result of soil nutrient analysis and investigation

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.2.4 GEOLOGIC HAZARDS

622. Two major geologic hazards identified to occur in the area of the SBT Section are ground shaking and liquefaction. Below are the potential impacts of the project activities related to these phenomena and their corresponding options for mitigation. The environmental risk assessment (**Chapter 6**) further details the hazards and risks associated with these natural events.

5.2.4.1 Construction Phase

(1) Inducement of Liquefaction and Other Geologic Hazards

1) Potential Impacts

623. Given the active tectonic setting of Luzon, earthquake events are likely to occur with or without the Project. Seismic hazard maps generated by PHIVOLCS indicate that the project area can experience up to Intensity VIII (Very Destructive) ground shaking from movement in the West Valley Fault. Ground shaking from volcanic quakes may also be triggered by high-alert activity in Mt. Taal, Mt. Pinatubo, or other potentially active volcanoes within the 100-km radius of the site. However, the SBT Section itself is not expected to induce such seismic hazards.

624. The site is generally characterized by geologic conditions that are highly susceptible to liquefaction. Strong ground shaking caused by earthquakes or rapid loading due to strong vibrations from construction activities may induce liquefaction.

625. Seismic hazards during the construction phase may cause injury to workers and passersby, loss of lives, work delay, and damage to equipment, facilities, unfinished structures, and adjacent properties.

2) Mitigation

626. To mitigate liquefaction due to construction activities, the Contractor will prepare the Construction Noise and Vibration Management Plan (CNVMP) for the management of the vibration levels of machineries. The mitigation measures for these risks and other natural hazards that may occur during the construction phase are further discussed in **Chapter 6**.

5.2.4.2 Operation Phase

(1) Inducement of Liquefaction and Other Geologic Hazards

1) Potential Impacts

627. The train operation in the SBT Section is not expected to induce geologic hazards. The effects of natural events (i.e. earthquakes, liquefaction), however, may indirectly affect the surrounding environment of the SBT Section.

2) Mitigation

628. To ensure the structural integrity of the SBT Section, the engineering design will follow the seismic design prescribed in the National Structural Code of the Philippines (NSCP) (2015), the Department of Public Works and Highways Load and Resistance Factor Design (LRFD) - Bridge Seismic Design Specifications (DPWH-BSDS) (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015), and the American Association of State Highway and Transportation Officials (AASHTO) LRFD (2015). Pile foundations will also be installed at depths that reach the load bearing strata based on the geotechnical study conducted.

629. An Emergency Preparedness and Response Plan (EPRP) will be prepared for the SBT Section as part of the overall plan for NSCR Project and implemented to include emergency protocols and post-event monitoring for the safety and well-being of workers and passengers during major ground shaking events. Appropriate measures such as preventive maintenance/inspection, temporary suspension of operations, safe evacuation, and prompt repairs and post-event monitoring for major ground shaking events shall also be taken to manage risks associated with ground shaking. Risks associated with geologic hazards during the operation phase are further detailed in **Chapter 6**.

Table 5.2.5 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Geologic Hazards

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Liquefaction in the event of an earthquake (or due to heavy load construction activities) may result to bearing failures, floatation of embedded structures, damage to overlying structures Continuous operation of heavy machinery produces vibration that may induce liquefaction	X	✓	✓	X	C-	- Design the earthquake loading capacity of the SBT Section structures to resist earthquake ground motion based on projected PGA values from the West Valley Fault. - Adhere to seismic and structure design standards adopted in the detailed design as provided in NSCP (2015), the DPWH Guide Specifications Load and Resistance Factor Design (LRFD) - Bridge Seismic Design (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015) and AASHTO LRFD (2015). - Implement the Emergency Preparedness and Response Plan (EPRP) to include emergency and evacuation protocols (temporary suspension of construction activities) and post-event monitoring of major ground shaking events - Ensure pile foundations are deep enough to reach the load bearing strata based on the geotechnical study conducted - Conduct preventive maintenance/inspection on the integrity of structures; reinforce if necessary - Conduct IEC campaign on railway structure and geologic hazards for the workers/employees, railway passengers and surrounding community

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.3 THE WATER

630. The potential impacts of the development of the SBT Section, including the Traction Substation (TSS-1), on surface water quality and flooding, along with proposed mitigating measures for the identified impacts, is provided below and summarized in **Table 5.3.1**. Assessment of impacts is based on review of related literatures and project engineering information. Significant impacts are determined to be when project impacts would cause surface water to degrade in quality to a lower quality level, or groundwater to breach guideline limits.

5.3.1 SURFACE WATER QUALITY

5.3.1.1 Pre-Construction/ Construction Phase

(1) Siltation and Sedimentation of Waterways

1) Potential Impacts

631. Site clearing, demolition of existing structures, and earthmoving activities during the construction phase of the SBT Section and TSS-1 have the potential to cause erosion and increase turbidity and sedimentation in surface runoff. Surface runoff with elevated levels of total suspended solids (TSS) may flow and discharge to the two creeks in the vicinity of the project site (i.e. South Antipolo Canal and Antipolo Creek), and eventually to Pasig River. Excavated soil may also spill into these two creeks especially if stockpiled near these waterways. Dust particles dispersed during earthworks and demolition activities may also be deposited into the creeks or eventually settle to the ground as loose particles and be readily eroded by water. Loose particles from concrete batching plants may also be entrained in wind and in runoffs which may then be deposited into the nearby surface waterbodies. After construction, decommissioning of equipment and temporary used may produce loose particulates that may be entrained by wind. This can likewise be deposited in nearby bodies of water.

632. At present, both South Antipolo Canal and Antipolo Creek appear turbid and gray in color, although recorded TSS concentrations in these waterbodies are still within the DAO 2016-08 TSS Class C Water Quality Guidelines (WQG). Elevated TSS levels may increase water temperature and decrease dissolved oxygen concentrations. Suspended particles absorb energy from the sun, thus increased suspended particles in the water tend to increase water temperature. Increase in water temperature lowers the solubility of oxygen in the water, leading to a decrease in dissolved oxygen concentrations. During construction, South Antipolo Canal and Antipolo Creek will be monitored for TSS levels.

633. There are no indirect impacts to other organisms identified due to siltation and sedimentation as currently there is little to no macroorganism thriving in the nearby bodies of water. Moreover, residents only use the bodies of water as drainage for their wastes.

2) Mitigation

634. In order to minimize erosion and sedimentation during construction, erosion prevention and sediment control measures and spill prevention techniques will be implemented at the construction sites. Earthworks will be planned in consideration of weather conditions. Construction activities will also be staged to minimize exposed areas and exposure duration. Removal of vegetation will also be minimized as much as practicable, in order to lessen the eroding capacity of strong winds and runoffs. Exposed earth and soil stockpiles will be covered with geotextiles, especially before heavy rains are expected. Stockpile heights will be limited to 2 m, in order to prevent collapse. The use of geotextiles can prevent loose soil from being entrained in surface runoff. During dry season, geotextiles can also act as erosion guard for wind erosion. Regular wetting of exposed earth, soil stockpiles, earth moving sites, and demolition sites during the dry season will be implemented to minimize the resuspension of loose particles/dust in the air.

635. Disturbed areas and stockpiles will be provided with perimeter controls such as silt fences, sediment traps, sandbags, and fiber rolls. These perimeter controls will be installed prior to the commencement of work. Construction site entrances and exits in unpaved areas will be provided with vehicle tracking pads or shaker racks to prevent soil and mud from being carried offsite. Installed sediment control measures will be inspected daily and maintained to ensure they are in good working condition.

636. In areas where the possibility of dust entrainment is high, especially, but not limited to concrete batching plants, silt fences will be installed. This will prevent dust from being entrained and eventually be deposited in nearby bodies of water. Siltation ponds will also be installed to prevent dust-laden runoff from contaminating nearby bodies of water. All dust-laden runoffs should be directed to these siltation ponds before disposal.

637. Loose soil, sediments, debris, and other excavated materials will be hauled from the site as soon as possible. It is estimated that approximately 6,945 m³ of surplus soil will be generated during the construction phase of the SBT Section. Hazardous materials will be disposed through DENR-accredited waste haulers as necessary.

638. Decommissioning of equipment and temporary structures after construction may produce loose particulates which can be entrained by wind and be deposited in nearby bodies of water. Silt fences will be installed in areas where loose particulates will be most likely produced. While wetting of loose particles will be employed in areas where production of these particles is minimal.

(2) Contamination of Waterways with Domestic Wastewater and Run-off from Construction Sites and Camps

1) Potential Impacts

639. Construction sites and temporary camps for construction workers will generate wastewater that may contaminate South Antipolo Canal and Antipolo Creek if handled and disposed inappropriately. At present, both waterways already exhibit impacts of organic pollution, with elevated levels of biological oxygen demand (BOD), fecal coliform, and phosphates, and low dissolved oxygen concentrations that do not meet the DAO 2016-08 Class C WQG. Further contamination of the two creeks will contribute to its already degraded condition and also impact the water quality of Pasig River (Class C) where the two waterways drain to. Indirect impacts identified should domestic wastewater and runoff be unwantedly discharged into nearby bodies of water is health hazard for individuals regularly cleaning the nearby bodies of water.

2) Mitigation

640. Construction workers will be prohibited from disposing wastewater into South Antipolo Canal and Antipolo Creek. Sewage and bathwater from construction camps will be managed through the installation and maintenance of a temporary septic-tank system or through the provision of portable sanitation facilities that comply with the requirements of PD 856 or the Code on Sanitation of the Philippines. Portable toilets will also be provided and maintained at strategic locations along the project alignment and in other work areas. Separate sanitation facilities will be provided for men and women workers. Food scraps and other putrescible wastes will be temporarily stored at the work sites in bins with tight fitting lids to minimize the attraction of vermin, insects, and pests, and will be disposed of in appropriate landfill facilities by truck.

641. Run-off from campsites, equipment maintenance areas, fabrication yards, and other work areas will be managed through the provision of temporary drainage facilities with sump to prevent water from these sites from directly discharging into storm drains.

642. Domestic wastewater that will be collected from the site will be disposed through DENR-accredited waste haulers and will meet the applicable DAO 2016-08 and DAO 2021-19 General Effluent Standards. Contracted waste haulers will be audited regularly to ensure that wastewater meet the DAO 2016-08 and DAO 2021-19 General Effluent Standards prior to discharge. Temporary discharge permits during construction for the disposal of construction wastewater may be secured as necessary. To ensure compliance to the effluent standards, the Contractor will develop an effluent management plan as part of their CEMMP.

643. It should be noted that the LGUs conduct regular cleaning efforts for the nearby bodies of water around the project site. Thus, it is expected that these efforts will continue during the construction phase and people will regularly conduct cleaning in the nearby bodies of water. As such, public involvement and information dissemination activities shall form part of the mitigating measures not only among the workers but also the community.

(3) Contamination of Waterways with Solid Wastes

1) Potential Impacts

644. Temporary camps for construction workers, vegetation clearing, and demolition and construction activities will generate domestic solid waste that may contaminate South Antipolo Canal and Antipolo Creek if handled and disposed inappropriately. At present, the respective barangays regularly cleans both waterways from solid wastes; solid waste traps have also been installed upstream the creeks to filter large solid wastes. Indirect impacts identified should solid wastes accumulate in the nearby bodies of water is temporary flooding.

2) Mitigation

645. As construction camps and construction activities generate solid wastes, the Contractor will develop and implement an SWMP to prohibit construction workers from disposing their solid wastes into South Antipolo Canal and Antipolo Creek. Given the current pandemic scenario, healthcare wastes will be disposed in accordance with RA 6969. Other mitigating measures to manage solid wastes are presented in **Section 5.2.1.1(2)**.

646. It should be noted that the LGUs conduct regular cleaning of the nearby bodies of water. This includes clearing of solid wastes. They also have installed solid waste entrainers/screens to capture large pieces of solid wastes.

647. Water quality from South Antipolo Canal and Antipolo Creek will be monitored regularly during construction. Results will be compared to baseline results and with DAO 2016-08/DAO 2021-19 Water Quality Guidelines (WQG) and General Effluent Standard (GES). The results shall also be disclosed to the public.

(4) Contamination of Waterways through Concrete and Drilling Wastewater Spills

1) Potential Impacts

648. Concrete wastewater is generally high in pH. Concrete laden water from construction activities could impact pH levels in South Antipolo Canal and Antipolo Creek should these flow into these water bodies. Baseline pH measurements of these surface water bodies are within the DAO 2016-08 Class C WQG for pH.

649. Stabilizers in the form of bentonite slurries or polymer-based stabilizers are used in pile boring activities to prevent collapse of boreholes. Usually, these stabilizers are inert and are used in excess. Although inert, these materials should still be properly disposed as these are introduced materials not normally found in the project site.

650. There are no indirect impacts to other organisms identified due to spillage of concrete and drilling wastewater as currently there is little to no macroorganism thriving in the nearby bodies of water. Moreover, residents only use the bodies of water as drainage for their wastes.

2) Mitigation

651. To avoid surface water contamination from concrete wastewater and bentonite slurries, these materials will be reconditioned and reused, whenever applicable. Used bentonite slurries can be desanded to be used again in desanding facilities. Concrete wastewater will be stored in a large PTFE container to avoid spillage onsite. Concrete wastewater will be disposed through a DENR-accredited concrete/drilling wastewater hauler and will be regularly audited to ensure compliance with the DAO 2016-08 and DAO 2021-19 General Effluent Standards. In the absence of a concrete/drilling wastewater hauler, construction wastewater and used bentonite slurries will be dried out in a settling tank/drying tank prior to appropriate disposal. Dried wastes will be disposed of in line with the project's SWMP.

652. Water quality from South Antipolo Canal and Antipolo Creek will be monitored regularly during construction. Results will be compared to baseline results and with DAO 2016-08/DAO 2021-19 WQG and GES. The results shall also be disclosed to the public.

(5) Contamination of Waterways through Accidental Spills of Oil, Lubricants, and Other Chemicals

1) Potential Impacts

653. Accidental oil, lubricants, or chemical spills that may occur during use of heavy equipment and vehicles and during other construction activities may further worsen the current water quality of South Antipolo Canal and Antipolo Creek if these spills flow to these waterbodies. Baseline oil and grease concentrations in these two creeks already exceed the DAO 2016-08 Class C WQG. Indirect impacts identified should oil, lubricants, and other hazardous chemicals be unwantedly discharged into nearby bodies of water is health hazard for individuals regularly cleaning the nearby bodies of water.

2) Mitigation

654. Mitigating measures to avoid accidental spills of contaminants are discussed in detail in **Section 5.2.1.1(3)**. The SPMERP that will be developed and implemented for the SBT Section will cover measures to address the waterway contamination impacts from accidental spills.

655. It should be noted that the LGUs conduct regular cleaning efforts for the nearby bodies of water around the project site. Thus, it is expected that these efforts will continue during the construction phase and people will regularly conduct cleaning in the nearby bodies of water. As such, public involvement and information dissemination activities shall form part of the mitigating measures not only among the workers but also the community.

656. Water quality from South Antipolo Canal and Antipolo Creek will be monitored regularly during construction. Results will be compared to baseline results and with DAO 2016-08/DAO 2021-19 WQG and GES.

5.3.1.2 Operation Phase

(1) Potential Impacts

657. There are no discharges anticipated from the SBT Section except for discharges from stormwater drains and maintenance activities on TSS-1. Potential water quality contaminants during the operations phase of the Project may come from leaks or spills of lubricant agents, used oil, and other hazardous wastes during maintenance activities. Since repair and maintenance of train wagons will be done mostly

in the depot, leaks or spills during maintenance activities from this activity will be nil. Nevertheless, minor oil leaks from trains during operation should it be considered as this may cause contamination along the tracks. Indirect impact identified should oil, lubricants, and other hazardous chemicals be unwantedly discharged into nearby bodies of water is health hazard for individuals regularly cleaning the nearby bodies of water.

(2) Mitigation

658. Proper disposal and/or clean-up of contaminated areas will be performed through DENR-accredited oil-laden waste disposal contractor. Appropriate permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest from DENR will be secured prior to disposal.

659. On the other hand, maintenance of TSS-1 may contaminate Antipolo Creek due to potential leaks or spills of hazardous wastes generated during this activity. Oil and water separator or a spill containment kit will be provided in TSS-1 to prevent the potential contamination of Antipolo Creek. Spill prevention measures during the operations phase are further discussed in **Section 5.2.1.2**.

660. It should be noted that the LGUs conduct regular cleaning efforts for the nearby bodies of water around the project site. Thus, it is expected that these efforts will continue during the construction phase and people will regularly conduct cleaning in the nearby bodies of water. Water quality from South Antipolo Canal and Antipolo Creek will be monitored regularly during operation and results will be compared with DAO 2016-08/DAO 2021-19 WQG and GES.

5.3.2 FLOODING

5.3.2.1 Pre-Construction/ Construction Phase

(1) Aggravation of Flooding Conditions due to Earthworks

1) Potential Impacts

661. Flood mapping efforts by DENR-MGB in 2015 has identified the majority of SBT Section within areas that are moderately susceptible to flooding (0.5 to 1 meter flood height and/or 1 to 3 days flooding), except for the western flank of the Blumentritt-Tutuban Section. This western portion covered by Barangays 218, 155, and 160 are situated in zones classified as highly susceptible, which means floods can reach heights of 1 to 2 meters and/or lasts more than 3 days. The high susceptibility rating is confirmed by interviews with local residents who reported that Typhoon Ondoy (internationally known as “Ketsana”) caused the overflowing of nearby creeks up to heights of more than 1 meter, especially those situated near the Cantarilla creek in Barangay 155. The construction works of the SBT Section will involve piling and excavation activities which may collect rainfall and groundwater, creating pools of water. Clogging of drainage may also result from siltation from earthworks and improper solid waste disposal and exacerbate the flooding conditions in the area. No indirect impacts are anticipated since flooding can be managed through proper planning.

2) Mitigation

662. Such depressions where water may accumulate will be dewatered regularly to prevent flooding. In addition, sediment transport from erosion site or stockpiles of excess soil during earthworks may cause increased flooding due to reduced channel capacities. Sufficient and effective drainage and dewatering systems such as drain channels and sumps will also be installed to facilitate proper drainage of excess water used during construction. These measures will be included in the Flooding Management Plan (to be included as part of the CEMMP).

663. The Flooding Management Plan will include, but not be limited to, installation of drainage and dewatering systems for the construction site and the temporary facilities, proper handling and storage of

electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project. Electrical outlets and wirings shall be properly insulated and organized in dry areas. Heavy equipment will be secured in a dry, flood-proof warehouse or storage area at the end of each working day. Temporary storage of machinery in flood-prone areas must also be avoided. Ancillary facilities such as site office and workers' quarters where people usually dwell are suggested to be constructed above flood levels. Emergency kits and supplies must be readily available in all workstations and temporary facilities.

664. To mitigate potential aggravation of flooding risks, the Contractor will provide erosion and sediment controls such as slope protection, silt screens, drain channels, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways especially during masonry and earthmoving activities. Waste bentonite slurry will be properly handled in accordance with RA 9003 and stored temporarily in bentonite tanks to prevent siltation. Construction and domestic wastes in the construction sites will be handled according to the SWMP (to be included as part of the CEMMP). Waterways within the site will be regularly cleaned and unclogged of solid wastes. An awareness campaign will also be implemented to the surrounding communities to prevent clogging of drains near the site.

(2) Potential Flooding due to Realignment of South Antipolo Canal

1) Potential Impacts

665. A portion of South Antipolo Canal will need to be re-aligned to achieve the necessary space required for the Project ROW. Flooding due to the creek re-alignment is not anticipated since flows in the existing creek channel will be maintained while the construction of the re-aligned section is ongoing. No indirect impacts are anticipated since flooding can be managed through proper planning.

2) Mitigation

666. Excavated material from the construction of the re-aligned section will be immediately hauled from the site to ensure that spoil material will not block existing flows.

(3) Potential Flooding due to Construction of TSS-1

1) Potential Impacts

667. TSS-1 will be elevated located approximately 60 m southwest of the nearest creek/canal in the area (i.e. Antipolo Creek). The elevation of TSS-1 is not expected to cause flooding in its vicinity since the area occupied by TSS-1 is very small compared to the overall catchment of Antipolo Creek. No indirect impacts are anticipated since flooding can be managed through proper planning.

2) Mitigation

668. To protect the substation facilities from flooding risks, construction of TSS-1 will be elevated. To prevent localized flooding, the TSS-1 will not block existing drains in the site; alternative drains will be provided in case existing drains are encroached by the substation. Significant flooding brought about by the construction is not expected.

5.3.2.2 Operation Phase

(1) Inducement of Flooding Hazards due to General Train Operations

1) Potential Impacts

669. Metro Manila experiences an average of two storms per year. The project site is expected to remain susceptible to rainfall events due to monsoons and tropical cyclones regardless of the SBT

Section's existence. The operations of the SBT Section is not anticipated to induce or aggravate the existing flooding conditions in the area. Railway structures will be constructed on elevated viaducts whereas supporting facilities will have a clearance of above established flood level.

2) Mitigation

670. The design height of these structures considered flood levels based on 100-year flooding hazard map, including allowance for climate change. Drainage facilities including exterior storm drainage and pavement surface drainage are not expected to cause flooding as well. Further discussion on the project risks associated with tropical cyclone, strong wind, heavy rainfall, and flooding are provided in **Chapter 6**. However, IEC campaign and community awareness initiatives on waste management and other environmental hazards in partnership with the LGU will be undertaken. Signages prohibiting waste disposal to the waterways will be installed along the SBT Section ROW.

(2) Flooding due to Realignment of South Antipolo Canal

671. The realigned section of South Antipolo Canal has been designed to have a larger canal compared to the existing creek canal, hence no flooding impacts are anticipated from this realignment. No indirect impacts are anticipated since flooding can be managed through proper planning.

(3) Potential Flooding due to Operations of TSS-1

672. During construction it will be ensured that the structure will not block any existing drainage. Should there be blockage, alternative drains will be provided. Significant flooding brought about by the operations of TSS-1 is not expected. No indirect impacts are anticipated since flooding can be managed through proper planning.

5.3.3 CUMULATIVE IMPACT ASSESSMENT

673. Foreseeable project in the near future that can contribute to the cumulative impacts to the NSCR SBT project is the NLEX-SLEX Connector project and the NSCR Calamba Extension Project. The connector project is an 8-kilometer elevated 4-lane expressway that connects the North Luzon Expressway and the South Luzon Expressway. This connector will coincide with a portion of the NSCR SBT Track. Construction activities for the connector project commenced last May 2019. For the NSCR Calamba Extension Project, it is a 72 kilometer mass transportation railway that will run from Manila to Laguna. It will be integrated with the PNR NSCR Project and PNR South Long Haul projects. It has also provisions for freight rail services to operate.

674. Currently, the identified Valued Environmental and Social Components (VECs) for this CIA are the locals living near the NSCR Project ROW for water quality. No aquatic organisms were considered as there were little to no macroorganisms found during the site reconnaissance survey and the actual environmental baseline survey.

675. If the construction phase of these projects will coincide, more stringent measures in enforcing the mitigating measures stated in the previous subchapters should be adopted. It is expected that more dust will be generated so erosion and dust suppressing measures should be enforced by these projects. Wastewater generated will also increase should these projects coincide during construction. The contractors should be very mindful of their wastewater generation and disposal. The mitigating measures stated in the previous subchapters are deemed sufficient to address the issue.

676. During the operation phase, it is expected that these projects will draw more people near the project site as these projects are prime modes of transportation. With this, it is expected that the domestic wastewater being discharged in the nearby bodies of water will also increase. During this phase, it is important for the LGUs to take part and regulate the discharges of these locals. It is important to take

note that the nearby bodies of water ultimately discharge into the Manila Bay. With this expected increase in domestic wastewater generation, it may worsen the currently bad water quality of the bay.

677. Manila Bay serves as the ultimate receiving body of the water drainage network in the western section of Manila. From SBT Section, runoff and effluent mainly drain to South Antipolo Canal and Antipolo Creek that link downstream with tributaries of the Pasig River that flows westward, ultimately draining towards Manila Bay. Although there will be minimal water consumption for the SBT Section to be used primarily for construction activities (cleaning of equipment, use of sanitation facilities) and for domestic purposes (use of sanitation facilities) during the operation of TSS-1, potential sources of wastewater from the project site will be properly controlled, managed and maintained in compliance with RA 9275, DAO 2016-18 and DAO 2021-19 to ensure that the project will not contribute detrimental effects to the overall health and quality of Manila Bay and other receiving waterbodies. Water quality from South Antipolo Canal and Antipolo Creek will be monitored regularly and results will be compared with DAO 2016-08/DAO 2021-19 WQG.

Table 5.3.1 Potential Impacts on Water and Options for Prevention or Mitigation or Enhancement

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Siltation and sedimentation of waterways due to construction and demolition works	✓	✓	X	✓	B-	- Minimize vegetation removal as much as practicable - Plan earthwork activities in consideration of weather conditions especially during wet season - Implement applicable erosion prevention and sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in construction site entrances and exits) based on Erosion and Sediment Control Plan (ESCP) - Construct the new drainage channel prior to re-training to avoid siltation and impeded flows and construct temporary facilities above flood levels and place machineries in a dry storage area at all times - Install, maintain and protect drainage channels to prevent drainage capacity overflow due to excess water during construction and demolition - Limit stockpile height of loose earth up to 2 m only, cover stockpiles and immediately remove loose earth materials from the site especially before expected heavy rains - Periodically remove sediments from the sediment traps and properly dispose off-site. If sediments have entered the surrounding waterways from surface runoff and streambank erosions, conduct dredging and clean up the waterways - Monitor visible signs of siltation and sedimentation and disposal activities - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public
Contamination of waterways with solid waste and wastewater	X	✓	✓	✓	B-	- Implement the Effluent Management Plan - Install, maintain and monitor a temporary septic tank system and/or the sanitation facilities (e.g. portalets) - Store concrete wastewater in large PTFE containers to avoid spillage on-site - Dispose dried waste in line with the project's Solid Waste Management Plan (SWMP) and dispose wastewater through DENR-accredited wastewater haulers - Prohibit workers/employees and surrounding communities from disposing wastes in South Antipolo Canal and Antipolo Creek - Secure necessary discharge and/or wastewater permits from DENR - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal to the waterways

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public
Contamination of waterways due to accidental spills of oil, lubricants, or other chemicals, and generation of hazardous wastes (Contaminated areas may transfer pollutants to surface run-off by rainfall and potentially contaminate nearby waterbodies)	X	✓	✓	✓	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) - Prepare a procedure manual for workers to prevent oil and chemical spills - Conduct safety induction training for the workers including personnel training on proper handling and disposal of potential contaminants and prevent accidental spills to the waterways - Properly handle and dispose potential contaminants through DENR-accredited hazardous waste haulers - Secure appropriate permits such as Permit to Transport and Hazardous Waste Manifest from DENR - Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) / Deploy heavy equipment operators with certification and conduct safety induction and training for the workers - Conduct regular maintenance of all vehicles and machinery - Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials - Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate spillage protection - Provide signages, fire extinguishers, barricades, and control access by vehicles and people to nearby waterways, restricting access to essential works only and prevent access to unstable areas - During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks Dispose used oil, lubricant and other chemicals by engaging DENR-accredited hazardous waste haulers - Provide proper roofing and concrete-paved floor with proper chemical-proofing to avoid permeation of chemicals. Remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. Use temporary waste storage to avoid spills

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						- Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP - Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 'Guidelines governing occupational safety and health in the construction industry' - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public
Contamination of waterways through concrete and drilling wastewater spills	X	✓	X	✓	B-	- Recondition and reuse bentonite slurries to lessen the amount of slurry to be disposed - Prohibit workers/employees and surrounding communities from disposing wastes in South Antipolo Canal and Antipolo Creek - Store concrete wastewater in large PTFE containers to avoid spillage on-site - Dispose wastes through a DENR-accredited wastewater hauler - Install settling tanks/drying ponds for concrete and drilling wastewater in the absence of wastewater haulers - Dispose dried waste in line with the project's Solid Waste Management Plan (SWMP) - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public
Flooding aggravated by excavation activities and siltation from earthworks	X	✓	X	X	B-	- Design the structures in consideration of flood levels based on 100-year flooding hazard map - Design the channel for retraining larger than the existing canal to avoid flooding and overflow of drainage capacity - Design railway structures on elevated viaducts and supporting facilities to have a clearance of above established flood level - Implement the Emergency Preparedness and Response Plan (EPRP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones in consideration of flooding induced by climate change such as extreme weather events

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Flooding affecting railway and TSS-1 operations	X	X	✓	X	B-	- Implement the Flood Management Plan (FMP) to include details on the installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal into the waterways to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities - Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP
Flooding due to siltation from demolition works	X	X	X	✓	B-	- Install and maintain sufficient and effective drainage and/or dewatering system with drain channels and sumps to facilitate proper drainage of excess water and to regularly remove water that accumulate in pits, excavations, and other depressions. For a new drainage channel, construct prior to retraining to avoid siltation and impeded flows - Construct temporary facilities above flood levels, place machineries and equipment in dry storage area at all times and insulate electrical wirings and sources away from wet working areas and flood-prone zones - Conduct cleaning or de-clogging of waterways as necessary to avoid blockage of existing drains or provide alternative drains should there be unavoidable blockage of existing drains - Enhance the capacity of the drainage system or provide alternative drains to prevent drainage overflow and prevent floodwaters from encroaching TSS-1 - Provide erosion and sediment controls such as slope protection, silt screens, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways especially during masonry and earthmoving activities - Properly handle waste bentonite slurry in accordance with RA 9003 and temporarily store in bentonite tanks to prevent siltation

Note:

“✓” - impact anticipated to occur during this phase,

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected,

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected,

D : extent of impact is unknown

5.4 IMPACTS ON AIR

5.4.1 CLIMATOLOGY

678. Potentially hazardous atmospheric phenomena include tropical cyclones, thunderstorms, lightning, rain, temperature extremes and climatic change. Significant hazards that may impact the project are summarized in **Table 5.4.1**. The environmental risk assessment further details the associated risks and mitigation measures for climate change and hydro-meteorological hazards in **Section 6.5.2.2**.

5.4.1.1 Pre-Construction/ Construction Phase

(1) Property Damage, Injury and Disruption of Construction Activities due to Climate-Induced Flooding, Strong Wind and Tropical Cyclones, and Systems Failure/Overheating of Construction Equipment due to Temperature Increase

1) Potential Impacts

679. Situated along the typhoon belt in the Pacific, the Philippines is frequently visited by typhoons. On average, approximately 20 typhoons pass through the PAR annually. Around two typhoons every year cross the region where the NSCR Project is located. Monsoons and tropical cyclones that enter the PAR often bring intense wind and precipitation that causes other destructive events like flooding which could affect infrastructure, property, and people especially those in low-lying areas. Flooding may cause overflow of drainage systems and restrictions/disruption of activities during construction.

680. As such, robust railway engineering design and construction standards are prepared and implemented in consideration of the national building code and other relevant standards as well as predicted climate changes.

681. Tropical cyclones with strong winds can result to structural damage, including temporary facilities, during construction. Additionally, occupational hazards created by strong winds include being struck by projectiles, eye injuries due to small particles of flying debris and dust, slips, trips and falls due to objects being blown by the wind. Nearby communities are also exposed to hazards due to projectiles from the construction site.

2) Mitigation

682. Weather forecasts and advisories including tropical-cyclone threat potential by PAGASA should be monitored. Necessary precautions and strategies should be taken to protect the people and property when typhoon hits the site. Exposure to the elements of tropical cyclone events will be limited by observing good housekeeping within construction sites and temporary facilities and suspending construction activities upon announcement of extreme weather from PAGASA. An EPRP will be prepared and implemented to include appropriate procedures and emergency protocols during extreme weather events. Regular inspection and proper maintenance of construction equipment, machineries and facilities (e.g, drainage system) are conducted to prevent drainage overflow and overheating, and regularly update reduction targets throughout the project duration.

683. Impacts may become worse due to projected climate change. A climate risk and vulnerability assessment will be conducted to provide information useful to relevant stakeholders in understanding the vulnerability of the Project to climate change and to identify appropriate adaptation options. Greenhouse gas (GHG) inventory will also be established and conducted to determine the GHG emissions of the existing PNR in operation and projected GHG emissions during construction and operation and to identify appropriate mitigation options consideration in the development of a Climate Change Adaptation and Mitigation (CCAM) Plan. As part of the CEMMP, a Climate Change Adaptation and Mitigation (CCAM) Plan will be prepared, implemented and updated based on latest climate

projections, predictions and technology. The implementation of the CCAM Plan will be monitored and periodically updated and reported to JICA as necessary.

5.4.1.2 Operations Phase

684. During operation, climate threats that may affect the SBT Section include increase in precipitation and temperature as well as extreme weather events. The impacts include overheating, thermal expansion, signaling problems, heat stress, drainage overflow, slower drainage, ground subsidence, flooding and train operation disruptions. To address climate change concerns, the Concessionaire/ Operator will prepare and implement a CCAM Plan. The Concessionaire is also required to track GHG emissions based on the operational activities covered by SBT Section or the NSCR Project as a whole. The implementation of the CCAM Plan will be monitored and periodically updated based on latest climate change projects, predictions and technology. The results of monitoring and developments on the CCAM Plan will be reported to JICA as necessary.

(1) Overheating, Thermal Expansion, Signaling Problems and Heat Stress due to Temperature Increase

1) Potential Impacts

685. With temperature increase including sudden temperature changes and intense sunlight, climate change effects include longer period of warm temperature and droughts and warmer days and nights. Increase in temperature may cause overheating of rolling stock equipment, thermal expansion of railway tracks, tension/overheating in track buckling, signaling problems due to thermal absorption, passenger discomfort due inefficient ventilation brought about by overcrowded trains and heat stress among employees.

2) Mitigation

686. To mitigate these impacts, regular monitoring of equipment and preventive maintenance of railway assets are necessary. OCHSMP and EPRMP will be implemented for the SBT Section to ensure the safety of the railway employees and passengers. Primarily, a CCAM Plan shall also be

(2) Drainage Overflow, Slower Drainage, Ground Subsidence, Flooding and Train Operation Disruption due to Precipitation Increase

1) Potential Impacts

687. For precipitation increase, the climate change effects include intense rainfall, extended rain periods and flooding which may lead to slower drainage, overflow of drainage systems, soil erosion of railway assets, flooding and restriction or disruption in train operations. Based on the drainage design report for the SBT Section, increase in the rainfall intensities is approximated at 10% to 20% based on Section 9 (Climate Change) of DPWH Design Guidelines, Criteria, and Standards (DGCS) Volume 3 (Water Engineering Projects) (2015). However, PAGASA's climate change projection (2011) suggests an increase in precipitation of 0.9 % to 63% for Luzon. As such, the average increase of these rainfall intensities is rounded up to 20%.

2) Mitigation

688. In anticipation of these potential impacts during operation, the capacity of drainage systems are enhanced and the railway system is designed as a viaduct and constructed above flood levels. Regular inspection and preventive maintenance of drainage and railway assets shall be conducted throughout the project operation.

(3) Infrastructure Damage, Drainage Overflow and Train Operation Disruption due to More Frequent and Intensified Extreme Weather Events

1) Potential Impacts

689. Extreme weather events such as typhoons with strong winds may cause damage to the infrastructure, overflow of drainage systems and disruption to train operations that further create an unsafe environment during operations.

2) Mitigation

690. Similar with drainage design, the detailed design of the SBT Section also considered the wind loading characteristics of the SBT Section structures in the event of severe weather conditions, based on the requirements of the NSCP 2015 Section 207 on the superstructure and substructure. Train operation protocols (i.e. speed restrictions, operation hours, suspension of operation, etc.) corresponding to each PAGASA warning signal for tropical cyclones will be included in the EPRP for the SBT Section as part of the overall plan for NSCR Project. Regular inspection and preventive maintenance of drainage and railway assets shall be conducted throughout the project operation.

Table 5.4.1 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Climatological Hazards

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Injury, property damage and disruption of activities due to flooding, strong wind, tropical cyclones, including events induced by climate change Systems failure /Overheating of infrastructure and equipment due to projected increase in temperature due to climate changes	✓	✓	X	X	C-	• Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology • Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety plans such as EPRP and OCHSMP • Conduct climate risk and vulnerability assessment (CRVA) to provide information useful to relevant stakeholders in understanding the vulnerability of the Project to climate change and to identify appropriate adaptation options for consideration in the CCAM Plan development • Conduct greenhouse gas (GHG) inventory to determine the GHG emissions of the existing PNR in operation and projected GHG emissions during construction and operation and identify appropriate mitigation options for consideration in CCAM Plan development • Design a resilient railway infrastructure based on robust engineering design and construction standards in consideration of the national building code and other relevant standards as well as predicted climate changes (e.g. ventilation, climate-resilient materials, rainfall intensities and flood levels) • Conduct regular inspection and proper maintenance of all construction equipment, machineries, and drainage systems • Track GHG emissions throughout project construction and regularly update GHG emission reduction targets • Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary
Overheating, thermal expansion, signaling problems, heat stress, drainage overflow, slower drainage, ground subsidence, flooding and train operation disruptions due to climate threats (temperature and precipitation increase, more frequent and intensified extreme weather events)	X	X	✓	X	C-	• Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology • Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety plans such as EPRP and OCHSMP • Conduct regular inspection and proper maintenance of all operation equipment, machineries, facilities (e.g. drainage system) and other railway assets (e.g. tracks, substation, viaduct piers) to ensure optimum working condition • Plant vegetation in open spaces along the SBT Section • Rehabilitate or improve the railway system to be more resilient to climate change impacts in case of significant damages during operation • Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Reduction in GHG emissions due to modal shift	X	X	✓	X	A+	• Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology • Integrate IEC activities on the benefits of the Project in reducing GHG emissions • Establish and maintain a GHG inventory database to track GHG emissions during operation and to keep GHG emission reduction targets and mitigation options updated throughout the project duration • Develop strategies to further reduce GHG emissions that include addressing the anticipated traffic congestion expected to occur in areas adjacent to the SBT Section that links Solis, Blumentritt and Tutuban stations due to pick-up and drop off of passengers by transport vehicles • Conduct regular inspection and proper maintenance of the railway system and facilities to ensure the efficient transport of goods and services and encourage the use of environmentally sustainable transport and to reduce public dependence on motor vehicles • Conduct energy/ water conservation program such as use energy efficient products (i.e. LED lights) and monitor carbon footprint

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.4.2 AMBIENT AIR QUALITY

691. The potential impacts of the development of the SBT Section on ambient quality, along with proposed mitigating measures for the identified impacts, is provided below and summarized in **Table 5.4.2**. The air quality impact assessment for the SBT Section focused mainly on the construction phase since majority of the emissions are expected to occur during this time. Air quality emissions during the pre-construction and operations phases are anticipated to be negligible in comparison since no sources are expected to emit air pollutants during these times.

5.4.2.1 Pre-Construction/ Construction Phase

(1) Air Quality Degradation due to Particulate/Gaseous Pollutants and Fugitive Dust Emissions

1) Potential Impacts

692. Relocation activities will be conducted in the Project ROW prior to any construction activities. The closest residences to the project construction area after the relocation activities would be from the edge of the ROW which varies from 15 m to 30 m. The ground level concentrations (GLCs) of air pollutants are expected to increase in construction sites along these barangays. Airborne emissions will occur during the Project's construction phase. Impacts of construction activities on air quality basically include the emission and generation of particulate matter (TSP, PM₁₀, and PM_{2.5}) and gaseous pollutants (SO₂ and NO₂). During the construction phase, gaseous pollutants will be emitted in the atmosphere from the combustion of fossil fuel by vehicles and construction equipment. The major sources of dusts are:

- Cleared, unpaved, and uncovered areas;
- Uncovered material stockpiles (demolition debris, soil, sand, and aggregates) and cement and bentonite stockpiles; and
- Wastes from drilling and excavation activities, dusts from concrete mixing activities, chipping of pile heads, pile capping, and girder launching.

693. Dusts from these construction activities will likely disperse to areas beyond the project direct impact area (see **Section 4.5.2.1** for discussion of DIAs) during dry windy days unless sufficient mitigating measures are implemented.

2) Mitigation

694. Measures to manage this will include the following:

- Fugitive dust from vehicular traffic, material handling activities, and other facilities that generate dust, excavation, and earthmoving will be controlled by management of vehicle speeds and application of regular water suppression (i.e. water sprinkling) to roads and stockpiles whenever visible dust is observed;
- Trucks that carry material will have speed limits of 10 km/hr in construction areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/municipal roads in accordance to JMC 2018-001 (*Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data*);
- Trucks and vehicles that transport construction material, spoils, and construction equipment will be covered to prevent spillage and fugitive emissions of dust;
- Immediate clean-up and light water sprinkling will be conducted in case of accidental spillage of soil or dusty materials in haul roads or public roads;

- Controls to prevent the build-up of mud and/or soil in wheels will be installed at the construction site exits. These controls may include the installation of wheel and truck wash facilities and/or use of mud mats to prevent mud and soil from getting into public roads;
- Workers will be provided with the appropriate personal protective equipment and safety protocols will be implemented pursuant to RA 11058 (*An Act Strengthening Compliance with Occupational Safety and Health Standards and Providing Penalties for Violations Thereof*), its Implementing Rules and Regulations (DO 2018-198), and the Bureau of Working Conditions-Department of Labor and Employment (BWC-DOLE) Occupational Safety and Health Standards (*The Guidelines Governing Occupational Safety and Health in the Construction Industry, 1998 [DO 13]*) to protect them from disease associated with dusts; and
- Regular dust monitoring will be conducted within the project site to ensure that the levels of air quality pollutants are within the DAO 2000-81 (*Implementing Rules and Regulations of the Philippine Clean Air Act of 1999*) standards. Station ANV2 (see **Figure 4.5.1**) may be used as monitoring stations once the Project goes into construction phase.

695. In addition to fugitive emissions, the consumption of fossil fuel from vehicles and construction equipment may increase the GLCs of particulates (TSP, PM₁₀, and PM_{2.5}) and gaseous pollutants (SO₂, and NO₂) in the area during construction. Based on published studies, emissions from traffic and vehicles are considered to have a foremost input of particulate matter that may cause degradation of air quality (Wahlin et al., 2001). Fine particles are generated mainly from the vehicle exhausts (Vallius et al., 2000). In addition to particulates, gaseous pollutants are also emitted through fossil fuel consumption, increasing their GLCs. Minimizing fuel consumption is not only economic; it may also have the potential to reduce particulate and gaseous pollutants. Measures to achieve this include:

- Traffic management guidelines will be incorporated in worker's and EPC contractor's induction seminar;
- Fuel efficiency will be maximized through scheduling of vehicle and equipment movements in order to minimize both idle time and distances travelled. Trucks and vehicles are not allowed to idle on site or roads while waiting;
- Vehicles and construction equipment will be regularly maintained in order to increase efficiency, reduce fuel use, and help reduce costs associated with equipment downtime;
- Equipment dispatch will be monitored closely in order to eliminate unnecessary use and to increase efficiency of use. Stationary equipment (Air Pollution Source Installations (APSI)s) will be applied for a Permit to Operate (PTO) under the DENR-EMB. Monitoring of the APSI/s will depend on the requirements stipulated in the PTO. The APSIs will be placed in strategic locations to ensure they are far from windows of houses and offices; and
- Contractors' vehicles and construction equipment will undergo the mandatory government vehicle emission tests prior to the start of construction. The vehicles will be properly maintained, and emission tests will be conducted annually during the construction phase to ensure that emissions are within air pollution targets.

696. If the project would require a batching plant during the construction phase, the Contractor will secure a separate ECC. The impacts and mitigating measures of the batching plant to ambient air quality will be identified during the separate EIA that will be conducted.

697. The sensitive receptors include, but are not limited to, hospitals, schools, daycare facilities, elderly housing, and convalescent facilities (see **Section 4.5.2.2**). These are areas where the occupants are more susceptible to the adverse effects of exposure air pollutants. Based on the land use types, Station ANV1 is located in a high-density residential area, while Station ANV2 and TSS-1 is located in a general public open space zone. As there are a number of sensitive receptors who may be affected by air quality degradation impacts, public involvement and information dissemination activities are necessary to be undertaken throughout the project construction. Monitoring of potential impacts in these zones are

undertaken since these locations are the most sensitive areas to impacts of ambient air quality. Monitoring results are for public disclosure.

5.4.2.2 Operation Phase

(1) Air Quality Degradation due to Particulate/Gaseous Pollutants and Fugitive Dust Emissions

1) Potential Impacts

698. Although the operation of the electric railway system itself has no direct gaseous and particulate pollutant emissions, standby generator sets may be used in case of power interruptions in the TSS-1 office. Also, feeder modes of fossil fuel-powered transport or vehicles going to and fro the TSS-1, and the Solis, Blumentritt and Tutuban stations interconnected by SBT Section may contribute to the traffic volume in access roads traversing and surrounding the Project. The impacts may include emissions of particulate and gaseous pollutants from both stationary (generator sets) and mobile sources (company/service vehicles, feeder transport) and dust generation within internal roads or open spaces within the SBT Section ROW premises and along external access roads traversing and surrounding the Project.

2) Mitigation

699. To address air quality degradation impacts, the identified mitigating measures include use of fuel-efficient and properly-rated equipment, equipment checkup and regular maintenance, regular cleaning and clearing of internal roads from dirt and spoils, wetting of ground in TSS-1 area or where vehicles frequent within the project vicinity, wearing of PPE, imposition of speed limits, compliance with environmental permitting requirements and monitoring of air quality with results for public disclosure.

700. Nevertheless, the positive impact of the modal shift from conventional diesel-powered to an electric-powered railway system outweigh any negative impacts associated with the operation of the Project as there is significant improvement in the overall ambient air quality in pollution hotspots and city centers such as the project site. Public involvement and information dissemination activities are also to be undertaken throughout project operation.

Table 5.4.2 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Ambient Air Quality

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning		
Emissions of particulate and gaseous pollutants	X	✓	✓	✓	A-	- Require construction vehicles and equipment to undergo the mandatory government vehicle emission tests prior to the start of construction - Select and use low-emitting and fuel-efficient vehicles, machineries and equipment - Secure Permit to Operate (PTO) from DENR-EMB for stationary equipment (Air Pollution Source Installations (APSI)s and conduct monitoring of the APSIs based on the requirements stipulated in the PTO - Incorporate traffic management guidelines in the induction seminar for workers and EPC contractors - Maximize fuel efficiency through scheduling of vehicle and equipment movements to minimize idle time and distances travelled - Prohibit idling of trucks and vehicles on site or roads while waiting - Conduct regular maintenance and annual emission testing of the vehicles to ensure that emissions are within acceptable limits - Closely monitor equipment dispatch to eliminate unnecessary use and to increase use efficiency - Regularly monitor ambient air quality (emissions of particulate and gaseous pollutants) and disclose all monitoring results to the public. - Evaluate effectiveness of mitigating measures and apply further interventions as necessary
Emissions of fugitive dusts such as wheel entrained dusts, storage and handling of materials, and stockpiles of construction equipment may increase dust concentrations in the area.	X	✓	✓	✓	A-	- Install controls at the construction site exits to prevent build-up of mud and/or soil in vehicle wheels and public roads such as wheel and truck wash facilities and/or mud mats - Implement a Dust and Emission Control Plan - Control vehicle movement, manage vehicle speeds and impose speed limits of 10 km/hr in construction areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/ municipal roads in accordance to JMC 2018-001 (Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data) to trucks that carry materials - Cover overfills, topsoil/ soils, spoils, and construction materials onsite as well as construction equipment, trucks and vehicles for the transport of materials to prevent escape of dusts - Execute water sprinkling of access roads, stockpiles and areas with exposed soils or dust-generating materials or equipment whenever visible dust is observed or at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area - Provide workers with appropriate PPEs and implement safety protocols pursuant to RA 11058 and its IRR (DO 2018-198), and DOLE-BWC DO 1998-13 to protect them from disease associated with dusts - Regularly monitor fugitive dust emissions/ generation and disclose all monitoring results to the public. - Evaluate effectiveness of mitigating measures and apply further interventions as necessary

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.4.3 AMBIENT NOISE

701. There is potential for increase in noise level to occur during the construction and operation phases of the project which may cause nuisance and disturbance. The potential impacts of the development of the SBT Section on ambient noise, along with proposed mitigating measures for the identified impacts, is summarized in **Table 5.4.3**.

702. An initial stage to relocate existing residents is planned within the NSCR Project ROW during the pre-construction stage. The closest remaining noise and vibration sensitive buildings would be located within 15 m to 30 m of the SBT Section centerline. These locations are at the greatest risk of noise and vibration impacts from the project.

5.4.3.1 Pre-Construction/ Construction Phase

(1) Increased Noise Level from Construction and Out-of-Hours Night Works Affecting Amenity and Causing Disturbance at Sensitive Receptors

1) Potential Impacts

703. The measured existing noise levels in all monitoring stations exceeded the noise level guidelines (NPCC, WBG, Japan) for all time periods. With the construction of the Project, existing noise levels are expected to be further exceeded especially that the proposed construction schedule includes two working shifts (approximately 24 hours per day) for 6 days per week. The overall construction schedule is expected to last for 36 months. Most of the construction stages will progressively move along the Project ROW throughout the construction program to support the installation of the new viaduct.

704. Key works required for the construction of the SBT Section include site preparation, drilled piling, installation of the substructure footings to support the new elevated superstructure, new maintenance roads and the relocation of the existing water way. Primarily, the construction activities that are expected to generate the higher noise levels are piling and footing and construction as well as construction of piers and cast-in-place box girders. The operation of temporary facilities would also be required to support a construction yard, construction camps, access, batching plants, etc. Prior to construction, noise baseline surveys are to be conducted adjacent to sensitive receptors once the location of the temporary construction facilities, construction yard, camp and access routes outside the Project ROW are identified.

705. Prediction method by construction type from the Acoustical Society of Japan Prediction Model 2007 for Construction Noise was applied. Based on construction noise prediction results, the noise levels of construction activities will exceed the guidelines values without noise barrier. Based on the prediction results and impacts to sensitive receptors, the predicted construction noise levels for 3.0-m noise barrier sheet will meet all guidelines. However, construction noise may increase depending on the operating conditions and operating positions of construction machinery.

2) Mitigation

706. Works close to these sensitive receptors should be managed in accordance with the following recommendations:

- Development of a construction noise and vibration management plan (CNVMP), including good practice noise management techniques.
- Introduce low-noise construction equipment as much as possible, install noise control devices such as mufflers and noise suppressors for all construction equipment and machineries or select equipment to be as quiet as is practicable. These should be appropriately fitted with silencers, acoustic enclosures and other noise attenuation measures where required.

- Consider site set up during site planning and address during contractor inductions (i.e. generators, refueling and laydown sites are located as far away from sensitive receptors where possible).
- Plan for construction activities considering the time and scale of construction activities (occur in the same time period or within a restricted area) to reduce the number of sensitive receptors exposed to noisy works and to minimize nuisance noise. For example, operation of vibration hammer and other noisy equipment will be scheduled at a limited time.
- Construct walled enclosures around especially noisy activities or clusters of noisy equipment 50 m from sensitive receptors.
- Install noise barrier walls or panels instead of noise barrier sheets to further reduce construction noise.
- Where practicable, limit heavy construction vehicle movements to normal working hours and elect traffic routes to limit the amount of accelerating and braking and avoid local roads. Minimize blowing of horns and implement speed limits when passing through residential areas.
- Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works.
- Encourage the community to use temporary or permanent acoustic insulation/ noise attenuation/ sound-proofing installations depending on the noise impact to sensitive receptors such as installation of soundproofing walls at most noise sensitive indoor areas of affected residences especially during sleep/resting time or installation of sound barrier curtains at the windows of nearby schools and places of worship especially during daytime when noise-generating activities are much higher.

707. During night works, sensitive receptors within 50 m from the edge of the ROW are expected to be exposed to noise levels that would impact resident's ability to rest and sleep during noisy works associated with all key construction stages. Construction works have to be done during daytime as national regulations do not permit construction activities from 7 pm to 7 am in residential areas.

708. However, if night works are inevitable, relevant works approval permit need to be secured from the barangay or LGU. The permit should include reference to the specific mitigation and management developed in the following documents covered in the Construction Noise and Vibration Management Plan of the CEMMP:

- Noise abatement/control plan
- Noise monitoring plan including public disclosure
- Compliance action plan
- Public information and complaint response procedure or Grievance Redress Mechanism (GRM) to handle complaints on noise during construction if any and monitor the actions taken to resolve the complaints

709. Furthermore, regular monitoring of ambient noise levels will be conducted at the identified sampling points and affected sensitive receptors in compliance with NPCC, WBG and Japan criteria. Monitoring report will clearly state methodology and results and will be made accessible to the public. Effectiveness of noise reduction measures will be regularly evaluated and modified as needed.

5.4.3.2 Operation Phase

(1) Increased Noise Level from Railway Operations Causing Disturbance at Nearby Sensitive Receptors

1) Potential Impacts

710. Impacts during the operational phase are largely associated with train movements on the new viaduct structure between Tutuban Station to Blumentritt Station and Blumentritt Station to Solis Station. The elevated structure will provide additional train services both during the day and during the night. The change in train numbers is likely to cause an increase to the existing ambient noise levels if noise mitigation measures are not implemented.

711. Where the railway corridor will be elevated, sensitive receptors previously protected by other buildings will be exposed to an increase in rail noise exposure. Sensitive receptors setback further from the rail corridor will experience an increase in rail noise exposure. Accordingly, the change in train noise at receptors located behind the first row of buildings immediately adjacent to the SBT Section alignment unlikely to impact the overall ambient sound level.

712. Receptors immediately adjacent to the SBT Section are already exposed to high levels of transport noise. Low set buildings are predicted to experience a minor change in noise level (< 3 dB). However, sensitive receptors previously protected by other buildings that are resumed will be exposed to increased rail noise exposure.

2) Mitigation

713. For Solis-Blumentritt Section, without noise barrier, the predicted noise levels do not exceed the WBG noise guideline but will exceed the Japanese Guideline for night time operation years 2023-2040, and both day and night time for operation years 2040 and onwards, and for distances up to 50m from edge of ROW. With a 1.5m noise barrier, predicted noise levels during night time for all operation years exceed the Japanese Guideline but only for 0m distance from the ROW. Operation noise impact to most sensitive receptors can meet the Japanese and WBG guidelines except for Melchora Aquino Elementary School at night time. However, this school will not be in operation during night time so this will not affect the sensitive receptor. Therefore, the 1.5m noise barrier will be sufficient to address the operation noise impact.

714. For Blumentritt-Tutuban Section, without the noise barrier, the predicted noise levels meet Japanese and WBG noise guideline values at both day and night time and for all operation years. The low value is assumed to be due to low number of trains on this section and relatively high noise source. However, if there is a possibility of change in the type of operated train in the future, the installation of 1.5m noise barrier walls is advised.

715. Based on the prediction results and impacts to sensitive receptors, the predicted operation noise levels for 1.5-m noise barrier wall can meet Japanese and WBG Guidelines. To further reduce noise impacts brought about by train operation, the following mitigation measures are recommended:

- Use ballastless track with elastic and absorbent sleeper supports to minimize noise generation from train operation;
- Install more sound-absorbing or sound-insulating noise barrier walls (See example in **Figure 5.4.1**);



Source: Metropolitan Expressway Company Limited Website (<https://www.shutoko.co.jp/en/index/>)

Figure 5.4.1 Sound-Absorbing Noise Barrier Wall

- Reduce train speed at nighttime to reduce the noise generated since train noise is highly dependent on train speed;
- Install noise barriers at effective heights especially in areas of high concentration of sensitive receptors between Solis and Blumentritt (e.g. from 0+600 to 0+800). (However, if noise barrier walls are too high, they may have structural impacts or cast shadow over wider area and reduce daylight. As such, incorporation of disaster-resilient, bird-friendly and road user- sensitive alternative/transparent noise barriers / panels in consideration of color, type, expected life and maintenance requirements of transparent material may be considered to allow light to areas that may be placed in the shadow of noise barriers. Use of transparent materials should be restricted where reverberation would cause problems.)
- Provide noise control device such as muffler to all stationary sources (i.e. generator set);
- Conduct regular inspection and proper maintenance of trains and tracks to ensure its optimal operation and functionality (e.g., rail grinding, wheel rolling, and so on);
- Monitor noise levels at identified sampling points and sensitive receptors likely to be affected by the operation and evaluate effectiveness of the noise reduction measures provided and modify as needed.
- Monitor the complaints and resolutions taken based on the established GRM.

716. For Traction Substation, the measured baseline noise levels near the TSS-1 exceeded all guidelines (NPCC, WBG, Japan) in all time periods. The operation of the TSS-1 causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria.

717. The structure will be designed to ensure that fixed mechanical plant and equipment associated with the substation can achieve the WBG EHS which is more stringent NPCC, 1980 regulations. Equipment will be installed in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance. Other noise abatement measures include:

- Significant noise generating equipment is enclosed within sealed concrete enclosure
- Supply air fans will be ducted (i.e. not mounted on the facade or roof)
- Doors that open to the environment will be well sealed

718. Another mitigation measure is to reduce rolling noise by reducing track roughness. Roughness can be reduced by grinding tracks to remove corrugated edges and by lubricating tracks. Regular inspection and maintenance of the tracks will be conducted to ensure that tracks are at acceptable

conditions and does not increase ambient noise to unacceptable levels. Further noise mitigation measures at the source include optimizing the number of train operations at night to reduce generated noise during critical time periods.

719. Monitoring activities will be carried out during operation stage to verify effectiveness of mitigation measures and in compliance with the Japanese and WBG guidelines. Results of monitoring, including the methodology, will be made available to the public.

Table 5.4.3 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Ambient Noise

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
General construction and demolition works produces noise levels that affect the amenity at nearby sensitive receptors	X	✓	X	✓	B-	• Develop construction noise and vibration management plan (CNVMP), including good practice noise management techniques. • Introduce low-noise construction equipment as much as possible, install noise control devices such as mufflers and noise suppressors for all construction equipment and machineries or select equipment to be as quiet as is practicable. These should be appropriately fitted with silencers, acoustic enclosures and other noise attenuation measures where required. • Consider site set up during site planning and address during contractor inductions (i.e. generators, refueling and laydown sites are located as far away from sensitive receptors where possible). • Plan for construction activities considering the time and scale of construction activities (occur in the same time period or within a restricted area) to reduce the number of sensitive receptors exposed to noisy works and to minimize nuisance noise. For example, operation of vibration hummer and other noisy equipment will be scheduled at a limited time. • Construct walled enclosures around especially noisy activities or clusters of noisy equipment 50 m from sensitive receptors. • Install noise barrier walls or panels instead of noise barrier sheets to further reduce construction noise. • Where practicable, limit heavy construction vehicle movements to normal working hours and elect traffic routes to limit the amount of accelerating and braking and avoid local roads. Minimize blowing of horns and implement speed limits when passing through residential areas. • Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works. • Encourage the community to use temporary or permanent acoustic insulation/ noise attenuation/ sound-proofing installations depending on the noise impact to sensitive receptors such as installation of soundproofing walls at most noise sensitive indoor areas of affected residences especially during sleep/resting time or installation of sound barrier curtains at the windows of nearby schools and places of worship especially during daytime when noise-generating activities are much higher • As much as possible, construction works have to be done during daytime as national regulations do not permit construction activities from 7 pm to 7 am in residential areas. However, if night works are inevitable, relevant works approval permit need to be secured from the barangay or LGU. The permit should include reference to the specific mitigation and
Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	X	✓	X	X	A-	

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						management developed in the following documents covered in the Construction Noise and Vibration Management Plan of the CEMMP: - Noise abatement/control plan - Noise monitoring plan including public disclosure - Compliance action plan - Public information and complaint response procedure or Grievance Redress Mechanism (GRM) to handle complaints on noise during construction if any and monitor the actions taken to resolve the complaints • Monitor ambient noise levels will be conducted at the identified sampling points and affected sensitive receptors in compliance with NPCC, WBG and Japan criteria. Monitoring report will clearly state methodology and results and will be made accessible to the public. • Evaluate effectiveness of noise reduction measures and modify as needed.
Operational noise from trains and TSS-1 noticeably increases existing noise levels and causes disturbance at nearby sensitive receptors	X	X	✓	X	B- / C-	• Use ballastless track with elastic and absorbent sleeper supports to minimize noise generation from train operation; • Install more sound-absorbing or sound-insulating noise barrier walls • Reduce train speed at nighttime to reduce the noise generated since train noise is highly dependent on train speed; • Install noise barriers at effective heights especially in areas of high concentration of sensitive receptors between Solis and Blumentritt (e.g. from 0+600 to 0+800). (However, if noise barrier walls are too high, they may have structural impacts or cast shadow over wider area and reduce daylight. As such, incorporation of disaster-resilient, bird-friendly and road user-sensitive alternative/transparent noise barriers / panels in consideration of color, type, expected life and maintenance requirements of transparent material may be considered to allow light to areas that may be placed in the shadow of noise barriers. Use of transparent materials should be restricted where reverberation would cause problems.) • Provide noise control device such as muffler to all stationary sources (i.e. generator set); • Conduct regular inspection and proper maintenance of trains and tracks to ensure its optimal operation and functionality (e.g., rail grinding, wheel rolling, and so on); • Monitor noise levels at identified sampling points and sensitive receptors likely to be affected by the operation and evaluate effectiveness of the noise reduction measures provided and modify as needed. • Monitor the complaints and resolutions taken based on the established GRM • Optimize the number of train operation at nighttime to reduce generated noise • Provide noise control device such as muffler to all stationary sources (i.e. generator set)

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Install traffic signs in the areas before and after passing SBT Section, e.g. directional signs, speed limit signs, no blowing of horn signs, etc. • Install noise barrier of at least 1.5-m in height extending the length of the SBT project alignment. Locate barriers on both sides of each rail viaduct to achieve compliance with project criteria at nearby residential receptors. Ensure that the inward facing wall of the barrier are acoustically absorptive to reduce reflections. • Provide noise control device such as muffler to all stationary sources (i.e. generator set) • Conduct regular inspection, proper maintenance and reconditioning of trains and tracks. • Design to ensure that fixed mechanical plant and equipment associated with the substation can achieve the WBG and Japanese guidelines • Enclose significant noise generating equipment within sealed concrete enclosure • Duct supply air fans (i.e. not mounted on the facade or roof) • Seal well the doors that open to the environment • Conduct regular monitoring and compliance to WBG and Japanese guidelines for rail operation and disclose results to the public • Evaluate effectiveness of the vibration reduction measures provided and apply further mitigation measures and/ or revised current measures

Note:

“√” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.4.4 VIBRATION

720. Procedures in the FTA manual are adopted to assess the potential impacts from vibration since there is no relevant Philippine guidelines. Similar to noise impact assessment, a distance of 200 meters from the SBT Section was considered appropriate for assessing potential vibration impacts. Below are the identified vibration impacts of the Project.

5.4.4.1 Pre-Construction/Construction Phase

(1) Human Disturbance and Structural Damage to Buildings Sensitive to Vibration

1) Potential Impacts

721. The measured baseline vibration levels were compared to FTA criteria for human annoyance for different frequencies of events and land use categories to determine the likelihood of existing vibration impacts.

722. In the comparison of measured baseline vibration levels with FTA GBV criteria based on the monitoring site land use, the sampling area was considered to be predominantly Category 2 (residences and buildings where people normally sleep). The results of the vibration monitoring at both locations confirm the measured baseline vibration levels are below the FTA GBV vibration impact criteria to protect people in residential and institutional buildings from annoyance. Although peak baseline vibration is 58 VdB in the evening for V1 sampling station and 57 VdB in the morning for V2 sampling station. These vibration levels are still below the threshold for human perception (65 VdB) and frequent event criterion of 100 dBV. Hence, it is unlikely that receptors exposed to this level of vibration would experience annoyance.

723. During construction, there is potential for high levels of vibration, and risk of cosmetic damage thresholds to be exceeded when works occur within 8 m from the perimeter or property line of the existing buildings. Maintaining a working distance of at least 10 m from these activities is recommended. Historical structures which are fragile are commonly vulnerable to damage from ground vibration. Currently, the Casitas de Tondo is the identified historical structure within the Project ROW. The historical structure will be relocated and therefore construction activities within the Project ROW are unlikely to cause damage to the structure.

724. However, some construction activities are expected to be undertaken outside the Project ROW. As such, once the location of temporary construction facilities, construction yards and access routes are determined, their vibration impacts on sensitive receptors should also be considered using FTA construction vibration damage criteria for buildings extremely susceptible to vibration damage and other relevant standards as necessary.

2) Mitigation

725. Works closer than 10 m from the perimeter or property line of a sensitive building (e.g. school, church, residential and historical structures) should be managed in accordance with the recommendations within the FTA manual to avoid exceeding cosmetic damage thresholds.

- Pre-condition assessments of residential and other sensitive assets prior to commencement of sheet/bored piling, vibratory rolling or other high impact works where these works are located within 10 meters from the perimeter or property line of buildings sensitive to vibration (greater distances may need to be considered if the construction plan changes (e.g. relocation of Casitas de Tondo does not proceed prior to construction))
- Substitution of construction methods to emit lower vibration levels were feasible, e.g. smaller vibratory rollers

- Design coordination and project layout so that heavy vehicles and activities are located as far from sensitive buildings as possible.

726. Compliance monitoring will also be undertaken where safe working distances cannot be maintained to demonstrate compliance and trigger further mitigation measures to reduce vibration where levels exceed acceptable thresholds. Vibration monitoring will also be undertaken during initial piling and vibratory roller activities at the closest receptors to verify predicted vibration levels and refine mitigation measures if necessary. Monitoring report will clearly state methodology and results and will be made accessible to the public.

727. Construction vibration during the use of heavy machinery (sheet piling, bore piling occur and vibratory rollers) is expected to be perceptible at distances up to 40 meters each activity. Consideration should be given to the operating schedule such that high levels of vibration only occurs during the day, where feasible.

5.4.4.2 Operation Phase

728. Based on the operational vibration modelling results, at distances of more than 3 m from the rail centerline, the predicted vibration is below the lowest impact threshold of 100 VdB for Category 2 in consideration of trains, tracks, ground environment and receiver building. However, damage to fragile historic buildings located near the ROW may be of concern. Damage is unlikely except when the track is located very close to the structure. In case of the Casitas de Tondo, the relocation site should consider vibration impacts from nearby Tutuban Station and NSCR Project. FTA construction vibration damage criteria for buildings extremely susceptible to vibration damage will apply.

729. Levels above the human amenity thresholds are unlikely to be exceeded based on the attenuation of vibration over distance from the new elevated structure. Although baseline and modelling results met acceptable levels that does not require stringent mitigation, built-in vibration reduction measures such as elastic sleeper tracks will be checked regularly and maintained or repaired as necessary. Aside from elastic sleeper track, regular inspection, proper maintenance and reconditioning of trains and tracks will also be undertaken such as rail grinding, slip-slide detectors and maintenance or replacement of suspension system, brakes and wheels.

730. Furthermore, vibration levels from the railway including impacts to identified nearby sensitive receptors, historical heritages and other ecologically significant areas likely to be affected by the operation will be monitored and evaluated based on compliance with the FTA criteria. Monitoring results will be disclosed to the public.

731. The equipment inside the traction substation (TSS-1) will be installed in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance. Compliance monitoring in accordance with FTA criteria will be undertaken regularly during operations. Monitoring report will clearly state methodology and results and will be made accessible to the public.

Table 5.4.4 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Ambient Vibration

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Vibration from construction/ demolition works causes human disturbance and structural damage to buildings sensitive to vibration	X	✓	X	✓	B-	• Conduct building condition survey of those with culturally significant and buildings adjacent to the alignment to provide proper protection measures and to conduct continuous monitoring of vibration impacts. Prepare and submit work plan for building and structures of historic concerns and obtain approval from cultural agencies • Inform local communities on potential vibration impacts and proposed work schedule • Implement the Construction Noise and Vibration Management Plan (CNVMP) during construction to avoid cosmetic damage to sensitive structures and the Noise and Vibration Management Plan as part of the Abandonment Plan during demolition/ abandonment • Locate heavy vehicles and activities as far from sensitive buildings as possible through design coordination and project layout • Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance • Plan the construction/demolition schedule such that high levels of vibration only occur during the day where feasible and consider time, duration, and scale of construction/demolition to optimize the use equipment, machineries, and vehicles with minimal vibration generation • Select construction equipment and machineries matching the scale of the construction and with minimal vibration generation if possible • Ensure that construction work areas/ activities have a working distance of at least 10 m from sensitive receptors. In areas where safe working distances cannot be maintained, demonstrate compliance or trigger further mitigation measures to reduce vibration where levels exceed acceptable FTA thresholds • For works closer than 10 m from a sensitive receptor (e.g. school, church, residential, historical structures), conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes) • Substitute construction methods to emit lower vibration levels where feasible • Strictly control construction activities close to historical/archaeological sites • In case construction activities cause continuous vibration, especially during foundation excavation, it is necessary to reduce energy at each excavation

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						- Require vehicles transporting construction materials and equipment to follow traffic rules strictly and limit speed not to exceed 30 kph and the load shall not exceed 25 tonnes if passing communities, commercial or sensitive areas (e.g. health premises, schools, educational institutions or religious institutions such as temples, mosques and churches) - Monitor vibration levels at the sites of sensitive receptors (i.e. affected ecologically and culturally significant areas), temporary facilities and construction especially during initial piling and vibratory roller activities at the closest sensitive receptors to verify predicted vibration levels and evaluate effectiveness of mitigation measures and compliance with WBG EHS and FTA noise criteria. - Document and clearly state the methodology and results in required monitoring reports accessible to the public
Increase in vibration causing human disturbance at sensitive receptors generated by the project operation	X	X	✓	X	C-	- Regularly check and maintain vibration reducing elastic sleeper track - Conduct regular inspection, proper maintenance and reconditioning of trains and tracks such as rail grinding, slip-slide detectors and maintenance or replacement of suspension system, brakes and wheels - Monitor vibration levels including identified nearby sensitive receptors, historical heritages including ecologically significant area/s (if any) likely to be affected by the operation and evaluate the compliance with the FTA criteria and disclose the results to public - Evaluate effectiveness of the vibration reduction measures provided and apply further mitigation measures as recommended in the FTA Manual (i.e., standard and non-standard methods) if current measures are ineffective
Increase in vibration due to the operation of the TSS-1 affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	X	X	✓	X	C-	Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

5.5 THE PEOPLE

733. The potential impacts of the development of the SBT Section on the social environment and the enhancement/mitigating measures for the identified impacts are provided below and summarized in **Table 5.2.1**. The discussion of impacts and measures are combined for this section. The baseline information used to assess the social impacts and come up with mitigating measures are mainly based on the Resettlement Action Plan (RAP) for the SBT Section, the EPRMP for the NSCR Project and the EIS for the NSCR Calamba Extension Project. The discussion on impacts on people also considered the project design and description of the SBT Section and other ongoing projects in the same area as SBT Section.

5.5.1 Public Participation and Information Disclosure

5.5.1.1 Pre-Construction/ Construction Phase

(1) Social Acceptability and Conflict of Interest

734. The project will affect a number of people and thus social acceptability is of utmost consideration for the successful implementation of the project. Public participation and information disclosure, activities include IEC campaigns, meetings, public/stakeholder consultations, focus group discussions (FGDs), key informant interviews (KIIs), perception surveys, grievance redress mechanism (GRM) and SDP implementation. The conduct of these public participation and information disclosure activities ensures that stakeholders are fully informed of the project and involved in project undertakings and decision-making throughout the project duration. Furthermore, these activities provide a platform for the DOTr to engage constructively and productively with affected communities and stakeholder groups and to address concerns and resolve conflicts relating to the project and its impacts on affected people, the environment, and communities. In case of low social acceptability and unresolved conflicts, conducted activities will be reviewed for corrective actions.

5.5.1.2 Operation Phase

735. During operation, regular consultations with affected communities and relevant government offices and agencies will be undertaken to ensure adequate and timely mitigation of project adverse environmental impacts and resolution of stakeholder complaints.

5.5.2 Land Acquisition and Utilization, and Involuntary Resettlement

5.5.2.1 Pre-Construction/Construction Phase

(1) Displacement of Project-Affected Persons (PAPs)

736. Although the existing PNR ROW will be utilized for the SBT Section, additional land acquisition for the Project ROW is necessary to achieve the capacity and design objective of the project that results in involuntary resettlement. Involuntary resettlement occurs when affected people do not have the right to refuse land acquisition and are displaced, which may result in long-term hardship and impoverishment as well as social stress. Involuntary resettlement impacts include physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood).

737. In order to mitigate social and economic impacts from land acquisition and restrictions on land use, DOTr will provide timely compensation for loss of assets at replacement cost and assist displaced persons in their efforts to improve or at least restore/maintain their pre-project living standards, income-earning capacity and production levels. As such, a Resettlement Action Plan (RAP) including the Livelihood Restoration and Improvement Program (LRIP) was developed to ensure that the livelihood

and living standards of the PAPs prior to displacement would be maintained or improved, as a result of project-related activities that trigger involuntary resettlement such as land acquisition or land clearance for the SBT Section. Furthermore, there will also be a grievance redress mechanism (GRM) platform for DOTr to engage constructively and productively with affected communities and stakeholder groups and to address concerns relating to the project and its impacts on affected people, the environment, and communities.

738. Furthermore, DOTr has put in place a monitoring system that tracks whether the planned resettlement activities for the PAPs are delivered (i.e., whether compensation for lost assets are promptly paid) and whether the planned activities contained in the RAP such as relocation and livelihood restoration achieved the desired outcomes. Internal monitoring tracks the progress in the delivery of physical and financial targets, resettlement assistance and other entitlements, while external monitoring assesses the results and impacts of the RAP implementation and the extent to which RAP objectives are being achieved.

739. In compliance with JICA Policy on stakeholder engagement, the PAPs ought to be informed of the resettlement process. As such, DOTr conducted meaningful consultations with the PAPs and disclosed relevant project information to ensure their full participation during feasibility study and detailed design stages.

(2) Conflict in Land Ownership, Change in Land Use and Relocation of Landowners

740. Due to eminent domain or the right of government to expropriate private property for public use, legitimate landowners or legal PAPs whose private lands are to be acquired for SBT Section will be physically displaced that may later affect their psychological well-being and cause hardship and social stress. As part of government requirements and compliance with Republic Act 10752, landowners will be provided with just compensation based on current market value and replacement cost in order to purchase a similar property. While the SBT Project ROW mainly utilizes the PNR ROW, apart from the existing government ROW, the land for acquisition include: land owned by the Manila LGU in Barangays 164 and 165 and land owned by the National Housing Authority in Barangays 221 and 228.

741. In addition, private lands for acquisition in other affected barangays (i.e. Barangay 164, 165, 217, 221 and 228) consisting mostly of residential, commercial, and mixed use will have a change in zoning. These private lands will become public lands and zoned as infrastructure/ utilities/ transportation land use following local government process.

742. Given that the NSCR - SBT Section connects to the NSCR Calamba-Ex line, both projects also have an impact on Barangay 217 and 218 (SB Section) and Barangay 213 and 227 (BT Section) in Manila. In terms of land parcels, specifically for the SB Section, two (2) lots are affected by both the SB and Manila Partial Operation (PO) Section. These pertain to one (1) lot in Barangay 217 (Lot ID 13012) which is part of the existing PNR ROW and one (1) residential lot in Barangay 217 (Lot ID 13054). The DOTr PMO shall coordinate with the Manila PO PMO regarding the acquisition of the residential lot affected by both Projects.

743. In addition, DOTr has also coordinated with other stakeholders such as Meralco to discuss the project-affected area. A joint inspection was held with DOTr, Meralco, JDT, EcosysCorp, Inc. and NSTren on July 30, 2021 to determine the estimate extent of the ROW impact to the land and structure. Upon confirmation shifting the ROW would have no impact on the civil structures (August 2021); thus the BT Section ROW was revised. In a Conforme Letter for the revised BT DD ROW dated 26 August 2021, DOTr and PNR have provided their concurrence, with the ROW avoiding the Meralco perimeter fence.

(3) Relocation of Informal Settler Families (ISFs) and other Non-Landowners

744. The SBT Section will displace and relocate ISFs and other non-landowners occupying private or public lands due to land acquisition for the Project ROW. ISFs who are homeless and/or have low incomes are eligible to become beneficiaries of government socialized housing programs if they satisfy the criteria set forth in the RAP. Non-landowners who are renting, leasing, sharing or occupying structures, formally or informally owned by someone else may also be eligible to avail of said housing programs if they satisfy such criteria.

745. Although the relocation entitlements for eligible ISFs and other eligible non-landowners will provide an opportunity to have their own formal housing units, adverse social and economic impacts are still expected. A significant adverse impact of the project is disruption in the day-to-day activities of the PAPs especially if they have to be relocated outside Metro Manila and if their employment and/or livelihood are located in Manila or nearby cities. As such, consultation and participation mechanisms were implemented for the SBT Section including IEC and stakeholder consultation meetings to ensure that social, economic and environmental concerns of all aggrieved parties, particularly concerns on the resettlement sites and livelihood, are considered in the RAP. Livelihood restoration measures will include various forms of compensation and assistance to enable the re-establishment of livelihood. Included also are skills training, training allowance and rehabilitation assistance for vulnerable groups. In the resettlement sites, sufficient social infrastructure and basic services will also be provided prior to relocation. DOTr has put in place a monitoring system that tracks livelihood restoration achieved the desired outcome.

(4) Potential Conflict Among PAFs and Other Government Infrastructure Projects

746. Based on DD RAP for Solis-Blumentritt Section, the project alignment interfaces with DPWH NLEx-SLEx Connector Road Project at 1+300.000, with three affected structures in the overlap section in Barangays 214 and 217. As such, close coordination with DWPH regarding financial assistance arrangements is necessary. Other relevant agencies with ongoing infrastructure projects will be consulted in case the SBT Section is later found to share impact areas with other projects in terms of PAFs.

747. In case of overlap with SBT Section, the RAP prepared for this Project will be implemented and PAPs will be compensated the same entitlements for SBT Section. Where required, DOTr is to top up or supplement the gap to meet the entitlements of the SBT Section and compensation for additional land acquisition. PAFs affected by both projects are also justly compensated for loss of income due to the project prior to displacement. Monitoring will be conducted to ensure that land acquisition and displacement activities are in compliance to the RAP. If PAFs raise an issue, prompt response and resolution will be provided per established GRM.

5.5.2.2 Operation Phase

748. No displacement of households and business establishments is expected during operation. However, in case additional land acquisition is required for the Project, the RAP will apply and continuous monitoring will be conducted as part of the requirements in handling grievances under the GRM.

5.5.3 Local Economy, Employment and Livelihood

5.5.3.1 Pre-Construction/Construction Phase

(1) Disruption of Livelihood, Local Business and Economy

749. Due to land acquisition, project-induced land use change and public access restrictions, economic displacement is inevitable. Economic displacement pertains to situations where people's houses are not

directly affected but where there is loss of other assets or access to assets that will result in disruption of livelihoods and associated loss of income. Based on the RAP socio-economic survey (SES), many wage-based earning PAPs contribute to household income that will be displaced from their current work if the resettlement site will be located in a place that makes daily commuting difficult and more expensive. The project will also disrupt the operations of businesses mostly owned by single proprietors. However, the stoppage of business operations will not only affect the owners but also its employees. As these businesses may experience significant decline in scale, sales and incomes, the local economy is also disrupted due to low inflow of investments and low locally derived revenues.

750. In consideration of the impact not only to the livelihood of PAPs but the local economy as a whole, construction activities will be undertaken at the shortest possible time to restore normal business operations immediately. Alternative livelihood programs in coordination with the LGU and other government agencies will include things such as vocational training for construction related works, employment in local communities, and soft loans to establish business etc. For business establishments that will be permanently removed, fair compensation measures will be provided to ensure continued economic activity and/or the restoration and/or improvement of livelihood. Alternative access for affected businesses and directional signboards will also be provided to ensure continuous business operations.

751. As part of the overall mitigation program of the NSCR Project, DOTr, in coordination with the LGUs and other government agencies, developed the LRIP that includes the provision for alternative livelihood programs, vocational training for construction-related works, employment in local communities, and soft loans to establish business etc. For business establishments to be permanently removed, fair compensation measures will be provided to ensure continued economic activity and/or the restoration and/or improvement of livelihood.

(2) Generation of Livelihood, Employment and Business Opportunities

752. The construction of the SBT Section is also expected to result in the creation of jobs and employment opportunities due to increased demand for local service businesses. To further enhance this positive impact, there will be prioritization of hiring qualified local workers and provision of equal opportunities for all qualified applicants including women and PWDs. Project contractors for national public works projects including foreign-assisted projects must hire at least 50% of the unskilled labor and 30% of the skilled labor requirements from the local community in which the project will be undertaken based on RA 6685. As such, DOTr will require the Contractor to strictly implement and explicitly spell out in the contracts the mandatory manpower requirements in compliance with RA 6685. As to RA 9710 (Magna Carta of Women), which upholds equality of opportunity to decent work and treatment for all women and men, the DOTr in coordination with the LGU and the Contractor may purposively set requirements in employing women in skilled or unskilled positions to ensure equal employment opportunities.

5.5.3.2 Operation Phase

753. The Project will increase investments and spur development in the host City of Manila, including host and surrounding barangays, and other localities adjacent to the Project during operation. There will be an influx of new industries and expansion of existing industries that will further increase opportunities for employment and business as well as the local economy in terms of income generation from taxes, permit fees and other development fees. Furthermore, local residents will be prioritized in hiring manpower for the railway operation. The employment opportunities provided by the Project shall ensure gender quality and social inclusion.

5.5.4 In-Migration

5.5.4.1 Pre-Construction/Construction Phase

(1) Encroachment / Proliferation of ISFs

754. Encroachment of informal settlers during pre-construction stage taking advantage of the relocation package for affected ISFs of the SBT Section has been minimized through the establishment of a firm cut-off date clearly communicated with the community that will benefit from the project compensation. Moreover, the Project ROW will be fenced and guarded with security personnel to limit access or entry of unauthorized persons. In addition, the time between the pre-construction and construction will be shortened as much as possible.

(2) Influx of Construction Labor Force

755. Influx of labor force for the construction works for SBT Section will be reduced by tapping the local workforce or by requiring the contractor to prioritize employing skilled and unskilled local residents. Depending on the manpower requirements of the project and skill level, local workers may be trained within a reasonable timeframe to meet project requirements. In case of inadequacy of local workers, incoming non-local workers will be accommodated in dedicated construction camps or other affordable accommodation options with appropriate trainings, supervision, and security to maintain public order and minimize unlawful conduct. The Contractor may also prepare and implement a Labor Influx Management Plan or Workers' Camp Management Plan.

5.5.4.2 Operation Phase

(1) Encroachment / Proliferation of ISFs

756. Improved accessibility and connectivity may cause an increase in migrants within the vicinity of the SBT Section to seek employment opportunities and to reside in the area in consideration of proximity to work places. In-migration may lead to demand for housing. However, the lack of affordable housing for low-income groups may cause encroachment of unsecured idle private and public lands and proliferation of ISFs. To prevent this impact, the ROW of the SBT Section will be fenced and guarded with security personnel to limit access or entry of unauthorized persons.

5.5.5 Cultural / Lifestyle Change

(1) Pre-Construction/Construction Phase

757. The community members of the localities where the Project will be situated and where the PAPs will be resettled will experience cultural and lifestyle changes.

758. The host barangays where the Project will be situated will lose community members who are mostly informal settlers residing within the Project ROW causing reduced congestion and urban poverty. Because the Project will bring new opportunities, the remaining residents and migrants will need to adapt to new lifestyle and culture as well as much higher living standards. As such, comprehensive development planning needs to be undertaken to ensure that concerns on in-migration and its socio-economic and cultural impacts are integrated.

759. On the other hand, the host community where the PAPs will be resettled outside Metro Manila, DOTr will provide financial assistance to the receiving LGU for off-city socialized housing site to

prevent the adverse impact of sudden increase in population in receiving LGUs. The amount of which will be discussed and agreed upon with the receiving LGU to cover any of the following:

- Health services, facilities and/or infrastructure;
- Educational services, facilities and/or infrastructure;
- Services, logistics or equipment for the maintenance of peace and order;
- Provision of transport services or improvement thereof;
- Solid waste management; and
- Implementation of the LRIP.

760. Overall, in order to address cultural and lifestyle changes, barangay and city development plans will incorporate concerns on influx of migrants as well as changes that come with development projects. DOTr will ensure close coordination and cooperation among national government agencies together with the sending and receiving LGUs.

5.5.5.2 Operation Phase

761. Relocated PAPs may still experience difficulty in adapting or adjusting to a new environment. As such, DOTr will continue to monitor and coordinate with the sending LGU and receiving LGU for assistance arrangements in ensuring that the restoration and/or improvement of the livelihood and living conditions of the PAPs remain unhampered despite changes in their way of life.

762. The operation of the Project will provide a more environment-friendly and efficient transport causing a paradigm shift to a low-carbon and eco-efficient lifestyle among the host communities and the railway users. However, efficient transport may also mean market accessibility attracting the business sector to influence development. Given the impacts of climate change on the future, the government and policymakers need to take advantage of these lifestyle and behavioral changes to pursue policy interventions and new market mechanisms to motivate citizens and companies to shift from a business-as-usual economic setting to a sustainable and climate-resilient economy. As such, inclusive and comprehensive development planning is necessary to realize this low-carbon society.

5.5.6 Vulnerable Groups, Gender Issues and Children's Rights

5.5.6.1 Pre-Construction/Construction Phase

(1) Difficulty in the Re-establishment of Living Standards and Additional Hardship due to Vulnerability

1) Vulnerable Groups

763. Based on DSWD Administrative Order 2011-07, vulnerable refers to an individual, family or group who is at risk of any potentially harmful event, loss, or danger. The major vulnerable sectors applicable to the project area would include children, youth, PWDs/ differently abled persons, older persons/senior citizens, displaced families, workers in informal sector, workers in the formal sectors and migrant workers, and urban poor. Due to urbanization, these vulnerable groups are most sensitive and exposed to risks associated with illness, disability, age, hunger, unemployment, low and irregular incomes, natural disasters (floods, typhoons), social exclusion and gender inequality. Vulnerable and marginalized groups are also defined as those that face higher exposure to disaster risk and poverty including, but not limited to, women, children, elderly, differently abled people, and ethnic minorities as per RA 10121. As such, particular attention and consideration has to be given to them in development planning throughout the project cycle.

764. Vulnerable groups refer to households belonging to the poverty threshold, elderly-headed household, solo parent-headed household, or a household with PWD, or who is very ill and/or mentally challenged. These vulnerable groups face greater challenges in re-establishing their living standards. These households are eligible for special assistance under the RAP to ensure that they are equipped to rehabilitate themselves from the effects of displacement. DOTR will provide additional transitional support and rehabilitation assistance to vulnerable groups. For family members needing special assistance and/or medical care, the Manila LGU will provide nurses or social workers to help them before and during resettlement activities. The beneficiaries of such assistance include households with pregnant women, the elderly, ill family members, young children, and people with physical and mental disabilities.

765. With additional hardship due to vulnerability, PAPs who are classified as vulnerable groups are entitled to the following:

- Inconvenience allowance in the amount equivalent to PhP 10,000 per household.
- For the families with persons who need special assistance and/or medical care, respective LGUs to provide nurses or social workers to help them before and during the resettlement activity.
- Rehabilitation assistance in the form of vocational training and other development activities with the value of up to PhP 15,000 will be provided in coordination with other government agencies.
- Support and/or maintain access to government welfare programs.
- Inclusion in the LRIP.

766. Furthermore, DOTR will also provide assistance to vulnerable groups who are outside the Project ROW but within the impact zone especially the surrounding communities as they are most affected by disruptions in accessibility and provision of social services due to construction activities. As such, the existing social development plan (SDP) for the NSCR Project shall be timely updated in consideration of any additional issues and concerns raised by vulnerable groups through GRM and public consultations. DOTR will consider the needs of vulnerable groups in updating the existing SDP for the NSCR Project or in the preparation of SDP for the SBT Section and align with the overall SDP of the LGU. In particular, the SDP will cover gender-responsive and socially inclusive programs, projects and activities in dealing with the identified risks, issues and concerns as raised in various public participation platforms. The SDP is expected to contribute to improving the state of well-being of vulnerable sectors and upgrading the quality of social services. Ultimately, the SDP should address equity, social justice and gender sensitivity.

2) Gender Issues

767. The Gender Impact Assessment conducted for NSCR Calamba Ex indicate a lack of awareness on the issue of gender and vulnerable groups among the infrastructure projects. Some identified issues among LGUs include: a (1) lack of specialized gender-sensitive facilities. In addition, the absence of a Gender-and-Development (GAD) database sets limitations on the capacity of LGUs to plan for their needs. To mitigate the identified concerns, measures include:

- Meaningful public consultations throughout the project cycle will be gender inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups.
- Detailed engineering design ensures major gender-responsive and inclusive design features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. installation of CCTV system and sufficient lighting for security purposes).
- Integration of GAD-related information in existing railway transport management information

system to ensure that relevant gender statistics and sex-disaggregated data will be regularly collected, analyzed and used as inputs for planning, budgeting, programming and policy formulation.

768. DOTr will implement gender-sensitive livelihood training programs that will cover skills training for construction work, handicraft making and food preparation, among others. The beneficiaries will include affected barangays, homeowners' associations and women's organizations. The DOTr will implement the program with support from the local government, DSWD and TESDA. Furthermore, DOTr will provide gender equal job opportunities in line with national laws and regulations during construction.

3) Children's Rights

769. Due to the project, children's basic rights including right to survival, development, protection and participation, may be adversely affected. Due to physical and economic displacement of their families, children may experience difficulties in thriving with their situation affecting their health and well-being and stealing their childhood life as a consequence of exploitative practices and education gaps. For example, physical displacement may cause high exposure to infectious and communicable diseases while economic displacement may cause malnourishment and may force them to work. The project will also require the removal of community day care centers and playgrounds that will reduce child learning and development activities. To promote the rights and welfare of children and to ensure inclusion of their rights in the preparation of the SDP, DOTr will coordinate with the City Council for the Protection of Children and conduct awareness campaign programs geared towards protecting children's rights. Furthermore, day care centers and playgrounds will immediately be replaced and strategically located in a safe area within the affected community. Lastly, throughout the project cycle, children-in-conflict-with-law (CICL), street children and drug users found to be loitering around the project premises will be reported immediately to appropriate authorities without violating their rights.

5.5.6.2 Operation Phase

770. During operation, the Operator / Concessionaire will conduct periodic monitoring, and identification of remedial actions to ensure accessibility and functionality of the gender responsive and inclusive physical design features/facilities (e.g. CCTV system, sufficient, toilet/sanitation facilities, elevators) of the project. In addition, there will be a separate allocation of trains for men and women as well as provision of priority lanes and train areas for vulnerable groups including the elderly, children, PWDs and pregnant. Security personnel will also be deployed to guard and guide the commuters and ensure the smooth and safe movement of people within the premises of the railways. The various programs and equality of employment consideration for all jobs ensure that there is no disproportionate impact on gender and vulnerable groups.

5.5.7 Cultural Heritage

5.5.7.1 Pre-Construction/Construction Phase

(1) Relocation of Physical Cultural Resources

771. Only the Casitas de Tondo, also known as Solis Signal Tower, is the identified affected historical structure within the Project ROW. Being over 50 years old, the structure receives statutory protection from the NHCP as important cultural property. Based on the project design for the SBT Section, the location of piers, excavation and vibration during construction of viaduct piers will impact Casitas de Tondo. In 2017, the structure was decided to be relocated and to be incorporated in the design of the Tutuban Station of the NSCR Project prior to construction.

772. Prior to the commencement of works including the relocation of the Casitas de Tondo in Tutuban Station, there is a need to conduct precondition assessment and building condition survey in case of high impact works during relocation as there are existing cultural properties in the vicinity of the Tutuban PNR Property including the Presidential Train Car (1913) with National Historical Institute (NHI), now National Historical Commission of the Philippines (NHCP), historical marker (1984) and the PNR Executive Building (1996), an architectural work by National Artist Ildefonso Santos. Furthermore, according to the NSCR Project EPRMP (2015), the Tutuban Center Mall at the Tutuban PNR Property has an NHCP historical marker as the old central terminal for the PNR Railway. Its original façade as well as columns, beams and roof trusses are preserved.

773. There are no other historical sites and structures within the standard distance of 0.10 km that will likely be affected by vibration coming from the Project as the distance of identified national and local cultural properties outside the Project ROW ranges from 0.21 km to 1.29 km. These cultural properties are also far from the Old Antipolo Street for realignment as well as the MERALCO access roads. As to temporary construction facilities and yards outside the Project ROW, their location are still to be determined.

774. Due to vibration risk, DOTr, with support from the Contractor, will coordinate with relevant cultural agencies (CAs) to monitor and protect the structures outside the Project ROW found to be in close proximity to the temporary construction facilities and access routes. DOTr will create an outline protection plan including methodology and drawings showing the historic buildings and proposed protection prior to construction for the approval of CAs and PNR. In consultation with building owners, a baseline condition survey or any additional survey will be conducted as the CAs require. The Contractor will carry out mitigation and traffic management in the area of the buildings at risk in order to not exceed allowable vibration level at the building. Vibration will be measured by vibrometer to be located at the building concerned as specified in EMoP. Furthermore, to avoid the potential risk of cosmetic damage due to vibration to these structures, mitigating measures for vibration impacts during the construction phase will be implemented, as discussed in **Section 5.4.4.2**.

(2) Accidental Discovery of Archaeological Finds

775. There are no available records of specific location of possible archaeological finds along the SBT Section. However, there is a risk of destruction of archaeological resources during construction or earthmoving activities. With this, the NM has required the conduct Archaeological Watch, which requires DOTr to conduct close coordination with NM for accidental finds. The DOTr or its Contractor report to the NM any accidental finds or upon the advice of DOTr's archaeologist. In the event that an archeological site or chance finds are discovered within the SBT Section that is covered by NSCR which had received a clearance, all earthmoving activities cease immediately, subject to an assessment by NM. NM will evaluate the finds and merit in-depth excavation and study. The NM will proceed with appropriate action whether for the project to continue or issue a cease and desist order if something violative of archaeological preservation warrants or if there is a very important find of archaeological significance.

5.5.7.2 Operation Phase

776. The operation of the SBT Section does not affect any physical cultural resource as there are no old PNR structures within the SBT Section with the relocation of the Casitas de Tondo and identified cultural properties outside the Project ROW are not within the standard distance of 0.10 km to be affected by vibration coming from the project. If cultural resources are discovered during operation that are within the standard distance of 0.10 km from the ROW, DOTr will prepare an outline protection plan including methodology and drawings showing discovered cultural resource/ historical structure and proposed protection to prevent damage risk due to railway vibration and seek the approval of CAs and PNR. DOTr will conduct baseline vibration survey or any additional survey upon the request of CAs to determine appropriate mitigating measure and implement periodic monitoring of impacts to cultural

resources. DOTr will ensure that necessary measures are in place in case of significant impacts are detected.

5.5.8 Public Utilities and Infrastructure

5.5.8.1 Pre-Construction/Construction Phase

(1) Relocation or Realignment of Public Utilities

777. The project will affect the public utilities within the Project ROW including utilities supplying basic service in the area such as those carried on poles and overhead wires (e.g. power supply, telecom, etc.). Prior to the construction of the segment, the overhead high voltage cables, telephone and communication cables and underground water pipes will be diverted or relocated to make way for the railway construction. Relocation or diversion may result to temporary service interruption. Coordination between DOTr and utility companies is ongoing as part of the preparation of the Utility Conflict and Relocation Plan.

778. Diversion or relocation of public utilities will be made ahead of construction phase to minimize the disruption of services. Affected communities of temporary disruption of services will be informed ahead of time through public notices and announcements in coordination with LGU or barangay.

(2) Increase in Demand for Resources

1) Power Supply

779. Consumption of electricity from nearest sources and use of generator sets will provide power supply during construction and contribute to the demand for local supply resources. In addition, the use of heavy equipment, transport, and service vehicles estimated at 3,908 kL for SBT Section will require fuel supply. Fuel supply is easily accessible in the open market and the local supply will not be significantly affected. Nevertheless, the public will be informed of construction schedule and potential impacts of construction activities to power and fuel supply. The Contractor will monitor the power and fuel consumption during construction and implement an energy conservation program.

2) Water supply

780. Water consumption for the SBT Section is estimated at 61,906 kL. Based on this, the estimated monthly water consumption is 1,673 kL/month. Water supply is restricted at certain times of the year in Metro Manila when droughts occur. The water companies have various projects in the pipeline to increase supply. The impact is rated as low as the demand is within local water supplier capacity and will persist only during the construction period. Nevertheless, the public will be informed of construction schedule and potential impacts of construction activities to water supply. The Contractor will monitor the water consumption during construction and implement a water conservation program.

3) Solid Waste Generation

781. Solid wastes will be handled and disposed in accordance with RA 9003. The project will generate significant solid waste at the pre-construction, construction and much smaller amounts at the operational stage. Waste disposal and demolition at the pre-construction site will all go to registered sanitary landfill sites. Concrete to be generated from affected structures may be recycled into aggregate if facilities are available. The LGU waste transfer operator or a similar locally contracted operator will collect the Contractor's accommodation and commercial waste and will dispose of the same to the accredited sanitary landfill.

(3) Disruption of Social Services Due to Removal or Relocation of Social Infrastructure

782. Due to the removal of affected structures including community facilities (schools, hospitals, barangay halls, religious institution, etc.) to give way to the SBT Section, community access to basic social services are affected including the social well-being of the community. To address adverse social impacts, public consultations will be conducted and community facilities will be relocated. Social services will be provided and made accessible by relocating near the original location or within the same barangay and by putting up temporary social facilities while the relocation is ongoing. A listing of alternative facilities near the community will also be provided to the affected communities.

783. The community will be timely informed and updated of schedules concerning the relocation of facilities as well as social development programs. If relocation of affected social facilities is not possible, DOTr is open for replacement intervention for potentially affected barangay facilities. The negotiation for the compensation and replacement of the affected structures will be discussed with the local government. Livelihood restoration measures will also be in place to mitigate the economic displacement.

(4) Increase in Demand for Social Infrastructure in Relocation Sites

784. As PAPs are relocated, there will be an increase in demand for social infrastructure in the relocation sites. DOTr in coordination with LGU are to provide financial assistance to LGUs with off-city socialized housing sites to cover social services required for the increased population caused by the project such as health, educational, religious and institutional services, facilities and/or infrastructure. Together with sending and receiving LGUs, there shall be close coordination with relevant national government agencies (DSWD, DOH, DepEd, and CHED, etc.) to ensure the delivery of social services.

5.5.8.2 Operation Phase

(1) Relocation or Realignment of Public Utilities

785. The SBT Section will no longer require the relocation or diversion of public utilities with the completion of relocation and realignment of project-affected public utilities during construction and permanent placement of public utilities to support the operation of the SBT Section.

(2) Increase in Demand for Resources

1) Power Supply

786. The estimated power requirement for the SBT Section during the operation phase is included in the overall consumption estimate for the NSCR Project system. Assuming an annual power consumption rate of 415,136 kWh per kilometer of the railway and that 80% of the calculated total consumption is used during operation, the SBT Section is predicted to consume 464,952 kWh every year in the operation phase. As the railway system will heavily rely on electricity supply, DOTr will timely coordinate with affected utility companies to prevent service interruption in nearby communities during operation. The power utility company will supply electric power to the proposed TSS-1. The TSS-1 will convert electrical power to a form suitable for providing power requirements of the SBT Section and the rail system. Operational fuel requirement for the overall NSCR Project estimated at 20,000 liter/per year will be used for service vehicles and back-up generators at stations including TSS-1 during power interruption.

2) Water supply

787. Water requirements during the operation of the SBT Section will be minimal. TSS-1 is also unmanned most of the time except for periodic inspection and required maintenance. Two flushing toilets will be built in the design of the TSS-1 and will be likely used mainly by visiting inspectors and other staff or guests on rare occasion, therefore water consumption will be almost nil.

3) Solid Waste Generation

788. Solid waste generated during operation will be managed in accordance with RA 9003. The solid waste disposal system in operation locally will be applied. The Operator will also generate hazardous waste during maintenance operations particularly in TSS-1. DENR-accredited haulers will be contracted and will dispose the hazardous waste to the appropriate waste disposal site by separation and using the hazardous waste manifest system under Philippine Law. The Operator will submit a waste management plan and seek the approval of the EMB to ensure minimal impact.

5.5.9 Community and Occupational Health and Safety

5.5.9.1 Pre-Construction/Construction Phase

(1) Risk of Construction-Related Accidents

789. Construction activities pose risks of accidents to the construction personnel as well as the community members of the host barangays where the construction activities will be situated and undertaken including the project site, temporary facilities and access roads. The types of accidental risk during construction include risks of public, falling and traffic accidents; risk of accidents caused by flying or falling objects, collapse of structure, earth slide, construction machinery or equipment; and, risks of explosion, fire, and damage of aerial lines and surrounding facilities. In order to prevent occupational and public accidents, the Contractor will prepare and implement an OCHSMP and EPRP as part of the CEMMP.

790. Specific mitigating measures may include the implementation of traffic management, safety and security policies and procedures. Security guards, traffic enforcers and safety officers will be assigned man in strategic posts to ensure the occupational and public safety. Visible police presence and installation of security cameras at strategic places within the ROW will also be encouraged. There will also be provisions for safety signages and warnings throughout all construction-affected areas especially those that are accessible to the general public. The Contractor will conduct regular inspection and maintenance of work areas. Visitors to the work area should coordinate with security personnel at least one day before the visit as unauthorized personnel will not be allowed to enter the work area.

(2) Exposure to Contaminated Soil via Incidental Ingestion and/or Dermal Contact

791. Potential human health impacts are anticipated if nearby communities and construction workers are chronically exposed via incidental ingestion and dermal contact of dust particles particularly if potentially contaminated soils are disturbed during construction. The Contractor will prepare and implement the OCHSMP and/or SCMP including the following identified mitigating measures based on arsenic exposure:

- Inform nearby communities and construction workers on the potential hazards associated with soil ingestion and dermal contact.
- Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil.
- Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin.
- Implement a dust control plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures.

- Incorporate a CMP with proper handling procedures in the OCHSMP and SCMP.

(3) Transmission of Communicable Diseases

792. Communicable diseases or sickness such as COVID-19 can be brought about by bacteria, viruses or their carriers such as certain insects, animals, ill individuals and unsanitary conditions. During construction, the influx of personnel may increase exposure risks to pathogens brought about by the interaction among the workers and community. There may also be non-local workers from various locations who may be carriers of communicable diseases and cause transmission among the workers and the community.

793. In addition, having the quality of existing surface water already contaminated, during wet season, heavy rainfall and flooding may increase the exposure of the community and construction workers to contaminated floodwater. Floodwater contamination potentially increases the transmission of waterborne diseases transmitted through water contaminated with human or animal waste. These include typhoid fever, cholera, leptospirosis, and hepatitis A.

794. To manage this, the SBT Section will be regularly maintained and sanitized to help reduce bacteria, viruses, and their carriers. There will also be less interaction with nearby community unless needed. Workers will be asked to submit medical clearances to certify their fitness to work. Workers who are ill will be advised to not report for work until they are well. The Contractor will prepare a Pandemic Response Plan (PRP) compliant with applicable *Inter-Agency Task Force for the Management of Emerging Infectious Diseases* guidelines. In addition, working conditions should comply with Republic Act 11058, Department Order 198-2018 and DOLE Department Order No. 13 'Guidelines governing occupational safety and health in the construction industry'. To address contaminated floodwater exposure, the nearby community and workers will not be allowed to wade or swim in floodwaters or standing water to avoid diseases. In close coordination with the LGU, DOTr and its Contractor shall implement proper solid waste management practices (e.g. regular cleaning of waterways) and awareness campaigns not only among workers but also the nearby communities. In addition, the Contractor will also prepare and implement protocols on good personal hygiene. Overall, the Contractor will prepare an OCHSMP to cover all community and occupational health and safety concerns.

(4) Nuisance to Receptors due to Dust, Noise and Vibration

795. The project area is a highly urbanized area and residents are used to noisy environment. During construction, various activities will generate unfamiliar noise that will be a nuisance to nearby receptors (residents, workers, etc.). As discussed in the noise section, receptors that are likely to experience nuisance are those located along the Project ROW (south and west side of the rail corridor) and those located along Old Antipolo Road and Dagupan Extension for associated construction works.

796. However, this impact will be intermittent and can be managed as discussed in the earlier noise section (i.e., through choosing less noisy equipment, siting, planning, etc.). Other than the mentioned mitigation measures, nuisance caused by noisy activities can also be managed by closely coordinating with local government units and the residents who are likely to be affected. The Contractor will provide prior information on the nature of work, expected noise levels and duration of work of construction activities where noise generation may be significant such as pile driving, concrete pouring, etc. The community should also be provided with information on where they can contact key project staff, if they have specific concerns during the course of the construction.

797. Prior information given to residents who are likely to be affected will not mitigate the actual level of noise and vibration that may be generated by the construction of the SBT Section but the receptors' anticipation on possible intermittent noise exposure will provide a more positive attitude and lessen sensitivity to project-related noise and vibration.

5.5.9.2 Operation Phase

(1) Risk of Railway Operation Accidents

798. Train derailment, structure failure and security/safety threats pose serious accidental risks to railway personnel and passengers.

799. Train derailment may be caused by mechanical failure of track components or train running gears, operational errors, and collision with another object that may result in temporary disruption of operations, property damage, serious injuries to people, or even death. To prevent serious impacts, anti-derailing rail or anti-derailing guard will be installed to prevent derailment and to minimize any consequences of derailment in accordance with the applicable technical and regulatory standards. Vertical curve will be introduced in sections where the grade changes to prevent derailing of rolling stock. A device to control the distance between trains will be installed to reduce train speed and prevent potential train collisions.

800. Structure failure or structural failure of train infrastructures such as the TSS-1, rail tracks/ viaduct, and rail line support may result in serious injuries, fatalities, or property damage. During operation, an inspection and maintenance program to regularly check and maintain the infrastructures will be established to ensure integrity and minimize the occurrence of failure.

801. Security threats and incidents may include violence and aggression, terrorist attacks, bomb threats, and other crimes. Security policies and procedures should be implemented to prevent security incidents. Assigned in strategic posts, security guards will conduct routine inspection around the area. Regular inspection and maintenance of gates/entrances of the work area should be conducted. Moreover, an EPRP should be established to provide detailed actions and responses to emergencies related to security threats to reduce the impact on human life and properties.

802. In terms of the community safety, the Project ROW will be installed with security cameras and clear signages at strategic locations especially in danger zones that are restricted to the locals and visitors of the community. Railway security guards will be assigned in strategic posts to ensure community safety. The needs of the community in terms of safety will be covered in the SDP for the SBT Section based on the overall SDP of the LGU.

(2) Transmission of Communicable Diseases

803. Prior to the current pandemic situation, trains tend to be overcrowded with passengers during peak hours and already pose exposure risks to pathogens brought about by the interaction among commuters. However, with the onset of COVID-19, stricter measures to prevent transmission of communicable/ infectious diseases are now being implemented such as social distancing, proper hand hygiene or sanitation and wearing of PPEs.

804. To mitigate potential exposure to COVID-19 or any pandemic during operation phase, the OCHSMP and the PRP will be implemented during operation. The Operator/ Concessionaire will implement safety protocols and procedures compliant with the applicable guidelines released by the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases along with agreed protocols with DOTr. In addition, working conditions should comply with RA 11058, DOLE Department Order 198-2018 and Department Order No. 13 'Guidelines governing occupational safety and health in the construction industry'.

(3) Nuisance to Receptors due to Operational Railway Noise and Vibration

805. During the operations phase, the passing of the train will cause intermittent noise. The Operator will use built-in measures such as elastic sleepers or fasteners to keep unnecessary noise from the interaction of the train and the rail tracks at the minimum. As other noise sources are present in the area,

mostly road traffic noise, the noise from passing trains are not expected to significantly affect the surrounding sensitive receptors.

5.5.10 Public Access and Traffic Management

5.5.10.1 Pre-Construction/ Construction Phase

(1) Restrictions to Public Access

806. In the event that the residual community will lose access due to the project, DOTr will either maintain access or acquire the remaining land. Any additional land acquisition (including all affected structures, improvements and crops therein) as a result of landlock, provision of access, and/or required setback will be compensated similarly as provided for in the RAP entitlement matrix. Should the landlock result to displacement of families and businesses, they will be eligible to all applicable entitlements and resettlement and/or LRIP provided for in the RAP.

(2) Traffic Congestion

807. The SBT Section is traversed by Hermosa Street and Solis Street to its north and Raxabago Street or Yuseco Street to its south. The existing roads that run parallel to SBT Section are Antipolo Street to its northeast and Old Antipolo Street to its southeast. These roads link with major roads such as Abad Santos Avenue and Juan Luna Street that are frequented by various types of vehicles. TIAs for NSCR Project (2017) and NSCR Calamba Ex Project (2019) only covered the streets of Hermosa and Solis which traverse SB Section being formerly under NSCR Calamba Ex Project. No street traversing BT Section was covered in the projections.

808. Based on the TIA, existing conditions of Hermosa-Juan Luna (C) and Hermosa-Dagupan (A) intersections are within acceptable LOS. LOS C corresponds to tolerable capacity while LOS A represents free flowing traffic conditions. On the other hand, Hermosa-Abad Santos (F), Solis-New Antipolo (E) and Solis-Dagupan (F) intersections are beyond capacities as characterized by long queues and forced flow condition with momentary stoppage. Under NSCR Calamba Ex Project, traffic signals at the signalized intersection of Hermosa-Abad Santos were optimized using parameters of working traffic signals that resulted in a significant improvement in delay and LOS from F to C. Signal optimization of signalized intersections is one way of maintaining desired LOS of an intersection by regularly updating the intersection's traffic signal cycle lengths, phasing and timing to correspond to the current traffic flow conditions.

809. During construction and realignment of Old Antipolo Street, in addition to the general traffic, traffic volume will increase in the form of trucks carrying soil fills, facilities, construction wastes among others, concrete mixers, coasters for workers and others. These construction-related vehicles will be plying to and from the Project ROW as well as the location of temporary facilities and construction yards.. Internal site roads will be used as much as possible for movements to and from the Project ROW including transport of construction materials, equipment, and workers throughout the construction phase.

810. Construction works for other projects such as NSCR Calamba Ex Project that will also coincide with the construction of the SBT Section will also compound traffic congestion in the area. The construction of the NLEX-SLEX Connector Road project by DPWH is currently ongoing and a portion of which will be built along the SB Section. The possible overlap of construction activities may further restrict vehicular movement in the area.

811. The widening of Moriones Bridge is also an ongoing DPWH project and is currently 53 % complete. While the bridge is located about 1.40 km from the SBT Section, the construction activities may also add up to the possible traffic congestion in the area. Should construction activities of the bridge

project coincide with the construction schedule of SBT Section as well as other sections of the railway, heavy traffic around this area is expected.

812. As there will be major disruption in the flow of vehicular traffic in affected areas once construction of the Project proceeds, effective traffic management measures are needed as recommended in NSCR Calamba Ex Project TIA and as identified for this Project below:

- Prepare and implement a Traffic Impact Assessment (TIA) and a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to construction activities (movement of construction vehicles, haulage trucks, and equipment) is minimized
- Transit-Oriented Development (TOD) measures to be planned by the TOD team should be considered during the operation period to encourage walking to/from railway stations.
- Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas
- Contain the movement of pedestrians by properly designating and marking pedestrian crossing, implementing an anti-jaywalking policy and improvement of pedestrian facilities.
- Causes of roadside friction should be removed such as parked cars, ambulant vendors and loading / unloading of public utility vehicles at different locations.
- Construction vehicles should be deployed from 10 PM to 6 AM when the intersections can accommodate more vehicles without experiencing congestion.
- Information dissemination using social media, tri-media, preselling to local government units, IEC campaigns and the like should be effectively conducted so motorists can avoid the areas affected by the construction.
- Plan routes for high-occupancy public utility vehicles as feeder mode to the railway stations to minimize the number of private cars plying major roads.
- Ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized.
- Coordinate with the traffic police for traffic management.
- Provide sufficient lighting at night within and in the vicinity of the construction sites.
- Prohibit prolonged side street parking of construction trucks.
- Schedule delivery and transport of construction materials and spoils during non-peak hours as much as possible.

5.5.10.2 Operation Phase

(1) Improved Public Accessibility

813. Currently, there are no strict buffer zones and control measures against the use of the existing PNR ROW as public access and crossing among the residents and visitors of surrounding communities. During operation, the ROW of the SBT Section and the whole of NSCR Project will be restricted for public use and access for security and safety concerns. However, the existing access roads traversing the Project ROW (Hermosa Street, Solis Street and Raxabago/Yuseco Street) as well as the surrounding public access roads including the access roads temporarily closed during construction will not be blocked. In addition, the realigned Old Antipolo Street that will connect with existing Yuseco Street can be utilized for the public, as a maintenance road for the viaduct and as a fire lane for emergency preparation. The new access road for MERALCO substation and Triangle Area will also be maintained.

(2) Improved Interoperability and Connectivity

814. The traffic conditions during operation period will be affected by the generation of feeder transportation to/from the railway stations and the shift in mode usage from existing public and private modes to the rail mode. Moreover, it is expected that there will be modal shift not only from other public modes but also from private cars to the use of rail especially among those living along the catchment area of the rail line. It is then important that the access/egress or feeder modes to/from the rail station be taken into consideration. Feeder transportations will be generated, such that there may also be a need to realign or introduce new fixed route public transport to and from the rail stations. Mode of feeder transportation is expected to cover all available modes currently present in the area, such as PUB, PUJ, UV Express, tricycles, motorcycles, bicycles, private car, courtesy bus, or walking.

815. Linkages with LRT and MRT railway lines, bus, jeepney, and AUV stations will be considered for efficient and seamless passenger flow transferring to other modes of transportation. In addition, provision of park and ride facilities for bike, motorcycle, and private users can enhance patronage of rail system. It is also important to inventory all these feeder modes so that a properly designed feeder terminal for them can be incorporated in the station plans of the rail line. Furthermore, anticipating the shift from private cars to rail, there may be a need to provide parking facilities at the rail stations for owner-driven vehicles.

816. As the SBT Section aims to further improve the interoperability and connectivity of the NSCR Project with the NSCR Calamba Ex Project, the SBT Section will provide commuters two more travel route options for their convenience. Commuters from Blumentritt to Tutuban will also be able to save time, instead of travelling from Blumentritt Station to Solis Station then finally to Tutuban Station. By the year 2025, the SBT Section is projected to support the estimated daily ridership of NSCR Project at 262,000 and NSCR Calamba Extension at 516,000.

817. There will be inter-agency cooperation and coordination between and among DOTr, DPWH and Manila LGU in the preparation of a Public Access and Traffic Management Plan (PATMP) for the above-mentioned projects. The plan will include identification of alternative routes and flow schemes. SBT contractors are also expected to provide inputs to the overall TMP of the project based on information on delivery schedules, truck movements and routes. Contractors will be closely coordinating with barangay LGUs (BLGUs) on concerns that may affect the traffic flow.

818. Furthermore, the following mitigating measures are to be implemented:

- Implement the PATMP for the project and in consultation with concerned traffic agencies, local officials and the general public.
- Implement Transit Oriented Development (TOD) surrounding the stations should be considered from planning to operational stage to encourage the use of low carbon transport (e.g. walking, cycling, personal mobility devices (PMDs)) to/from railway stations.
- Ensure that traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimized.
- Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas
- Coordinate with the traffic police for traffic management.
- Provide sufficient lighting at night within and in the vicinity of the construction sites.
- Synchronize and monitor traffic through an improved centralized traffic monitoring system
- Provide traffic advisory signs for the public that construction is in progress and that road narrows in some sections.
- Install optimized traffic signals especially at the access intersections to the railway stations.

Greater vehicle volume is expected to be generated due to addition of feeder modes. Optimizing the traffic signals would minimize delay at intersections and likewise increases the safety of pedestrians and vehicles.

- Plan routes for high-occupancy public utility vehicles as feeder mode to the railway stations to minimize the number of private cars plying major roads. Provision of proper loading/unloading area near or within the railway station is recommended to provide seamless connection of feeder modes to railway stations and to minimize road friction created by feeder modes.
- Define bus and jeepney stops. Jeepneys and buses can only drop off or pick up passengers on these designated stops. This is to minimize disruption of the stop and go movement of buses and jeepneys that disrupts the flow of other vehicles on the road.

5.5.11 Landscape Value and Quality

5.5.11.1 Pre-Construction/ Construction Phase

(1) Visual Blight and Landscape Quality Degradation

819. The ROW where the existing PNR is in operation and where the SBT Section will be put up is at-grade, accessible to the public, vegetated with grasses and shrubs, and scattered with solid wastes or garbage. However, to pave the way for the new railway line that will be elevated and restricted from public access, construction activities including establishment of construction yards will cause temporary visual blight that may affect the well-being of surrounding communities.

820. To address the adverse impacts, public consultations will be conducted to inform the stakeholders about the visual impacts. Necessary approvals and permits will be secured prior to the construction. The Contractor will also coordinate with the affected LGU and barangay/s for the identification of available lands that can be temporarily used as access roads, material storage areas and construction yards. The temporary use lands will be negotiated with the landowner. The payment of rent will be commensurate with market rates. The land will be restored to pre-use conditions within 3 months after use discontinuation and rent for the land will continue to be paid until restored.

821. Construction camps and other construction facilities will be located at least 300 m from sensitive receptors such as residential housing areas, hospitals, schools, and religious and cultural sites. To lessen visual impacts of construction activities, there shall be planting areas within the ROW to act as buffer zone or green corridor. Prior to materials transport to and from the project site and construction yards, conditions of the roads and other infrastructures shall be recorded.

822. Furthermore, the Contractor will strictly implement the SWMP and SMP in accordance with RA 9003. The SDP will also be implemented in consideration of waste management. Project structure exteriors (fencing, wall, roofs) will be installed in harmony with the surrounding environment. Construction site and yards shall be kept clean at all times and revitalized after construction. Cover-ups (e.g., vertical sheets of plywood or metal fencing) will be used around the boundary/vicinity of the construction area.

5.5.11.2 Operation Phase

823. During operation, vegetation will be planted in open areas of the ROW to minimize the visual impact by the Project and create a green corridor within the ROW.

5.5.12 Cumulative Impact Assessment

824. The transit development projects of the DOTr are expected to bring long-term positive cumulative impact to communities along the alignment through enhanced economy, improved travel time, less road congestion and enhanced development at the station nodes. The SBT Section along with related infrastructure development projects within the area will result in positive long-term benefits in air quality, public health, safety, travel time savings and connectivity and, the local economy.

825. No adverse residual effects to human health will occur as a result of project operation. Project operations will benefit the general public by contributing to the long-term improvement of air quality in the locality. By providing a viable alternative to the use of private vehicles, traffic volumes are reduced, traffic congestion is relieved, and community livability is improved.

Table 5.5.1 Potential Impacts and Options for Prevention or Mitigation or Enhancement for Social Considerations

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Social acceptability and conflict of interest	✓	✓	✓	✓	A+/-	• Inform project stakeholders who are likely to be affected by the project on the construction schedule and activities, potential environmental impacts, mitigation measures and grievance redress procedure through public meetings • Establish the approved grievance redress mechanism in coordination with the contractors prior to commencement of site works • Conduct public involvement activities on public participation and disclosure framework and conduct regular consultations with affected people and relevant offices/agencies by the contractor during construction phase and during operation phase to ensure adequate and timely mitigation of project adverse environmental impacts • Install notice boards at the construction sites that indicate the contact details of the DOTr helpdesk • Act on complaints reported by the affected person(s) based on the following RAP and HSE GRM Procedure levels • RAP: (1) Local Help Desk/Central Help Desk (Local/Central GRM Team), (2) TWC/ROW Site Acquisition Committee or DOTr Legal Department, (3) Court of Law • HSE: (1) Local Help Desk/ Central Help Desk, (2) PMO HSE, HSEC or TPA, (3) EGF Committee / DENR Pollution Adjudication Board, (4) Court • If not resolved, elevated to DENR-EMB Regional Office for environment-related grievances and DOTr management for health and safety-related grievances • If still not resolved to DENR for environment related and Court of Justice for health and safety grievances • Install notice boards at the construction sites that indicate the name and telephone numbers (hotline) who are tasked to receive and document complaints • Monitor the conduct of public involvement and information dissemination in terms of target stakeholders, information provided, means of dissemination/involvement, and timing involved/disseminated • Monitor the activities and effectiveness of GRM and disclose the monitoring results to the public • Prepare detailed Abandonment Plan for the approval of DENR-EMB • Conduct regular consultations with the affected LGU, community and relevant government agencies to ensure adequate and timely mitigation of project adverse environmental impacts • Conduct public consultation and information disclosure activities on demolition schedule and potential impacts using all media • Implement the Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder groups

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Displacement of PAPs - Displacement of PAPs (informal settler families (ISFs) and other non-landowners; and), - Removal/ relocation of project affected structures - Conflict in land ownership, change in land use and relocation of landowners	✓	✓	✓	X	A-	- Implement the RAP including LRIP to provide timely compensation for loss of assets at replacement cost and assist displaced persons in their efforts to improve or at least restore/maintain their pre-project living standards, income-earning capacity and production levels - Implement Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder group - Conduct monitoring to track whether the planned compensation are provided, resettlement activities for the PAPs and LRIP are delivered and whether the planned activities in the RAP achieved the desired outcomes, and disclose the result to public - Conduct meaningful public consultations and information disclosure - Clearly communicate a cut-off date to be eligible for resettlement assistance and other entitlements for compensation
Conflict in land ownership, change in land use and relocation of landowners/ Incompatibility with existing land use and development plan	✓	X	✓	X	A-	- Maximize the use of existing PNR ROW and minimize additional land acquisition - Coordinate with the affected LGU to share information and align/ integrate the project with future land use plan and zoning ordinance - Provide just compensation to legal PAPs / landowners whose private lands are to be acquired for the project based on current market value and replacement cost in order to purchase a similar property - Coordinate with the affected/ host LGU for the updating of land use classification and local zoning - Maximize the use of existing PNR ROW and minimize land acquisition - Coordinate with the affected LGU to align and ensure that SBT Section is integrated in the updating of land use plan and zoning ordinance - Coordinate with the lot owners, LGUs, other relevant agencies and concerned stakeholders in acquiring and/or securing the ROW in accordance with RAP - Coordinate with PNR, affected LGU and other concerned parties in relation to the Casita de Tondo (refer to Cultural Heritage)
Relocation of ISFs and other non-landowners	✓	✓	✓	X	A-	- Provide formal housing units/ permanent relocation site - Provide temporary accommodation and rental subsidy for ISFs whose relocation site will be newly developed until the completion of the permanent relocation sites.

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Conflict among PAFs and other government infrastructure projects	✓	✓	✓	X	A-	• Closely coordinate regarding financial assistance arrangements with DPWH, and other relevant agencies with ongoing infrastructure projects that share impact areas with the SBT Section in terms of PAFs • Coordinate with DPWH and other relevant agencies that share the same PAFs due to ROW overlap with SBT Section so that PAPs are compensated the same entitlements for SBT Section. Where required, DOTr is to top up the gap to meet the entitlement of the SBT Section • Prepare and implement RAP to ensure that PAFs affected by both projects are justly compensated for the loss of income by the project prior to displacement. Any gap is to be topped up by DOTr • Provide prompt response and resolution to issues raised by PAFs per established GRM • Conduct monitoring to ensure that land acquisition and displacement activities are conducted in compliance to the RAP
Impairment of visual aesthetics	X	X	✓	X	C-	• Planting of trees to minimize the visual impact by the Project and harmonize with the surrounding environments in open areas within the ROW to create a green corridor
Removal/ relocation of affected structures	✓	X	X	X	A-	• Relocate affected community facilities • Discuss with the LGU the negotiation for the compensation and replacement of the affected structures • Compensate the barangay LGU for the affected community facilities based on replacement cost at current market value or provide financial assistance in replacing and relocating the facilities a new location within the community
Disruption of livelihood, local business and economy / Generation of local employment and business opportunities	✓	✓	✓	✓	A+/A-	• Prepare and implement the LRIP in coordination with the LGU and other government agencies • Identify relocation sites for those to be displaced within the same LGU or as close as possible to their current residence where if feasible so that PAPs can maintain their current livelihood • Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs • Provide alternative livelihood program in coordination with the LGU and relevant government agencies • For business establishments for permanent removal, provide fair compensation measures to ensure continued economic activity and/or the restoration and/or improvement of livelihood • Provide alternative access for affected businesses and directional signboards to ensure continuous business operations. In case of disturbances on income earnings and capacity, consult with the affected and make necessary arrangements to ensure livelihoods are maintained or improved • Undertake construction activities at the shortest possible time to restore normal business operations immediately • Monitor compliance to manpower requirements in terms of local hiring, gender and vulnerable groups • Prioritize hiring qualified locals as employees of the TSS-1 in coordination with the host LGU

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Ensure equal participation of women and men in all employment/ business opportunities arising from the Project • Monitor the implementation and effectiveness of the LRIP and project impact to the local economy • Undertake construction activities at the shortest possible time to restore normal business operations immediately • Provide alternative livelihood program in coordination with relevant government agencies and the LGU. Fair compensation for business establishments that will be affected. • Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs • Establish a referral system prior to retrenchment and closure. • Provide alternative livelihood or employment program in coordination with the LGU and relevant government agencies for affected railway employees • Provide alternative access for affected businesses and directional signboards to ensure continuous business operations • Undertake demolition activities at the shortest possible time to restore normal business operations within the project vicinity • Conduct monitoring of livelihood status of PAPs to ensure that LRIP are conducted in compliance to the RAP and disclose the result to public
Encroachment / proliferation of ISFs, Increased in-migration due to construction labor influx	✓	✓	✓	✓	B-	• Minimize encroachment of informal settlers taking advantage of the relocation package for ISFs through setting of cut-off dates under RAP • Train local workers within a reasonable timeframe to meet project requirements on manpower and skill level and prioritize employing skilled and unskilled local residents. In the inadequacy of local workers, accommodate incoming non-local workers in dedicated construction camps or other affordable accommodation options with appropriate trainings, supervision, and security to maintain public order and minimize unlawful conduct • Closely coordinate with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx • Shorten the time between the pre-construction and construction • Install boundary fences for the Project ROW and assign security personnel to limit access or entry of unauthorized persons during construction • Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW during operation; only allow authorized personnel to access the ROW; timely inspect the condition of the boundary fence • Implement the Labor Influx Management Plan or Workers' Camp Management Plan

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Employ skilled and unskilled local residents and accommodate non-local workers in case of inadequate local workers. Monitor compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public • Continue close coordination with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx • Establish and clearly communicate a cut-off date to be eligible for compensation and/or resettlement assistance • Put fencing around the Project ROW and deploy onsite security guards to limit access or entry of unauthorized persons • Shorten the time period between pre-construction and construction as much as possible • Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW even after the completion of demolition works • Implement proper land use planning (designation to new land use, as needed), and turnover of ROW to LGU or relevant NGA for management
Cultural and lifestyle change of community members of the localities where the Project will be situated and where the PAPs will be resettled	✓	✓	✓	X	C-	• Undertake comprehensive development planning with integration of concerns on cultural and lifestyle change and integrate in the Social Development Plan (SDP) for SBT Section in line with the NSCR Project SDP and LGU SDP • Coordinate with the receiving LGU to discuss and agree on the financial assistance for the relocates to cover any of the following: - Health services, facilities and/or infrastructure - Educational services, facilities and/or infrastructure - Services, logistics or equipment for the maintenance of peace and order - Provision of transport services or improvement thereof - Solid waste management - Implementation of the LRIP (alternative livelihood programs vocational trainings, employment in local communities, soft loans to establish business) - Identify relocation sites within same LGU if feasible so that social and cultural environments can be maintained • Provide financial assistance to the receiving LGU for off-city socialized housing site to prevent the adverse impact of sudden increase in population in receiving LGUs specifically to compensate for the strain on social infrastructure • During operation, implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP and continue to monitor and coordinate with the sending LGU and receiving LGU for assistance arrangements to ensure the restoration and/or improvement of the livelihood and living conditions of the PAPs

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Continue to monitor and coordinate with the sending LGU and receiving LGU for assistance arrangements to ensure the restoration and/or improvement of the livelihood and living conditions of the PAPs
Paradigm shift to a low-carbon and eco-efficient lifestyle due to a more environment-friendly and efficient transport	X	X	✓	X	A+	- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Pursue policy interventions and new market mechanisms to motivate citizens and companies to shift from a business-as-usual economic setting to a sustainable and climate-resilient economy
Greater challenges in re-establishing living standards and additional hardship due to vulnerability	✓	✓	X	✓	A-	- Conduct meaningful, gender-responsive and response public consultations tailored to the needs of disadvantaged and vulnerable groups - Update and implement RAP in consideration of gender equality and vulnerable groups including livelihood and skills training program with support from the LGU, DSWD and TESDA - Prepare and implement the Social Development Plan (SDP) aligned with LGU SDP integrated with gender-responsive and socially inclusive programs, projects and activities to deal with risks, issues and concerns raised during public participation activities - Consider the rights and welfare of children in the preparation of the SDP and coordinate with the City Council for the Protection of Children and conduct awareness campaign programs geared towards protecting children's rights - Design and install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. work environment and facilities for women and PWD like toilet, changing room, access ramp) - Integrate GAD-related information in existing railway transport management information system to ensure that relevant gender statistics and sex-disaggregated data are regularly collected, analyzed and used as inputs for planning, budgeting, programming and policy formulation - Continue the implementation of the LRIP ensuring the provision of gender equal job opportunities in line with national laws and regulations - Maintain access to government welfare programs and provide support to help family members needing special assistance and/or medical care before and during resettlement activities and/or and nurses or social workers - Immediately replace the social/barangay facilities (clinic, chapel, barangay hall, grotto, basketball court) affected by Project ROW (if any) and strategically locate in in safe areas within the affected community

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities • Monitor provision of entitlements for PAPs classified under RAP as vulnerable groups and compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public • Immediately report to appropriate authorities' incidents involving children-in-conflict-with-law (CICL) and street children around the project premises while respecting their rights • Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation • Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities • Monitor compliance to manpower requirements in terms of work environment / employment status and disclose all monitoring results to the public
Threat to train safety and accessibility and convenience to all users	X	X	✓	X	A-	• Provide train system (station and trains) to account for the needs of women, allocation of trains for women (especially those pregnant), senior citizens, children, and persons with disability including allocation of visible security officers • Provide adequate security personnel and sufficient lighting to ensure safety and security • Install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. CCTV system and sufficient lighting for security purposes) • Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation • Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities • Monitor the train user environments, LRIP, work environment / employment status. If measures is not effective, revise and provide supplement measures
Damage/ destruction risk to physical cultural/ archaeological resources	✓	X	X	X	B-	• Prior to the relocation of the Casitas de Tondo in Tutuban Station, undertake the actions agreed with NHCP and PNR • Incorporate the structure into the design of the Tutuban Station • Prepare necessary detailed design/ relocation documents and plans including but not limited to architectural and structural plans, specifications, and dismantling and reconstruction methodologies, terms of reference (TOR) for conservation works, conservation management plan, protection plan, etc. • Submit all relevant documentation and seek the approval of the CAs

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• During the relocation of the Casitas de Tondo, undertake the following agreed with NHCP and PNR: • Implement the approved plans for the Casitas de Tondo and closely coordinate the relocation activities with the CA • Implement historical heritage protection plan including noise and vibration measures as applicable • Follow the procedure for the preservation of historic structures/ buildings during construction developed for NSCR Ex: • Determine temporary facilities and access routes to be affected by vibration impacts due to pile driving, concrete/rock breaking activities and movement of heavy equipment, machineries and trucks • Identify historical structures or buildings within the vibration impact standard distance of 0.10 km from temporary construction yards, facilities and access routes • Inform the CAs about identified historical structures or buildings adjacent or close to the temporary construction facilities with significant vibration source and conduct baseline condition surveys or other any other additional surveys as the CAs require in consultation with the building owner • Implement the approved historical heritage protection plan in case of any new assets found to be adjacent or close to the Project ROW and temporary construction facilities and access routes with vibration source • Prepare and implement the Construction Noise and Vibration Management Plan (CNVMP) to consider measures to address damage risks to historical structures due to construction noise and vibration • Coordinate with relevant cultural agencies (CAs) and NGO/CNO to monitor and protect the structures outside the Project ROW in close proximity to the temporary construction facilities and access routes • Carry out mitigation and traffic management in the area of the buildings to not exceed allowable vibration level at the building • Regularly monitor and measure vibration level at concerned buildings identified prior to construction and ensure public disclosure of results • Conduct archaeological watch in close coordination with NM for accidental finds • In the event that an archaeological site or chance finds, immediately cease all earthmoving activities until the CA decides the project to continue • If cultural resources are discovered during operation that are within the standard distance of 0.10 km from the ROW, prepare an outline protection plan including methodology and drawings showing discovered cultural resource/ historical structure and proposed protection to prevent damage risk due to railway vibration and seek the approval of CAs and PNR • conduct baseline vibration survey or any additional survey upon the request of CAs to determine appropriate mitigating measure and implement periodic monitoring of impacts to cultural resources • Continue conservation activities of old PNR structures in coordination with PNR and LGUs • Relocate the Casitas de Tondo and incorporate in the design of Tutuban Station of the NSCR Project

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Implement mitigating measures for construction vibration to avoid cosmetic damage to sensitive structures such as: • Ensure that construction work areas/ activities have a working distance of at least 10 m from sensitive receptors • For works located 10 m from a sensitive building, conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes), substitute construction methods to emit lower vibration levels were feasible and design coordination and project layout so that heavy vehicles and activities are located as far from sensitive buildings as possible • Conduct standard monitoring and protection procedures for vibration risk in close coordination with relevant CAs to protect and monitor historic structures found to be in close proximity to the temporary construction facilities and access routes • Create an outline protection plan including methodology and drawings showing the historic buildings and proposed protection prior to construction for approval of CAs and PNR. • Conduct baseline vibration survey and any additional survey (if any requested by CAs) based on consultations to the building owners • Carry out mitigation and traffic management in the area of the buildings at risk in order to not exceed allowable vibration level at the building. • Measure vibration levels using vibrometer at the building concerned as specified in EMoP. • Designate a focal person from DOTr / Contractor or hire an archaeologist to monitor and report for archaeological finds • Conduct archaeological watch in close coordination with NM • Immediately cease all earthmoving activities in the event that an archaeological site or chance finds are discovered within the SBT Section that is covered by NSCR which had received a clearance, • Coordinate with NM to evaluate the finds and merit in-depth excavation and study. NM to decide whether for the project to continue or issue a cease and desist order if something violative of archaeological preservation warrants it or if there is really a very important find of archaeological significance
Relocation or realignment of affected public utilities and disruption in public utility services	✓	✓	✓	X	B-	• Coordinate with the affected LGU and public utility companies to negotiate the appropriate relocation compensation and replacement for the affected community facilities and/or public utilities • Prepare and implement a Utility Conflict and Relocation Plan prior to construction • Consider affected structures including community facilities and public utilities in the RAP • Divert or relocate utilities overhead high voltage cables, telephone and communication cables, underground water pipes and other utilities prior to construction to minimize service interruption • Public notices or announcements in advance regarding temporary disruption of services

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Disruption in public utility services, Increase in demand for resources, resource depletion	✓	✓	✓	X	C-	• Closely coordinate with public utility companies for the relocation of existing utilities within Project ROW as well as power, water and other utility requirements • Timely coordinate with public utility companies to prevent service interruption in nearby communities and to arrange utility requirements for construction • Timely coordinate with affected utility companies so that there will be no service interruption in nearby communities during operation as the railway system will heavily rely on electricity supply • Issue public notices or announcements in advance regarding temporary disruption of services if any • Install energy-efficient equipment and water saving fixtures • Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section • Use back-up generators during power interruption • Implement Energy/Water Conservation Program • Monitor power, fuel and water consumption and solid waste generation and disposal • Timely coordinate with affected utility companies so that there will be no service interruption in nearby communities during operation as the railway system will heavily rely on electricity supply • Issue notices or announcements in advance regarding temporary disruption of services. • Install energy-efficient equipment and water saving fixtures • Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section • Use back-up generators during power interruption • Implement Energy/Water Conservation Program • Monitor power, fuel and water consumption and solid waste generation and disposal
Disruption of social services due to removal or relocation of social infrastructure	✓	✓	X	X	B-	• Provide public notices or announcements in advance regarding temporary disruption of social services • Negotiate with the local government for the compensation and replacement intervention for the affected social infrastructure • Compensate for the cost of replacement and relocation at current market value for the affected social infrastructure and facilities • Consider employees of affected social infrastructure and facilities in livelihood restoration measures (alternative livelihood programs) to mitigate economic impacts of displacement • Coordinate with utility companies for power, water and other utility requirements for the facilities • Provide listing of alternative social infrastructure or facilities available and accessible to the affected communities • Build the social infrastructure and facilities near the original location

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
Increase in demand for social infrastructure in the relocation site	✓	✓	X	X	B-	• Provide public notices or announcements in advance regarding temporary disruption of services • Provide financial assistance to LGUs offering the off-city socialized housing sites to cover social services required for the increased population caused by the project such as health, educational, religious and institutional services, facilities and/or infrastructure • Closely coordinate with national government agencies together with the sending and receiving LGUs • Provide listing of social infrastructure or facilities available and accessible to the affected communities • Closely coordinate with the LGU and national government agencies (DSWD, DOH, DepEd, and CHED, etc.) to ensure the delivery of social services
Risk of accidents	X	✓	✓	✓	B-	• Integrate health, safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP • Inform the public on work schedule, planned activities and potential impacts • Conduct safety and security training for the workers • Implement an Occupational and Community Safety and Health Management Plan (OCSHMP) in compliance to OSH and the WB-IFC EHS Guidelines • Implement an Emergency Preparedness and Response Plan (EPRP) to include emergency protocols and post-event monitoring for safety and well-being of workers • Assign security guards and safety officers in strategic posts and coordinate with the Philippine National Police (PNP) or LGU for police visibility • Install fencing of the construction site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public. Install and utilize security cameras at strategic places within the ROW • Provide sufficient lighting system and safety measures such as venting, monitoring, and emergency rescue procedures • Provide safety signages and warnings throughout all construction-affected areas especially those that are accessible to the general public • Prohibit unauthorized personnel to access the work area unless coordinated with security personnel at least one day before the visit • Conduct regular inspection and maintenance of work areas. • Place a first aid centre and provide first aid kits in strategic areas at the construction site • Hire safety officers to monitor the health and safety of the local community. If any complaints arise, immediately identify the causes and evaluate built-in measures

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan will be prepared and compliant with the applicable legal guidelines (e.g. DOH) • Limit exposure to elements, suspend construction activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin • Implement the GRM (complaints management system) including setting up of help desk • Regularly monitor and report construction-related accidents and make information available to the public • Prepare and implement train safety operations plan • Train workers and staff on implementation of the operations particularly in TSS-1 operations • Conduct drills on emergency situations at least once a year through professional experts • Conduct internal safety audits at least every six months. • Conduct full audit of the fire protection system every month and conduct daily random checks • Implement the GRM (complaints management system) with complaint desks at all stations • Prepare and implement the SDP based on LGU SDP with due consideration of needs of the community in terms of safety • Implement security policies and procedures such as the OCHSMP and EPRP detailed actions and responses to emergencies related to security threats to reduce the impact on human life and properties • Implement the grievance redress mechanism (complaints management system) with complaint desks at all stations • Install anti-derailing rail or anti-derailing guard in accordance with applicable technical and regulatory standards. • Provide vertical curve in sections where the grade changes to prevent derailing of rolling stock. • Install device to control the distance between trains to reduce train speed and prevent potential train collisions • Establish an inspection and maintenance program to regularly check and maintain the infrastructures to minimize the occurrence of failure • Assign security guards, traffic enforcers and/or safety officers in strategic posts to ensure the occupational and public safety • Install security cameras and clear signages at strategic locations around the Project ROW especially in danger zones that are restricted to the locals and visitors of the community. • Conduct regular inspection and maintenance of the work area. • Prepare and implement train safety operations plan • Train workers and staff on implementation of the operations particularly in TSS-1 operations

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Conduct drills on emergency situations at least once a year through professional experts • Conduct internal safety audits at least every six months. • Conduct full audit of the fire protection system every month and conduct daily random checks • Prepare and implement Occupational and Community Health and Safety Management Plan (OCHSMP) and Emergency Preparedness and Response Plan (EPRP) to include safety and security policies and procedures • Install fencing of the demolition site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public • Use proper PPEs and install signages within the demolition area • Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan will be prepared and compliant with the applicable legal guidelines (e.g. DOH) • Provide sufficient lighting system and safety measures such as venting, monitoring, and emergency rescue procedures • Limit exposure to elements, suspend construction activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin • Appoint an environment, health, and safety officer to supervise the implementation of environmental mitigation measures and to ensure that health and safety measures are strictly implemented at the demolition site and immediate vicinity • Establish Health and Safety Desk or Medical Station at strategic sites to monitor and safeguard the health of the workers and local residents (if applicable) and provide immediate response as per Emergency Preparedness and Response Plan (EPRP) during emergencies • Implement the GRM (complaints management system) including setting up of help desk • Monitor demolition-related accidents among the workers and the community and disclose results for appropriate action • Immediately inspect areas where accidents happen, determine/ investigate the cause and apply corrective actions to prevent similar events in the future
Exposure to contaminated soil via incidental ingestion and/or dermal contact	X	✓	✓	✓	B-	• Inform nearby communities and construction workers on the potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and/or Soil Contamination Management Plan (SCMP) in consideration of arsenic exposure and incorporated with Contact Management Plan (CMP) for proper handling procedures • Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin • Implement a Dust Emission Control Plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures • Restrict public access to the Project ROW especially in areas with contaminated soils • Prepare and implement a Soil Contamination Management Plan (SCMP) and Occupational and Community Health and Safety Management Plan (OCHSMP) incorporated with Contact Management Plan (CMP) as part of Abandonment Plan • Inform nearby communities and construction workers on the potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil • Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin • Implement a dust control plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measure
Transmission of communicable diseases	X	✓	✓	✓	B-	• Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and the Pandemic Response Plan (PRP) based on international and national guidelines (i.e. IATF guidelines) to effectively respond to COVID-19 and other communicable diseases including protocols on personal hygiene • Implement proper solid waste management practices (e.g. regular cleaning of waterways) and awareness campaigns not only among workers but also the among the nearby communities in close coordination with the LGU • Implement daily health check (temperature, health condition, symptoms) of workers, use of PPEs, disinfection (hands, venue, equipment, etc.), social distancing • Integrate health and safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP and conduct trainings for the workers and the community • Require workers to submit medical clearances and to certify their fitness to work • Regularly maintain and sanitize work areas to help reduce bacteria, viruses, and their carriers • Lessen interaction with nearby community unless needed

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Coordinate with the DOH to obtain the status and potential health risks of communicable diseases within the vicinity of the project area • Coordinate with the LGU and barangays for the preventive actions against the transmission of communicable diseases • Comply with working condition requirements in RA 11058, DOLE DO 198-2018 and DO No. 13 • Prohibit the nearby community and workers to wade or swim in floodwaters or standing water to avoid diseases • Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers • Prepare and implement OCSHMP and Pandemic Response Plan (PRP) compliant with national and international guidelines. • Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers. • Comply with working condition requirements or guidelines governing occupational safety and health • Interact less with nearby community unless needed and following appropriate protocols • Require workers to undertake/ submit fitness-to-work certification prior to demolition works and medical clearances will be required after a sick leave • Conduct health and safety trainings for workers • Ensure adequate health and safety considerations in the Social Development Plan (SDP) for the community
Nuisance to receptors due to dust/ noise and vibration	X	✓	✓	✓	B-	• Implement Dust Emission Control Plan and Noise and Vibration Management Plan as applicable • If loud work is unavoidable, assign restricted areas to limit noise exposure • Ensure equipment is properly maintained • Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers • Require the proper use of PPEs and conduct regular safety trainings • Organize work schedules and shifts to limit workers exposure to dust, noise and vibration • Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible • Maintain the surface condition of access roads to reduce vibrations being transferred to plant operators • Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload • Provide protection walls and/or noise barriers • secure out-of-hours permit as necessary • Conduct public consultation and information disclosure and prepare/implement GRM procedure

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Implement Noise and Vibration Management Plan and Dust Emission Control Plan • If loud work is unavoidable, assign restricted areas to limit noise exposure • Ensure equipment is properly maintained • Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers • Provide PPEs and conduct regular safety trainings for workers • Organize work schedules and shifts to limit workers exposure to dust, noise and vibration hazards • Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible • Maintain the surface condition of access roads to reduce vibrations being transferred • Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload
Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads Improved public accessibility due to opening of access roads affected during construction	✓	✓	✓	✓	B-/+	• Maintain access or acquire the remaining land in case the residual community loses access due to the project • Compensate for additional land acquisition (including all affected structures, improvements and crops) as a result of landlock, access provision or required setback as similarly provided in the RAP entitlement matrix; Likewise, apply all relevant entitlements to eligible families and businesses to be displaced as provided for in the RAP • Conduct consultation meetings on public access arrangements and construction schedule with affected barangays and residents • Always provide access to the public and maintain the existing public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of construction activities, in case of any temporary closure during construction • Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs • Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts • Install boundary fence and restrict public use and access of the ROW. Only allow authorized personnel to access the construction sites and temporary construction yards and facility areas as well as "off-limits"/ danger zones areas • Apply RAP in case of permanent loss of public access. • Assign traffic guides to provide assistance to road users when necessary

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures • Ensure accessibility and avoid blocking existing access roads traversing the SBT Section ROW (Hermosa Street, Solis Street and Raxabago/Yuseco Street) as well as the surrounding public access roads including access roads temporarily closed during construction • Restrict public use and access of SBT Section ROW except road crossings • Update the Public Access and Traffic Management Plan (PATMP) for the SBT Section / NSCR Project and coordinate with the LGU for the incorporation of public access and traffic management concerns into the LGU TMP • Maintain the relocated Old Antipolo Street and the new access road for MERALCO substation and Triangle Area in coordination with DPWH and other concerned agencies. • Conduct public consultation and information disclosure and prepare/implement GRM procedure • Provide and maintain public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of demolition activities in case of any temporary road closure • Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs • Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts • Restrict public use and access of the ROW by Installing boundary fence and “off-limits”/ danger zones areas • Only allow authorized personnel to access the demolition site • Assign traffic guides to provide assistance to road users when necessary • Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures • Maintain access or acquire the remaining land in the event that the residual community will lose access due to the project • Compensate for any additional land acquisition (including all affected structures, improvements and crops therein) as a result of landlock, provision of access, and/or required setback as provided for in this entitlement matrix. Provide entitlements in the RAP to displaced families and businesses as a result of landlock or provision of access road or required setback • Install boundary fence and restrict public use and access of the ROW. Only allow authorized personnel to access the construction sites and temporary construction yards and facility areas as well as “off-limits”/ danger zones areas

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Conduct consultation meetings with affected barangay/s and residents to inform them about public access arrangements and construction schedule. • During operation, ensure accessibility and avoid blocking existing access roads traversing the Project ROW (Hermosa Street, Solis Street and Raxabago/Yuseco Street) as well as the surrounding public access roads including the access roads temporarily closed during construction • Develop and implement a PAMP with due consideration of public access impacts and LGU and community recommendations • Provide alternate route/s such as the Old Antipolo Street for relocation that will connect to the existing Yuseco Street for public use, as a maintenance road for the viaduct and as a fire lane for emergency preparation. • Maintain the relocated Old Antipolo Street and the new access road for MERALCO substation and Triangle Area in coordination with DPWH and other concerned agencies
Traffic congestion	✓	✓	✓	X	B-	• If required, update Traffic Impact Assessment (TIA), prepare and implement a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to construction activities (movement of construction vehicles, haulage trucks, and equipment) is minimized • Publicize the access arrangements and construction schedule to community as well as wider public for potential user of roads in the area • Coordinate with the LGU, DPWH and MMDA to ensure alternative public access for pedestrians and vehicles • Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas • Coordinate with the traffic police or employ flag persons for traffic management • Disseminate information to the general public, host barangays, and LGUs on the potential impact of the project to the existing access and provide mitigating measures • Provide traffic advisory signs stating that construction is in progress and that road narrows in some sections • Provide sufficient lighting at night within and in the vicinity of the construction sites • Prohibit prolonged side street parking of construction trucks. • Schedule delivery and transport of construction materials and spoils during non-peak hours • Participate in interagency cooperation and coordination between and among LGU, DOTr, DPWH, and other NGAs in the updating the overall LGU TMP covering identification of alternative traffic routes and traffic flow schemes and closely coordinate with barangay LGUs (BLGUs) on concerns that may affect the traffic flow

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Prepare and implement a Public Access and Traffic Management Plan (PATMP) in consideration of the TIA for the project and in consultation with concerned traffic agencies, local officials and the general public • Coordinate with the PNP and LGU for traffic management especially during peak hour
Improved interoperability and connectivity of NSCR and NSCR Calamba Extension Projects resulting in faster travel time and commuter convenience	X	X	✓	X	A+	Long term positive benefits: • Improved travel time • Less road congestion • Enhanced development at station nodes • Improved community livability
Visual blight and landscape quality degradation	X	✓	✓	✓	B-	• Secure the necessary approvals and permits prior to establishment and operation of construction-related facilities • Coordinate with LGUs to identify minimization options, including identification of available public land where possible for access roads, material storage areas, construction yards, etc. • Negotiate for temporary land use with landowners and payment of rent commensurate with market rates and restoration of land to pre-use conditions within 3 months of discontinuation of use. Rent will continue to be paid until the land is restored • Select construction camps and other construction facilities at least 300m from sensitive receptors such as residential housing areas, hospitals, schools, religious and cultural sites • Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures • Record the condition of roads, agricultural lands, and other infrastructure prior to transporting materials to the project site and construction activities • Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) by contractor strictly in accordance with RA 9003 • Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the construction site/yard tidy and clean and rehabilitate after construction • Use of cover-ups (e.g., vertical sheets of plywood or metal fencing) around the boundary/vicinity of the construction area, as necessary, that will aesthetically blend with the general landscape of the area. For project structures, use combination of embankment, fencing, seeding of bare soils where sites are in proximity to aesthetically sensitive sites • Implement Social Development Plan (SDP) including waste management

Potential Impacts	Phases				Significance of Impact	Options for Prevention or Mitigation or Enhancement
	Preconstruction	Construction	Operation	Decommissioning and Abandonment		
						• Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures • Ensure that the railway structures are aesthetically blend with the general landscape of the area in scale, color and shape • Ensure cleanliness of facilities and substation area through the implementation of Solid Waste Management Plan (SWMP) • Consider the rail corridor in Transit Oriented Development (TOD) of nearest stations to increase land use efficiency, discourage urban sprawl leading to informal settlements along the ROW and promote sense of uniqueness of the place • Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) in accordance with RA 9003 • Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the demolition area clean and rehabilitate after demolition/ before abandonment • Use cover-ups (e.g., vertical sheets of plywood or metal fencing) around the demolition area, as necessary, that will aesthetically blend with the general landscape of the area or use seeding of bare soils where sites are in proximity to aesthetically sensitive sites • Implement Social Development Plan (SDP) including waste management

Note:

“✓” - - impact anticipated to occur during this phase

“X” - - impact not anticipated to occur during this phase

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

6 ENVIRONMENTAL RISK MANAGEMENT AND EMERGENCY RESPONSE PROGRAMS

826. Environmental Risk Assessment (ERA) was carried out for the SBT Section, or “the Project”, in accordance with the Procedural Guidelines for the Scoping of ERA provided in Annex 2-7e of the Revised Procedural Manual of DENR Administrative Order 2003-30 (DAO 2003-30). The management of risks and emergency response programs are also presented in this chapter.

6.1 AIM AND OBJECTIVES

827. The ERA identified and assessed the environmental, safety, and health risks associated with the implementation of the Project from pre-construction to abandonment. The specific objectives undertaken are as follows:

- Identified the conditions, events, and circumstances which could bring about risks to people and to the environment;
- Described and assessed possible accident scenarios;
- Assessed the predicted extreme climate events for the projection years 2020 (2001 to 2035) and 2050 (2036 to 2065) that could contribute to trigger the identified possible accident scenarios; and
- Described the immediate (acute) and delayed (chronic) effects of release of toxic substances and physical failure of structures to humans and to the environment, as applicable.

828. Safety measures incorporated into the project design of the SBT Section (including the traction substation or TSS-1), as well as the emergency response systems and procedures to be implemented for the overall NSCR Project are also included to avoid or prevent the risks attributable to the identified hazards and limit the consequences to man and the environment.

6.1.1 Terminology

829. **Table 6.1.1** provides the definition of different terms used throughout the chapter.

Table 6.1.1 Terminology for the Environmental Risk Assessment

Term	Definition
Hazard	A hazard is a physical situation with a potential for human injury, damage to the environment or property, or a combination of these. It is the potential for an agent or process to cause harm.
Risk	Risk is the possibility that a harmful event (death, injury or loss) arising from exposure to a chemical or physical agent may occur under specific conditions; or alternatively, the expected frequency of occurrence of a harmful event (death, injury or loss) arising from exposure to a chemical or physical agent under specific conditions.
Hazard Identification	Hazard identification is the determination of all possible events or processes that could lead to disastrous or fatal incidents, defining inherent and potential hazards of the substances/materials used, as well as the process hazards with potential to adversely affect project personnel, the public and the environment.
Risk Assessment	Risk assessment is the identification and quantification of the risk resulting from a specific use or occurrence of a chemical or physical agent, considering possible harmful effects on individual people or society of using the chemical or physical agent in the amount and manner proposed and all the possible routes of exposure. Quantification ideally requires the establishment of dose-effect and dose-response relationships in likely target individuals and populations.
Risk Estimation	Risk estimation is the determination of the outcome of an activity taking into account the probability of occurrence. To obtain risk, the product function of the frequency and consequence analyses will be determined.

Term	Definition
Risk Management	Risk management is the logical and systematic method of identifying, analyzing, assessing, mitigating, monitoring and communicating risks associated with any activity, function or process in a manner that would enable the proponent to minimize losses and maximize opportunities.

Source: International Programme on Chemical Safety & Organization for Economic Cooperation and Development. (2004).
IPCS Risk Assessment Terminology. World Health Organization.

6.2 SCOPING

830. The Procedural Guidelines for Scoping of ERA specifies three screening levels which define the type of risk assessment required and the corresponding report to be prepared. These are:

- Level 2 – Facilities that will use, manufacture, process or store hazardous materials in excess of Level 2 threshold inventory is required to conduct a Quantitative Risk Assessment (QRA) and prepare an Emergency/Contingency Plan based on the results of the QRA;
- Level 1 – Facilities that will use, manufacture, process, or store hazardous materials in excess of Level 1 threshold inventory will be required to prepare an Emergency/Contingency Plan based on the worst-case scenario; this plan will be based on a Hazard Analysis study; and
- Risk Screening Level – Specific facilities or the use of certain processes will require the conduct of a risk screening study even if the projected or estimated inventory does not reach the threshold levels.

831. Level 1 and Level 2 threshold levels for hazardous substance categories are shown in **Table 6.2.1**. Based on assessment for the project, diesel is the only hazardous material (i.e., flammable) that will be used mainly by hauling trucks and other heavy equipment during the pre-construction stage (i.e., demolition and clearing activities), construction stage (i.e., drilling and lifting equipment, excavators, road rollers, mixers, hauling trucks, etc.), operation stage (i.e., maintenance equipment), and abandonment/rehabilitation stage (i.e., trucks, excavators, etc.). The maximum volume of diesel to be stored in one storage area at any given time is not expected to reach either the Level 2 or the Level 1 threshold, hence only risk screening is required.

Table 6.2.1 Threshold Levels of Hazardous Substances for the SBT Section

Category of Hazardous Materials to be Used or Stored	DAO 2003-30 Threshold Levels for Determination of Risk Study to be Undertaken		Assessment of Risk Level of Materials on Site and ERA Study Needed
	Level 1 (tons)	Level 2 (tons)	
Explosives	10	50	Not applicable
Flammable Substances	5,000	50,000	Will not reach threshold Level 1 and Level 2. Risk screening study is required
Highly Flammable Substances	50	200	Not applicable
Extremely Flammable Substances	10	50	Not applicable
Oxidizing Substances	50	200	Not applicable
Toxic Substances (low)	50	200	Not applicable
Toxic Substances (medium)	10	50	Not applicable
Toxic Substances (high)	5	20	Not applicable
Toxic Substances (very high)	0.2	1	Not applicable
Toxic Substances (extreme)	0.001	0.1	Not applicable
Unclassified (Type A)	100	500	Not applicable
Unclassified (Type B)	50	200	Not applicable

Source: DENR-EMB. (2008). Annex 2-7e of the Revised Procedural Manual for DAO 2003-30

6.3 METHODOLOGY

6.3.1 General Process

832. Risk assessment is the scientific determination of the levels of risk related to situations and recognized threats inherent to a project, with the ultimate objective of proposing management solutions to bring risk exposure to acceptable and manageable levels. It involves three basic steps:

1. Identification of hazards such as substances, activities, processes, and natural phenomena that may cause harm to people or deterioration of the environment,
2. Evaluation of the incidence and severity of the hazards, and their possible consequences to the environment, and
3. Determination of appropriate measures to eliminate or control the hazards.

833. The risk assessment process was based on the overall project context, which is defined by the project components and specific activities at each phase of the Project, particularly the pre-construction, construction, operation and abandonment phases.

6.3.2 Qualitative Risk Assessment Approach

834. The risk analyses and assessments can be done using either a quantitative or qualitative approach. Quantitative risk assessment uses all available data to calculate and predict the probability and hence, acceptability of outcomes of a risk event. On the other hand, qualitative risk assessment utilizes subjective assessment of a likelihood of the risks to occur against the potential severity of the risk outcomes to determine the overall severity of the risks. As identified above, the Project will require only risk screening and qualitative risk assessment was applied.

835. The basis of the qualitative assessment is formed with descriptive assessments and systematic characterization. Based on professional judgment and in line with the NSCR Project EPRMP (2015), a qualitative risk assessment was conducted because of the potential for the Project to cause significant public concern (safety risk). This is best applied to accidents or events with little or no data pertaining to frequencies of occurrence or ecosystem and health impacts. Limitations of the qualitative approach is that the data analysis is non-statistical, it is a labor-intensive approach, and it may be influenced unconsciously by the expert's perspective.

836. A flow diagram for qualitative risk assessment is shown in **Figure 6.3.1** and each step is further described below.

1. System definition: identification of the elements or components of the system being studied,
2. Hazard identification: identification of events or hazards associated with the construction and operation phases, which have the potential to adversely affect the environment or human health,
3. Risk assessment: estimation of the incidence and severity of the effects likelihood to occur in an environmental compartment due to actual or predicted exposure to a hazard;
4. Risk management: systematic method of preventing or mitigating the assessed risks that would enable the proponent to minimize losses and maximize opportunities; and
5. Risk communication: conveyance of both the assessed risks and their corresponding management schemes to relevant personnel to make certain that concerned parties are informed and can act accordingly.

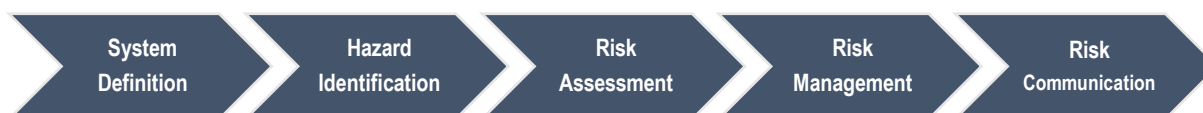


Figure 6.3.1 Flow diagram for qualitative risk assessment

6.3.3 Risk Analysis

837. The risk matrix is used in qualitative risk assessment for the easy identification of the highest risks (e.g., screening and prioritization of risks). The categories and ratings were adopted from the Federal Transit Administration Guidance document entitled Sample Safety Risk Assessment Matrices for Rail Transit Agencies dated September 2019¹ considering the project involves rail transit construction and operation. These matrices provide a structure for a systematic approach in assessing likelihood and consequence severity, determining if safety risk is acceptable with existing mitigations or if additional action is needed, and prioritizing hazards based on the safety risk of their potential consequence.

838. Once hazards were identified (Step 2), the associated risks were assessed (Step 3) with respect to the probability (likelihood) of occurrence and the potential severity of loss (consequence) from the resulting impact. These quantities can either be simple to measure (i.e. environmental impacts of site clearing), or impossible to know definitively (i.e. probability of structural failure from an unlikely event occurring, such as an earthquake). The factors that allow the rating of risks, likelihood and consequence, are discussed below. Ratings of likelihood and consequences of various events are presented in **Table 6.3.1** while the relationship of exposure and severity of effects are shown in **Table 6.3.2**.

Table 6.3.1 Likelihood Levels

Likelihood	Definition
Improbable	So unlikely, it can be assumed it will not be experienced in the life of the Project
Remote	Unlikely, but possible to occur in the life of the Project
Occasional	Likely to occur sometime in the life of the Project
Probable	Will occur several times in the life of the Project
Frequent	Likely to occur often in the life of the Project

Source: Federal Transit Administration Guidance document (September 2019) "Sample Safety Risk Assessment Matrices for Rail Transit Agencies"

Table 6.3.2 Consequence/Impact Rating

Event Category	General Description
Negligible	Injury or occupational illness not resulting in a lost workday; Minimal environmental impact;
Marginal	Injury or occupational illness not resulting in one or more lost workday(s); Reversible moderate environmental impact;
Serious	Death; Permanent partial disability; Injury or illness resulting in hospitalization; Reversible significant environmental impact;

¹ The guidance document is not legally binding and is not relied upon by the FTA as separate basis for affirmative enforcement action or other administrative penalty.

Event Category	General Description
Catastrophic	Multiple deaths; Permanent total disability; Irreversible significant environmental impact;

Source: Federal Transit Administration Guidance document (September 2019) "Sample Safety Risk Assessment Matrices for Rail Transit Agencies"

839. Using the risk matrix shown in **Table 6.3.3**, the risks posed by the identified hazards for the Project will be assessed qualitatively and will be classified as either Low, Medium or High. Those with initial risk levels of high required the identification of mitigating and control measures to reduce the residual rating to acceptable levels. Those under medium risk require executive management review to decide whether to accept the safety risk with monitoring or if it will require additional action. Those with low risk are considered acceptable pending management review.

Table 6.3.3 Risk Matrix

		CONSEQUENCE/IMPACT RATING			
		Negligible	Marginal	Serious	Catastrophic
LIKELIHOOD RATING	Improbable	Low Risk	Low Risk	Low Risk	Low Risk
	Remote	Low Risk	Low Risk	Medium Risk	Medium Risk
	Occasional	Low Risk	Medium Risk	Medium Risk	High Risk
	Probable	Medium Risk	Medium Risk	High Risk	High Risk
	Frequent	Medium Risk	High Risk	High Risk	High Risk

Source: Federal Transit Administration Guidance document (September 2019) "Sample Safety Risk Assessment Matrices for Rail Transit Agencies"

6.4 SYSTEM DEFINITION

840. The components of the SBT Section considered in this assessment include the railway systems, track structure and components, electrical and mechanical systems, support facilities including the traction substation (TSS-1), drainage systems and maintenance roads, temporary facilities (i.e., main site/satellite office, material storage/warehouse, segment casting yard, batching plant and workers' quarters), and pollution control management systems. These project components are discussed in detail in **Section 2**.

6.5 HAZARD IDENTIFICATION

841. A hazard is defined as a physical situation, event, process or substance with a potential for human injury (physical, emotional, and mental), damage to the environment or property, or a combination of these. These hazards were identified to affect both workers and the community. Hazards associated with SBT Section during its construction and operation phases were categorized as:

- Physical Hazards – These hazards include natural (e.g., geologic, hydro-meteorological) and man-made hazards (e.g., accidents, collisions, etc.),
- Chemical Hazards – These hazards include hazardous or dangerous substances which threaten the physical safety of a human being. Substances which are classified as explosive, flammable, oxidizing agent, and toxic are the most common types of chemical and process hazards, and
- Biological Hazards – These hazards include biological substances that pose a threat to the health of some organisms, primarily humans. This could include a sample of a microorganism, virus or

toxin that can adversely affect human health. A biohazard could also be a substance harmful to other animals.

842. Identified hazards associated with the SBT Section during its various stages of implementation are listed in **Table 6.5.1** and discussed in the next sections.

Table 6.5.1 Identified Hazards during Project Implementation

Hazard			Pre-Construction Phase	Construction Phase	Operation Phase	Closure/Abandonment/Rehabilitation Phase
Physical Hazard	Geologic Hazards	Earthquake and Ground Shaking	Yes	Yes	Yes	Yes
		Liquefaction	No	Yes	Yes	No
		Volcanic Hazards	Yes	Yes	Yes	Yes
	Hydro-meteorological Hazards	Heavy Rainfall and Flooding	Yes	Yes	Yes	Yes
		Typhoon and Strong Wind	Yes	Yes	Yes	Yes
		Climate Change Impacts	Yes	Yes	Yes	Yes
	Structural Hazards	Train Derailment	No	No	Yes	No
		Structural Failure	No	Yes	Yes	No
	Security Hazards	Security Threats	Yes	Yes	Yes	Yes
	Health and Safety Hazards	Mechanical Hazards	Yes	Yes	Yes	Yes
		Electrical Hazards	Yes	Yes	Yes	Yes
		Temperature Hazards	Yes	Yes	Yes	Yes
		Noise and Vibration Hazards	No	Yes	Yes	Yes
		Gravity Hazards	Yes	Yes	Yes	Yes
		Motion Hazards	Yes	Yes	Yes	Yes
Chemical Hazard	Flammable Substances		No	Yes	Yes	Yes
	Toxic/Hazardous Substances		No	Yes	Yes	Yes
	Emissions		No	Yes	Yes	Yes
	Fire		Yes	Yes	Yes	Yes
Biological Hazard	Viruses and Bacteria		Yes	Yes	Yes	Yes
	Plants and Plant Secretions		Yes	Yes	No	Yes
	Insect and Animal Bites		Yes	Yes	Yes	Yes

Note: Yes means the hazard poses risk during the specific project phase; No means the hazard does not pose risk.

6.5.1 Environmental Pathways

843. Ground can be considered as an environmental pathway when liquid substances such as chemicals or waste (i.e. oils) travel through it by seepage or surface runoff. These may potentially impact the subsurface soils and affect the groundwater beneath the site.

844. Water is one of the fastest and the most short-term pathway for potential pollutant impact. In many cases, this pathway is a combination of surface water runoff and groundwater. The physical and chemical processes that affect migration of contaminants with both surface water and groundwater pathways are similar. Topographic and geomorphologic conditions also influence this pathway. Surface water bodies identified near the project alignment include the Estero near Antipolo St. and South Antipolo Canal.

845. Air can only become an environmental pathway when substances are in gaseous state. Vapors from hazardous chemicals and other substances are volatile. If these substances are released, they may diffuse into the air. Particulates are also another example such as cement dust which may be produced during cement movement/loading and cutting of concrete. Emergency generators to be used in the project may emit gaseous substances such as CO, NO_x, SO_x, PM_{2.5} and PM₁₀.

846. To avoid deleterious effects of the various potential contaminants/pollutants on humans via the enumerated pathways, all possible mitigating measures will be made available by DOTr and the Contractor.

6.5.2 Physical Hazards

6.5.2.1 Geologic Hazard

847. Geologic hazards are natural phenomena triggered by earth processes and influenced by topographic and geologic conditions, resulting in adverse effects on life and property when exposed to these events. The different types of geologic hazards that have been identified to have possible occurrences and impacts on the SBT Section are discussed below and maps are in **Annex F-1**.

(1) Earthquake and Ground Shaking

848. Movement along fault lines and other structural features can result in ground shaking. The nearest fault to the SBT Section is the West Valley Fault, which is approximately 10 km away. Other potential tectonic triggers are the East Valley Fault and the Manila Trench to the west of Luzon Island. In the event of a 7.2-magnitude earthquake along the West Valley Fault, the SBT Section and its immediate vicinity may experience a very destructive ground shaking.

849. While technical standards for the railway sector have not yet been established in the Philippines, the structural design for buildings and other vertical structures of the SBT Section follows the seismic design prescribed in the NSCP (2015)², the DPWH-BSDS (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015) and other relevant local rules and regulations. Structural design standards from The American Association of State Highway and Transportation Officials (AASHTO) LRFD (2015) were adopted for the SBT Section.

850. The occurrence of a high magnitude earthquake during site preparation and development activities may result in injury, loss of lives, work delay, and damage to equipment, facilities, unfinished structures, and adjacent properties. An Emergency Preparedness and Response Plan (EPRP) must be prepared by the Contractor to address the hazards and risks in the event of an earthquake during construction stage. Site control measures, protection of machineries, provision of PPE, temporary suspension of work, evacuation and emergency protocols, and post-event inspection of the workplace and equipment are advised to be included in the plan.

851. Strong ground shaking while railway services are in operation can cause injury, loss of lives of workers and passengers, train derailment (**Section 6.5.2.3(1)**), and damage to the rolling stock, equipment, facilities, railway structures, electric power lines, and adjacent properties. An EPRP will be

²Association of Structural Engineers of the Philippines (1992). National Structural Code of the Philippines (NSCP), Volume 1, Fourth Edition 1992.

prepared for the SBT Section as part of the overall plan for NSCR Project and implemented to include emergency protocols and post-event monitoring for the safety and well-being of workers and passengers during major ground shaking events. Appropriate measures such as preventive maintenance/inspection, temporary suspension of operations, safe evacuation, and prompt repairs and post-event monitoring will also be taken to manage risks associated with ground shaking.

(2) Liquefaction

852. The area covering the SBT Section is highly susceptible to liquefaction hazards. Liquefaction, when not appropriately addressed, primarily results in structural instability. When structures with poor foundations subside, topple, or become displaced due to liquefaction, the resulting unstable environment can lead to casualties and grave economic loss.

853. Detailed engineering design of the SBT Section has taken liquefaction hazards into account by designing piles deep enough to reach the load bearing strata. Pile foundations of the railway structure will consist of 4 to 6 piles per borehole with lengths ranging from 20 to 35 m based on the geotechnical study conducted.

854. Liquefaction could occur during the construction and result in injury or death of workers, work delay, and significant damage to construction equipment, temporary facilities, unfinished structures, and adjacent properties. Temporary facilities (i.e., workers' quarters, office, storage area, and casting yard) are ideally advised to be situated outside areas that are prone to liquefaction. The findings of the geotechnical studies conducted will be used as basis in determining areas without liquefiable and/or soft soils. Emergency procedures in the event of liquefaction during the construction will be detailed in the EPRP.

855. Liquefaction may also happen during the operation phase and cause harm to both workers and passengers, suspension of train operations, structural failures along the alignment, and serious damage to facilities and nearby properties. Structural failures as a result of liquefaction in the project site can possibly result in injury, property damage, power interruption, disruption of train operation, stranded passengers, short circuit explosion, and other electrical hazards (**Section 6.5.2.5(2)**). Emergency and evacuation procedures during the operation phase will be included in the EPRP.

(3) Volcanic Hazards

856. The SBT Section is outside the Danger Zone radii of Taal and Pinatubo, the nearest active volcanoes to the site. However, strong ground shaking and ashfall hazards may be experienced.

857. Strong ground movement and instability triggered by volcanic quakes can lead to injury, loss of lives, and destruction or collapse of structures and properties. Ash mixed with (atmospheric) water will form a thick and heavy mud that can cause roof collapse or even structural failure due to excess loading. Airborne volcanic ash can also block sunlight and reduce visibility. Moreover, prolonged exposure to ash fall also presents a health hazard as fine ash particles can become lodged deep in the lungs, which can trigger irritation, difficulty in breathing, and other respiratory problems.

858. To prevent such risks, stoppage of work is advised in case high alert level volcanic activity is observed from a nearby active volcano. This, along with other emergency and safety protocols concerning volcanic hazards, will be incorporated in the Emergency Preparedness and Response Plan during the construction and operation phases.

6.5.2.2 Climate Change and Hydrometeorological Hazards

859. Hydrometeorological hazards are associated with phenomena of atmospheric, hydrological or oceanographic nature. With climate change, increasing frequency and magnitude of atmospheric

patterns lead to more frequent and intense hydrometeorological events that may result in more casualties, property damage, social and economic disruption, or environmental damage. Potentially hazardous hydro-meteorological phenomena that have been identified to affect the SBT Section are discussed in the following sections.

(1) Typhoon and Strong Wind

860. Situated along the typhoon belt in the Pacific, the Philippines is frequently visited by typhoons. On average, approximately 20 typhoons pass through the PAR annually. Around two typhoons every year cross the region where the NSCR Project is located. Strong typhoons may lead to facility damage, loss of life, restriction of access, or stoppage of work.

861. Strong winds are often caused by the quick movement of air from an area of high atmospheric pressure to an area of low pressure over short distances. They are usually associated with tropical cyclones, although sudden gusts may also occur randomly especially in high elevations. Strong winds have the capacity to uproot trees and fell transmission lines, generate large ocean waves which can create an unsafe environment to work and operate.

862. During the construction stage, it is recommended to limit exposure to the elements of typhoon events, by observing good housekeeping within construction sites and temporary facilities and suspending construction activities upon announcement of inclement weather from PAGASA.

863. The detailed design of the SBT Section considered the wind loading characteristics of the SBT Section structures in the event of severe weather conditions, based on the requirements of the NSCP 2015 Section 207 on the superstructure and substructure. Train operation protocols (i.e. speed restrictions, operation hours, suspension of operation, etc.) corresponding to each PAGASA warning signal for tropical cyclones will be included in the EPRP for the SBT Section as part of the overall plan for NSCR Project.

(2) Heavy Rainfall and Flooding

864. Monsoons and tropical cyclones that enter the PAR often bring intense wind and precipitation that causes other destructive events like flooding which could affect infrastructure, property, and people. Flooding is one of the costliest natural disasters in the Philippines, causing displacement of people, and partial to complete damage to structures and properties. Aside from inundation by high water, flooding can also bring about torrential flows that collide with objects, erode riverbeds and riverbanks, and deposit large amounts of debris. It is common in low-lying floodplains or along river channels following intense precipitation brought by typhoon or monsoon rains.

865. Potential impacts, hazards, and associated risks due to flooding during the construction and operation phases and the relevant mitigating measures are discussed in detail in **Section 5**.

866. During construction, hazards and risks associated with flooding include slipping hazards, electrical hazards, injury, delay of work, and loss of lives. An Occupational and Community Health and Safety Management Plan (OCHSMP) will be established, along with an EPRP that includes evacuation procedures and safety protocols. The OCHSMP will cover provision of safety signs, barricades, and visibility cones, and regular monitoring of excavations, scaffoldings, overhead worksites, and other temporary facilities, especially when heavy rain is forecasted. The Contractor will also prepare a Flooding Management Plan to account the flood susceptibility along the SBT Section.

867. Hazards and risks associated with heavy rainfall and flooding during the operation phase include disruption of train services, health effects to workers and passengers, electrical hazards, slipping hazards, injury, and loss of lives. To mitigate the operation risks, the viaduct structures of the SBT Section were designed to have a rail elevation of 15.605 m to 17.161 m. The design of ground-level

facilities and structures, and the drainage system of the SBT Section also considered the projected flood levels in a 100-year rainfall scenario. Emergency protocols during inclement weather (as advised by PAGASA) will be considered in the EPRP including suspension of train operations, evacuation, and post-flood maintenance checks.

(3) Climate Change Impacts

868. Based on a minimum operational lifetime of 20 years for the proposed SBT Section, it is anticipated that the site will be exposed to the predicted effects of climate change. Projected rainfall changes under the medium range emission scenario indicate up to 5.2% drier months during the dry season and 12.8% wetter months during the wet season from 2020 to 2050 (**Section 4.5.3.2**). The intensification of extreme climactic conditions based on the PAGASA predictions is expected to have more significant effects on geologic hazards greatly influenced by hydrologic processes.

869. It can be expected that flooding, storm surges and coastal erosion, identified to be of low significance under current conditions, may become more pronounced or evident in the next few decades. Other climate change impacts include changes in mean temperatures, rainfall, and extremes. Increases in rainfall during the wet season could cause localized flooding and changes to sedimentation loading.

870. The SBT Section will enhance connectivity, but also raises the question of vulnerability to climate change impacts over the next 50 years. There are few studies on how climate change affects railway systems (Intergovernmental Panel on Climate Change, 2014), but railway system failures are known to be related to high temperatures and storms (Koetse & Rietveld, 2009). Heat impacts are often significant, as railway systems gradually warm due to engine heat, brakes, and passenger loads. Projected changes in temperature highlight the vulnerability of tracks to temperature increases and the accompanying issue of track expansion which can lead to train delays, and in the most extreme cases can lead to derailments (Chinowsky, Helman, Gulati, Neumann, & Martinich, 2019).

871. The electricity in Metro Manila is mostly provided by the Manila Electric Company (MERALCO). The projected temperature increases may increase total and peak energy demands in the warmer dry seasons caused by increased residential cooling needs. The addition of population growth and air-conditioning penetration in Metro Manila will increase residential cooling demand. This will strain the capacity of electricity transmission and distribution facilities, which may affect MERALCO operations. This may translate to increase in electrical costs and potential power interruptions during project operations in the event there is shortage of energy due to the rising demand. Alternative sources of power should be explored to reduce dependence on MERALCO alone.

872. Climate change also has the potential to impact worker health and safety conditions for the Project. Rising temperatures may increase the risk of heat-related illnesses and inhibit decision-making, increasing the likelihood of injuries, accidents, and fatalities and decreasing worker productivity.

873. As mentioned, the railway was designed on elevated viaducts to address flooding hazards that may be attributed to climate change events. The design of the track considered temperature highs associated with climate change to avoid track expansion issues. A Climate Change Adaptation and Mitigation Plan will be established and updated regularly based on latest predictions and technology. In addition, the Contractor's OCHSMP will include mitigations for heat-related illnesses.

6.5.2.3 Structural Hazards

(1) Train Derailment

874. Train derailment can be caused by a number of factors or events such as mechanical failure of track components or train running gears, operational errors such as improper operation of points or improper observance of signals, and collision with another object. Derailments result in temporary

disruption of operations. This event can be potentially hazardous as it can also result in property damage, serious injuries to people, or even death.

875. Protective devices, such as anti-derailing rail or anti-derailing guard, will be installed to prevent derailment as well as to minimize any consequences of derailment in accordance with the applicable technical and regulatory standards. Vertical curve will be introduced in sections where the grade changes to prevent derailing of rolling stock. A device to control the distance between trains will be installed to reduce train speed and prevent potential train collisions.

(2) Structure Failure

876. Structural failure of train infrastructures including buildings, substation, rail tracks, and rail line support may result in serious injuries, fatalities, or property damage.

877. Design of all infrastructures associated with the SBT Section complied with relevant codes and standards such as the National Structural Code of the Philippines and the National Building Code of the Philippines.³ Construction of these infrastructures will comply with the afore-mentioned standards. The Contractor will strictly follow the engineering design plans. An inspection and maintenance program to regularly check and maintain the infrastructures will be established to ensure integrity and minimize the occurrence of failure.

6.5.2.4 Security Hazards / Threats

878. Security threats exist for the Project for both construction and operation phases. Security incidents may include violence and aggression, terrorist attacks, bomb threats, and other crimes.

879. Security policies and procedures will be implemented to prevent security incidents in the Project both during construction and operation phases. Guard will be assigned in strategic posts and conduct routine inspection around the area. Regular inspection and maintenance of gates/entrances of the work area will be conducted. Visitors to the work area will always be coordinated with security. Unknown personnel will not be allowed to enter the work area. Moreover, an EPRP will be established to provide detailed actions and responses to emergencies related to security threats to reduce the impact on human life and properties.

6.5.2.5 Health and Safety Hazards

880. During construction and operation, all personnel assigned at the project site as well as adjacent communities may be subject to accidents if the OCHSMP is not properly implemented. OCHSMP required for the works will be set up by the Contractor and Operator in accordance with the Philippine Occupational Safety and Health Standards and related regulations issued by the Department of Labor and Employment, Bureau of Working Conditions (DOLE-BWC) and Department of Health (DOH).

(1) Mechanical Hazards

881. Mechanical hazards are hazards encountered during the operation of an equipment or tool that is mechanical in nature. These hazards vary from movement of rotating arms and members, moving belts, meshing gears, cutting teeth, shearing parts and any parts may cause injury. These may be present during the Project especially in the labor-intensive construction phases including manual handling of tools and operating mechanical equipment such as mobile heavy equipment. Direct contact between a person and the running equipment may result in entanglement of body parts causing injuries such as crushed hands and arms, severed fingers, lacerations, cuts, and even blindness.

³ Department of Public Works and Highways. (1977). National Building Code of the Philippines
https://www.dpwh.gov.ph/dpwh/references/laws_codes_orders/national_law.

882. Effective and proper machine guarding can help reduce or even eliminate mechanical injuries. Machine guarding is a covering for the hazardous areas of a machine to prevent contact with body parts or to control projectile hazards exiting the machine. In addition, training of personnel for proper handling and operations of equipment, regular inspection and maintenance of equipment, and use of personal protective equipment (PPE) can help further mitigate this type of hazard. Only experienced and trained heavy operators will be hired/engaged to operate heavy equipment.

(2) Electrical Hazards

883. Electrical hazards are hazards brought forth by working closely with sources of electrical power. Electrical hazards include power lines, generators, energized equipment, wiring and batteries. The severity of electrical injury ranges from faint shock to severe burns or even cardiac arrest and possibly even death. The most common electricity related injuries are burns suffered in electrical accidents which may be classified into three types: electrical burns, arc burns, and thermal contact burns.

884. Methods of protection for electrical hazards include insulation, guarding, grounding, and safe work procedures. Electrical equipment will be properly grounded. Training of personnel for proper handling and operations of equipment, regular inspection, and maintenance of equipment, and use of PPE can help further mitigate this type of hazard.

885. For any lifting and rigging work, there will be a minimum of 4.5 meters clearance from overhead electrical lines and/or reasonable distance (i.e., outside the line of fire/working radius); dedicated watchmen will be allocated on the site. If necessary, attendance of the person in charge of the power company etc. will be required. Also, method statements on safety prior to start of work will be prepared.

886. During operation, the name of chief engineer will be indicated at the substation facilities. Enclosures will be established to prevent entry of unauthorized persons. During maintenance works, the name of the person in charge will be indicated; the signboard of "Under Maintenance" will be attached; and the area will be locked. Movable electric cables placed on the roads will be properly protected, and the insulation coating of the cable will be confirmed not to have any damages. At wet places where electric cables are installed inevitably, watertight movable electric cables and their connecting tools will be used.

(3) Temperature Hazards

887. Exposure to high temperatures may lead to dehydration, exhaustion, heat stress, or heat stroke. The four environmental factors which determine heat stress are temperature, humidity, ventilation and radiant heat. In many operations, combinations of these factors may result in serious heat stress to the workers, who may be performing heavy work, and producing large amounts of body heat, thus also exacerbating the heat stress problem.

888. High temperature conditions are prevalent in the Philippines especially during summer. Individuals exposed to any hot environment such as enclosed spaces or unventilated room are also vulnerable to temperature-related hazards. High temperature hazard may be mitigated via engineering controls such as ventilation or air conditioning and provision of shaded rest areas, and/or administrative controls such as crew rotation, training, and protocols to protect personnel against extreme temperatures.

(4) Noise and Vibration Hazards

889. Noise and vibration hazards are most anticipated to occur during the construction of the viaduct piers, raising of the superstructure, relocation of the waterways that run parallel to the SBT Section, and construction of the TSS-1 and maintenance road that runs parallel to the rail alignment.

890. Receptors (i.e. residents and workers) that are likely to experience nuisance to noise are those located working at the construction sites as well as those residing along the Project ROW (south and west side of the rail corridor), and along Old Antipolo Road and Dagupan Extension for associated construction works. Works in close proximity to sensitive receptors will be managed in accordance with the recommendations within the FTA manual (**Section 4.5.3.1**). During night works, sensitive receptors within 50 m of SBT Section are expected to be exposed to noise levels that would impact resident's ability to rest and sleep (above $L_{Aeq, 8 \text{ hours}}$ 70 dB) during noisy works associated with all key construction stages. As such, it is critical to obtain the public acceptance prior to the construction.

891. For vibration, hazards may be encountered during the use of hand pneumatic tools. Localized vibrations may lead to neurovascular alterations in the hands, bone alterations, including formation of cysts on some of the bones of the hand, weakness and atrophy, etc. The risk of cosmetic damage thresholds during construction may also be exceeded as a result of works occurring within 8 m of existing buildings. A working distance of at least 10 m will thus be maintained from nearby existing structures to ensure that no damages can be incurred by the construction activities. Works closer than 10 m from a sensitive building should be managed in accordance with the recommendations within the FTA manual to avoid exceeding cosmetic damage thresholds (**Section 5.4.4.1**).

892. During operation, noise impacts are largely associated with train movements on the new viaduct structure. The future rail noise emissions at several locations are predicted to exceed the FTA manual criteria of L_{dn} 65 dB(A), which considers noise exposure during the night-time period when people are sleeping. The increase in noise exposure would result in a moderate impact (as defined in the FTA guidelines) that would require noise mitigation. As such, a 2-meter high noise barrier will be installed extending the length of the SBT constructed from a non-porous construction with no gaps and a surface density of at least 20 kg/m² at its thinnest point. The barriers will be located on both sides of each rail viaduct to achieve compliance with project criteria at nearby residential receptors. Moreover, inward facing wall of the barrier will be acoustically absorptive to reduce reflections.

893. For vibration, levels above the human amenity thresholds are unlikely to be exceeded based on the attenuation of vibration over distance from the new elevated structure. Nevertheless, built-in vibration reduction measures such as elastic sleeper tracks will be checked regularly and maintained or repaired as necessary. The equipment inside the traction substation (TSS-1) will be installed in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance. Compliance monitoring in accordance with FTA criteria will be undertaken regularly during operations. Monitoring report will clearly state methodology and results and will be made accessible to the public.

(5) Gravity Hazards

894. Gravity hazards are a group of hazards that occur when gravity acts upon an unstable or an unsecured object. These include trips: when a foot or leg is caught on an object or surface; slips: when grip between the foot and the ground surface is lost; and falls: when a person moves from a higher level to a lower level without control or when an object moves from a higher level to a lower level causing injury or damage to anything it hits.

895. The best way to control these hazards is to eliminate them such as removing all tripping objects in the workplace, maintaining clean and dry ground surfaces, and working at elevated levels with the proper personal PPE such as fall arrest system or full body harness.

896. Workers and pedestrians are also exposed to hazards from falling debris during construction that may lead to serious injuries. Falling debris signages will be displayed to warn workers and pedestrians of potentially dangerous falling objects. Additionally, construction areas will be isolated and "no go" zones for pedestrians will be identified where there is a risk of falling objects.

(6) Motion Hazards

897. Motion hazards include being involved or hit by vehicles and getting caught by moving equipment. Potential flowing water from shafts can cause injury or hurt to personnel and poor work ergonomics may result to acute or chronic health conditions.

898. Mobile equipment will be made highly visible so people will know areas that should be avoided. For work ergonomics, training will be conducted to inform proper lifting, pulling, lifting postures and other working procedures for personnel.

899. To avoid vehicular accidents, dedicated and well-marked crosswalks for pedestrians will be installed as well as the reduce vehicular speed signs and traffic signs. Workers will be prohibited from taking alcohol and other mind-altering substances to avoid driving under its influence. Headlights will be used during the dark or during rain and workers will be required to wear reflector vests.

6.5.3 Chemical Hazards

900. The identification of chemical hazards associated with the Project is based on the physicochemical properties of the hazardous chemicals, substances and wastes to be stored, handled, or generated during the operation. Since the construction and operation of all the stations and alignment is essentially similar, the expected chemicals for storage and hazardous wastes to be generated are grouped together, as shown in **Table 6.5.1**.

Table 6.5.1 List of Chemicals Used and/or Wastes to be Generated

Chemical	Category	Storage	Generator	Method of disposal
Waste Oil	Flammable/ Toxic, Low	Steel drums	Operation and Maintenance	Hazardous Waste Treater
Oil Contaminated Materials	Flammable/ Toxic, Low	Steel drums	Operation and Maintenance	Hazardous Waste Treater
Oil Contaminated Water	Flammable/ Toxic, Low	Steel drums	Operation and Maintenance	Hazardous Waste Treater
Paints and Solvents	Flammable/ Toxic, Low	Sealed containers	Operation and Maintenance	Hazardous Waste Treater
Waste Electrical and Electronic Equipment (WEEE)	Toxic, Low	Sealed containers	Operation and Maintenance	Hazardous Waste Treater
Waste fluorescent bulbs (mercury containing)	Toxic, Low	Sealed containers	Operation and Maintenance	Hazardous Waste Treater

6.5.3.1 Flammable Substances

901. Wastes may be considered hazardous if it exhibits certain hazardous properties such as ignitability/flammability, reactivity, corrosivity and toxicity (EPA, 2009). Flammable substances are chemicals having a flashpoint of less than or equal to 55°C (DAO 2003 - 30). Flammable liquids are categorized into three classes in DAO 2003-30: (1) flammable, (2) highly flammable and (3) extremely flammable. The flammability of a liquid can be determined by flash point using either the closed-cup or open-cup method. The criterion for degree of flammability that is used to categorize flammable substances is in Annex 2.7e of DAO 2003-30 and is presented below.

- Flammable substances – substances having a flash point equal or greater than 21°C and less than or equal to 55°C, capable of supporting combustion.
- Highly flammable substances – substances that may become hot and catch fire in contact with air at ambient temperature sans any input of energy or substances which have a flash point lower than 55°C and which remain liquid under pressure.

- Extremely flammable substances – liquid substances which have a flash point lower than 0°C and the boiling point at normal pressure is less than or equal to 35°C.

902. During construction phase, heavy equipment will likely use diesel fuel for operations and lubricant oil for maintenance. During operation phase, the station will be equipped with generator sets to maintain train services during power outages and/or emergencies. These generators will also likely run on diesel and are expected to have ample diesel storage to operate the substation for an extended amount of time (i.e., 12 hrs. or 24 hrs.). The diesel fuel and waste lube oils are not considered flammable but rather combustible (i.e., require higher than normal temperatures to ignite). However, these substances can still pose fire hazards on the project site. Proper containment facility will be provided for these substances. Regular disposal of flammable wastes by DENR accredited hauler/treater and regular inspection of containment facility will be conducted.

903. Paints and solvents may be used during the construction of substation and during operations and maintenance of the vehicles and machineries. These substances can also pose fire hazards on the project site which could range from minor risk to severe risk

6.5.3.2 Toxic / Hazardous Substances

904. A waste may be considered hazardous if it exhibits certain hazardous properties such as ignitability, reactivity, corrosivity and toxicity (EPA, 2009). These may be toxic chemicals used by the Project or toxic wastes generated by the Project. Toxicity level of a substance is dictated by its chemical state, vapor pressure, boiling point and the lethal concentration 50 (LC₅₀). Based on toxicity class definitions of DAO 2003-30, diesel fuel and lubricant oil can be classified as low toxicity substances.

905. Toxicity is defined through a laboratory procedure called the Toxicity Characteristic Leaching Procedure (TCLP) (Method 1311). The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment (EPA, 2009). Hazardous wastes are defined in DAO 2013-22, *Revised Procedures and Standards for the Management of Hazardous Wastes*, as a by-product which present unreasonable risk to the health and safety of the people and the environment. DAO 2013-22 provides a list of prescribed hazardous wastes, which includes oil-contaminated materials and wastes with arsenic concentration >1 mg/L based on TCLP analysis.

906. Toxic and hazardous substances (**Table 6.5.1**) will be handled and stored properly according to their Material Safety Data Sheet (MSDS). Only trained personnel will handle these materials and a Hazardous Waste Generator ID Number will be secured from DENR prior to construction. A Health and Safety Management Plan will be prepared and these toxic and hazardous substances will be considered to minimize risks to the workers and the community.

907. Baseline results also indicated potentially arsenic-contaminated soil at the site (refer to **Chapter 4** for a more detailed discussion). Ingestion of arsenic may result in swollen skin, lesions, abdominal pain, nausea, diarrhea, arrhythmia, muscle cramps and tingling of fingers and toes. Long term exposure may lead to cancer, diabetes, heart disease and neurotoxicity⁴. The health hazard of arsenic-contaminated soil depends on both the toxicity of arsenic and the amount to which people are exposed through contact with soil⁵.

908. There is potential health risk to the workers as well as the neighboring communities who may be exposed to such arsenic-contaminated materials (i.e., soil and groundwater) through incidental ingestion

⁴Healthline. (n.d.). *Complications of Arsenic Poisoning*. <https://www.healthline.com/health/arsenic-poisoning#complicationsns>

⁵ Washington State Department of Health (1999, January). *Hazards of Short-Term Exposure to Arsenic Contaminated Soil*

and dermal contact during excavation of the site for the construction of the SBT Section. Exposure is also possible from improper management and disposal of such materials.

909. Care will be exercised during excavation and construction activities to minimize exposure of workers and the public. This may be done through information dissemination to the workers and the community regarding the potential hazards associated with arsenic contaminated materials. An OCHSMP will be prepared to cover all health and safety concerns of the workers and the community.

910. Contact of workers with contaminated soil can be minimized through provision of PPE such as face mask and gloves, provision of decontamination area to ensure they are properly sanitized during breaks or after working hours and conduct of regular hand washing and avoidance of touching the face and eating using bare hands or gloves. Also, a dust control plan will be implemented to minimize generation of dust. The OCHSMP (to be included as part of the Contractor's Environmental Management and Monitoring Plan (CEMMP)) will be prepared and a Contact Management Plan will be incorporated specific to handling of arsenic.

6.5.3.3 Emissions

911. During the construction phase, generator sets, and mobile equipment will be used for the Project. These stationary and mobile sources of air pollutants may emit combustion products such as CO, NOx, SOx and VOCs which may be considered hazardous to health (**Table 6.5.2**). Maximum exposure limits for these gases are given by the 8 hr. Time Weighted Average (TWA) and Short-Term Exposure Limit (STEL). The TWA is defined as the average concentration to which nearly all workers may be exposed during an 8-hour shift or 40-hour work week without known adverse effects. On the other hand, STEL is defined as the maximum concentration over a period of 15 minutes⁶.

912. An inspection and maintenance program will be established to ensure that these equipment (e.g., generator sets, mobile equipment) are in good working condition. Environment-friendly fuel (i.e., unleaded gasoline and Euro 4 diesel) will be used to help reduce emissions. The equipment will also comply with emission testing requirements.

Table 6.5.2 Combustion Products and Associated Hazards

Chemical	8 hr Time Weighted Average	Short Term Exposure Limit	Hazards
Carbon Monoxide (CO)	35 parts per million (ppm)	200 ppm ⁷	May induce headache, dizziness, vomiting and nausea; At high concentrations, can lead to unconsciousness or even death ⁸
Nitrogen Oxides (NOx)	0.2 ppm	1 ppm ⁹	Affects respiratory conditions; May also form smog and acid rain along which are related with adverse health effects ¹⁰

⁶ Mehta, B. R., & Reddy, Y. J. (2015). Chapter 6 - Fire and gas detection system. *Industrial Process Automation Systems Design and Implementation*, 217–235. <https://doi.org/10.1016/B978-0-12-800939-0.00005-X>

⁷ National Institute for Occupational Safety and Health. (n.d.). 1988 OSHA PEL Project - Carbon Monoxide | NIOSH | CDC. <https://www.cdc.gov/niosh/pel88/630-08.html#:~:Text=OSHA's%20former%20limit%20for%20carbon,With%20a%20200%2Dppm%20ceiling.>

⁸ Centers for Disease Control and Prevention. (n.d.). Carbon Monoxide | Tracking | NCEH | CDC. <https://www.cdc.gov/nceh/tracking/topics/CarbonMonoxide.htm>

⁹ Olson, K., Anderson, I., Benowitz, N., Blanc, P., Clark, R., Kearney, T., Kim-Katz, S., & Wu, A. (2017). *Poisoning and Drug Overdose, Seventh Edition (Poisoning & Drug Overdose)* (7th ed.). McGraw-Hill Education / Medical.

¹⁰ Icopal Noxite. (n.d.). Nitrogen Oxide (NOx) Pollution - Health Issues - Icopal. <http://www.icopal-noxite.co.uk/Nox-Problem/Nox-Pollution.aspx>. <http://www.icopal-noxite.co.uk/nox-problem/nox-pollution.aspx>

Chemical	8 hr Time Weighted Average	Short Term Exposure Limit	Hazards
Sulfur Oxides (SO _x)	2 ppm	5 ppm ¹¹	Contributes to respiratory ailments and has been linked to asthma attacks, heart and lung disease; May also form acid rain ¹²
Volatile Organic Compounds (VOCs)	1 ppm	5 ppm ¹³	Prolonged exposure has the potential to cause cancer ¹⁴

6.5.3.4 Fire

913. Fire is the physical manifestation of combustion or the chemical reaction between oxygen and a fuel source such as flammable substances and combustible materials. An ignition source or heat source is required to start a fire. Ignition sources that may be present at the project site include open flames and sparks (during construction) and faulty electrical equipment or build-up of static electricity (during operation). A potential risk for fire exists at the project site which could lead to catastrophic events involving major injuries, fatalities, and damage to properties.

914. All design aspect of the SBT Section including substation, trainways and railway tracks, ventilation systems, vehicles, communications, control systems, escalators and elevators, egress routes, and alarm systems considered the Bureau of Fire Protection (BFP) resolution regarding adherence to National Fire Protection Association (NFPA) Standards¹⁵ specifically NFPA 130 or the “Standard for Fixed Guideway Transit and Passenger Rail Systems”.

915. Fire prevention and mitigation programs will be implemented during construction and operation phase in accordance with the Fire Code of the Philippines, NFPA 130, and “Technical Regulatory Standards on Japanese Railways”.

916. Handling and storage of hazardous substances including flammable and combustible materials will comply with Republic Act 6969 or the Toxic Substances and Nuclear Wastes Control Act 1990. Periodic maintenance of all electrical equipment will be carried out to ensure that these will not generate sparks that may ignite flammable gases or liquids. Firefighting equipment and fire suppression system which are compliant with the abovementioned codes and standards will be available and installed within the facilities. Regular inspection and maintenance of these equipment will be conducted to ensure reliability and good working conditions.

917. A fire prevention and emergency response plan will be included in the EPRP which will cover conduct of fire drills, training of workers on emergency response and use of fire extinguishers, and compliance with safety procedure for hot works. Information dissemination will be done on the hazards and mitigations related to fire.

¹¹ Simmons, M. K. (2007, November). *Sulfur Dioxide*. <https://www.Osha.Gov/Dts/Sltc/Methods/Validated/1011/1011.Pdf>.

¹² Exhaust Glass Cleaning Systems Association. (n.d.). *What are the effects of sulphur oxides on human health and ecosystems?* <https://www.Egcsa.Com/Technical-Reference/What-Are-the-Effects-of-Sulphur-Oxides-on-Human-Health-and-Ecosystems/>.

¹³ Merck. (n.d.). *Petrochemical VOCs Analysis*. <https://www.sigmaaldrich.com/analytical-chromatography/air-monitoring/applications/petrochemical/volatile-organic-compounds.html>

¹⁴ Soni, V., Singh, P., Shree, V., & Goel, V. (2018). Effects of VOCs on human health. In *Air Pollution and Control* (pp. 119-142). Springer, Singapore

¹⁵ National Fire Protection Association. (n.d) *List of NFPA Codes & Standards* <https://www.nfpa.org/Codes-and-Standards/All-Codes-and-Standards/List-of-Codes-and-Standards>

6.5.4 Biological Hazards

918. Biological hazards are hazards that arise from contact with animals, insects, plants, bacteria, viruses, etc. Trees that will be removed may secrete allergenic sap or may host insects that sting or bite. Communicable diseases or sickness such as COVID-19 can be brought about by bacteria, viruses or their carriers such as certain insects, animals, ill individuals and unsanitary conditions.

919. To mitigate these, workers assigned to clearing or excavation, for example, will wear appropriate PPE. The wearing of insect or animal repellent will also help minimize such hazards. In terms of communicable diseases or sickness, good sanitary conditions will be maintained within the construction area to help reduce bacteria, viruses and their carriers. Workers who are ill will also be advised not to come to work until they are well to minimize the transmission of the contagion to healthy workers.

920. To mitigate potential exposure to COVID-19 or any pandemic during construction and operation phase, a Pandemic Response Plan will be prepared. Safety protocols and procedures compliant with the applicable guidelines released by the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases along with agreed protocols with DOTr.

6.6 RISK ASSESSMENT AND ANALYSIS

921. Based on the previous discussions of hazard identification, environmental pathways, and accident scenarios, risk analysis was performed for the SBT Section. The analyses combine subjective ratings or categories of likelihood and consequences of various events.

922. A summary of these analyses using the categories as applied to the identified accident or risk scenarios is presented in **Table 6.6.1**. The risk classification presented indicates the classification prior to implementation of the safety measures.

923. Focusing on the failure modes with High Risk, the summary of the residual risk after establishing safety measures are presented in **Table 6.6.2**.

Table 6.6.1 Qualitative Risk Assessment for the SBT Section

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
PRE-CONSTRUCTION/CONSTRUCTION PHASE					
Ground shaking	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to Catastrophic (human health consequence)	Improbable	Low	- Construct facilities according to acceptable standards (Table 6.7.1) and in consideration of PHIVOLCS earthquake models for the Valley Fault System. - Contractor's EPRP will include emergency and safety protocols to address seismic events.
Liquefaction	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to Catastrophic (human health consequence)	Remote	Low to Medium	- Construct facilities according to acceptable standards (Table 6.7.1) and in consideration of PHIVOLCS earthquake models for the Valley Fault System - Pile foundations will be deep enough to reach the load bearing strata based on the geotechnical study conducted. - Temporary facilities such as the workers' quarters, office, storage area, and casting yard will be situated on areas without liquefiable and/or soft soils. - Contractor's EPRP will include emergency and safety protocols to address seismic events.
Volcanic hazards	Possible damage to property; respiratory illness	Negligible (environmental degradation) to Marginal (human health consequence)	Improbable	Low	Contractor's EPRP will include protocols for high alert level volcanic activity in Mt. Taal and Mt. Pinatubo. Stoppage of work is advised during ash fall events.
Tropical cyclone and strong wind	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to Marginal (human health consequence)	Occasional to Probable	Low to Medium	- The viaduct was designed with wind loading characteristics that meet the requirements of the NSCP on superstructures and substructures. - Limit exposure to elements, suspend construction activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin. - Contractor's EPRP and OCHSMP will include emergency and safety protocols during inclement weather conditions and safety measures to minimize relevant risks during typhoon events.
Heavy rainfall and flooding	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to serious (human health consequence)	Occasional to Probable	Low to High	- Structures and facilities were designed with elevations well above flooding levels. - Install proper drainage and dewatering systems, avoid accumulation of water in pits and excavations through regular dewatering.

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
					• Establish a Flooding Management Plan which will include installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project. • Provide erosion and sediment controls such as slope protection, silt screens, drain channels, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways especially during masonry and earthmoving activities. • Proper handling and disposal of waste bentonite slurry in accordance with RA 9003, provide bentonite tank as temporary waste storage. • Proper solid waste management to avoid clogging of waterways. • Contractor's EPRP will include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones.
Climate Change	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	• SBT Section was designed with elevated structures and facilities; The track was designed to accommodate temperature highs associated with climate change to avoid track expansion issues. • Contractor's OCHSMP will include mitigations for heat-related illnesses. • Establishment of a Climate Change Adaptation and Mitigation Plan which will be updated regularly based on latest predictions and technology
Security threats	Injury/loss to human life	Negligible (environmental degradation) to serious (human health consequence)	Remote	Low to Medium	• Guard will be assigned in strategic posts and conduct routine inspection around the area. Regular inspection and maintenance of gates/entrances of the work area will be conducted. Visitors to the work area will always be coordinated with security. Unknown personnel will not be allowed to enter the work area. • Establish emergency response protocols in case of security threats.
Temperature hazards	Injury, illness, or loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Occasional	Low to Medium	• Provision of mechanical ventilation in the work area; implement shift rotation as required; and enforce rest breaks.

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
Mechanical hazards	Injury/loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	- Regular inspection and maintenance of equipment - Training of workers on handling and operation of equipment; and provision of appropriate PPE to workers. - Only experienced and trained heavy operators will be hired/engaged to operate heavy equipment.
Electrical hazards	Injury/loss to human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Remote	Low to Medium	- Establish lock-out/tag-out procedures - Regular inspection and maintenance of equipment - Training of workers on handling and operation of equipment; and provision of appropriate PPE to workers; Electrical equipment will be properly grounded. - For any lifting and rigging work, there will be a minimum of 4.5 meters clearance from overhead electrical lines and/or reasonable distance (i.e., outside the line of fire/working radius); Dedicated watchmen will be allocated on the site. If necessary, attendance of the person in charge of the power company etc. will be required; Preparation of method statements on safety prior to start of work.
Noise and vibration hazards	Injury, illness, or loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	- Conduct noise level monitoring to ensure that the noise levels are within the threshold values - Provide ear plugs and ear muffs for workers exposed to loud operational environments; implement regular shift rotation; use anti-vibration gloves as needed.
Motion hazards	Injury/loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	- Provide signages and other early warning signs; provide sufficient illumination; and follow traffic rules. - Well-marked crosswalks will be installed - If night-works are to be conducted, the construction work area will have a minimum illumination of 10 foot-candles. Early warning signages will also be displayed around the work area.
Chemical hazards	Injury/loss of human life; damage to environment due to potential contamination	Marginal (environmental degradation) to marginal (human health consequence)	Remote	Low	- Provide proper containment for fuels and hazardous chemicals; regular disposal of flammable wastes through DENR accredited hauler/treater; and regular inspection and maintenance of containment and equipment along with regular inspection and maintenance of equipment which may generate air pollutants/emissions. - Diesel-powered equipment such as generators will comply with emission testing requirements.

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
Fire	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Improbable	Low	- Design considerations complied with NFPA 130 standards and Fire Code of the Philippines; implementation of fire prevention and mitigation programs in accordance with relevant standards and regulations; Periodic maintenance of all electrical equipment. - A fire prevention and emergency response plan will be included in the EPRP which will include conduct of fire drills, training of workers on emergency response and use of fire extinguishers and compliance with safety procedure for hot works.
Improper management and disposal of potentially contaminated soil	Threat to human health due to potential contamination	Negligible (environmental degradation) to serious (human health consequence)	Remote to Occasional	Low to Medium	- Information dissemination of potential hazards associated with soil ingestion and dermal contact, provision of PPE to minimize direct contact with soil such as face mask and gloves, provision of decontamination area for workers and conduct of regular hand washing and avoidance of touching the face and eating using bare hands or gloves. - A dust control plan will be implemented to minimize generation of dust. During the dry season, there may be a need to conduct water spraying to avoid dust clouds. Regular monitoring through visual inspection will be conducted to assess the effectivity of dust control measures. - The OCHSMP will include a Contact Management Plan to cover health and safety concerns including handling of arsenic-contaminated soils.
Biological hazards	Injury, illness, or loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	Maintain personal hygiene; avoid contact with unfamiliar plants and potentially venomous animals; provide first aid and animal bite kits; implement a Pandemic Response Plan and comply with applicable guidelines released by IATF for the Management of Emerging Infectious Diseases along with agreed protocols with DOTr.
OPERATION PHASE					
Liquefaction	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Remote	Low to Medium	- Conduct of preventive maintenance or inspection of structures to check the integrity; reinforce if necessary. - Establish an EPRP that includes emergency protocols for major ground shaking events that can trigger liquefaction.

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
Volcanic hazards	Possible damage to property; respiratory illness	Negligible (environmental degradation) to marginal (human health consequence)	Improbable	Low	Establish an EPRP which includes protocols for high alert level volcanic activity in Mt. Taal and Mt. Pinatubo
Ground shaking	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Improbable	Low	- Conduct of preventive maintenance or inspection on integrity of structures; reinforce if necessary. - Establish an EPRP that includes protocols for major ground shaking events.
Tropical cyclone and strong wind	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to marginal (human health consequence)	Occasional to Probable	Low to Medium	- Limit exposure to elements, suspend train operation as advised by PAGASA, keep updated with the latest weather bulletin. - Establish an EPRP which includes implementation of appropriate operation protocols for each PAGASA warning signal for tropical cyclones
Heavy rainfall and flooding	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to serious (human health consequence)	Occasional to Probable	Low to High	Establish an EPRP which includes implementation of appropriate operation protocols for each PAGASA warning signal for tropical cyclones.
Climate Change	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	- Contractor's OCHSMP will include mitigations for heat-related stresses to workers and passengers - Establishment of a Climate Change Adaptation and Mitigation Plan which will be updated regularly based on latest predictions and technology
Train derailment	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Improbable	Low	Design of rail system and protective devices conformed with applicable technical standards (Table 6.7.1); and regular inspection and maintenance of railway system.
Structural failure	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Improbable	Low	Construction of all infrastructures will adhere to relevant codes and standards (Table 6.7.1); inspection and maintenance of infrastructures to be conducted to ensure integrity of the infrastructures.
Security threats	Injury/loss to human life	Negligible (environmental degradation) to serious (human health consequence)	Remote	Low to Medium	Guard will be assigned in strategic posts and conduct routine inspection around the area. Regular inspection and maintenance of gates/entrances of the work area will be conducted. Visitors to the work area will always be coordinated

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
					with security. Unknown personnel will not be allowed to enter the work area. Establish emergency response protocols in case of security threats
Mechanical hazards	Injury/loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	- Regular inspection and maintenance of equipment - Training of workers on handling and operation of equipment; and provision of appropriate PPE to workers. - Only experienced and trained heavy operators will be hired/engaged to operate heavy equipment
Electrical hazards	Injury/loss to human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Remote	Low	- Establish lock-out/tag-out procedures; regular inspection and maintenance of equipment; training of workers on handling and operation of equipment; and provision of appropriate PPE to workers. Electrical equipment will be properly grounded. - During operation, the name of chief engineer will be indicated at the substation facilities. Enclosures will be established to prevent entry of unauthorized persons. - During maintenance works, the name of the person in charge will be indicated; the signboard of "Under Maintenance" will be attached; and the area will be locked. - Movable electric cables placed on the roads will be properly protected, and the insulation coating of the cable will be confirmed not to have any damages. At wet places where electric cables are installed inevitably, watertight movable electric cables and their connecting tools will be used.
Noise and vibration hazards	Injury, illness, or loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	Conduct noise level monitoring to ensure that the noise levels are within the threshold values and provide ear plugs and ear muffers for workers exposed to loud operational environments; implement regular shift rotation; use anti-vibration gloves as needed.
Gravity hazards	Injury/loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Occasional	Low to Medium	- Employ good housekeeping to ensure workplace is free of slipping and tripping hazards; provide warning signs for slippery or wet surfaces; and provide appropriate PPE especially for working at elevated levels - Display falling debris signages and isolate construction areas where there is a risk of falling objects.

Hazard	Impact	Consequences	Likelihood	Risk Classification	Safety measure
		Category	Category		
Motion hazards	Injury/loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	• Provide signages and other early warning signs; provide sufficient illumination; and follow traffic rules. • If night-works are to be conducted, the construction work area will have a minimum illumination of 10 foot-candles. Early warning signages will also be displayed around the work area.
Chemical hazards	Injury/loss of human life; damage to environment due to potential contamination	Marginal (environmental degradation) to marginal (human health consequence)	Remote	Low	• Provide proper containment for fuels and hazardous chemicals; regular disposal of flammable wastes to DENR accredited hauler/treater; and regular inspection and maintenance of containment and equipment along with regular inspection and maintenance of equipment which may generate air pollutants/emissions. • Diesel-powered equipment such as generators will comply with emission testing requirements.
Fire	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to catastrophic (human health consequence)	Improbable	Low	• Implementation of fire prevention and mitigation programs in accordance with relevant standards and regulations; Periodic maintenance of all electrical equipment. • A fire prevention and emergency response plan will be included in the EPRP which will include conduct of fire drills, training of workers on emergency response and use of fire extinguishers and compliance with safety procedure for hot works.
Biological hazards	Injury, illness, or loss to human life	Negligible (environmental degradation) to marginal (human health consequence)	Remote	Low	• Maintain personal hygiene; avoid contact with unfamiliar plants and potentially venomous animals; provide first aid and animal bite kits; implement a Pandemic Response Plan and comply with applicable guidelines released by IATF for the Management of Emerging Infectious Diseases along with agreed protocols with DOTr.

Table 6.6.2 Residual Risk for Failure Modes with Initial High Risk for the SBT Section

Description of Failure Mode	Effects	Consequences (w/ safety measures in place)	Likelihood		Residual Risk Classification
		Category	Category	Confidence	
CONSTRUCTION PHASE					
Heavy rainfall and flooding	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to marginal (human health consequence)	Occasional to Probable		Low to Medium
OPERATION PHASE					
Heavy rainfall and flooding	Possible damage to property; injury/loss of human life	Negligible (environmental degradation) to marginal (human health consequence)	Improbable		Low

6.7 RISK MANAGEMENT

924. Risk management was undertaken by identifying specific cost-effective strategies and mitigation measures, specifically to address those risks initially rated as having high or extreme base risk level. If the risk level is unacceptable after identifying strategies and action plans, further control and mitigation measures were identified.

6.7.1 Design Considerations for Physical Hazards of the SBT Section

925. Prior to construction of the SBT Section, the appropriate design criteria were selected to assure structural soundness against realistic worst-case scenarios during the operational lifetime of the Project. The project site being prone to meteorological and seismic hazards, it is important that the proposed project be designed using parameters that reflect the actual hazard vulnerability of the area. Based on the geohazard as well as chemical and process hazards assessment conducted for this Project, the design criteria that were adopted for the facilities is presented in **Table 6.7.1**.

Table 6.7.1 Codes and Standard to be used in the Construction and Operation of the SBT Components

Subject	Philippine Codes and Standards	International Codes and Standards
Building and Space Planning/Barrier-Free Design (Accessibility)	Design and Construction Phase • Department of Public Works and Highways. (1977). National Building Code of the Philippines (NBCP) (PD 1096) • Association of Structural Engineers of the Philippines. (1992). National Structural Code of the Philippines (NSCP) • Referral Codes of the NBCP (both laws and self-regulatory documents) such as: – BP 344 - Accessibility Law; – Institute of Integrated Electrical Engineers of the Philippines. (2000). – Philippine Electrical Code (PEC) – Philippine Society of Mechanical Engineers. (2002). – Philippine Mechanical Engineering Code – National Master Plumbers Association of the Philippines. (2000). – National Plumbing Code of the Philippines – DPWH 2000 Architectural Code of the Philippines (ACP, as applicable) • DPWH DGCS Vol. 6 Public Buildings & Other Related Structures 2015 • DPWH-promulgated 2015 Philippine Green Building Code (PGBC) • DPWH (2013) Guide Specifications Load and Resistance Factor Design - Bridge Seismic Design • Department of Energy (DoE). (2008). Guidelines on Energy Conserving Design on Buildings • RA 6716 - rainwater collection • 2016 NBCP: Illustrated data compact disc (CD) applicable standards by other infrastructure agencies such as the Department of Transportation (DOTr) • Applicable DOTr standards • RA 386, the 1949 New Civil Code of the Philippines • BP 344 - Accessibility Law and its IRR RA7277, The Magna Carta for Disabled Persons	Design and Construction Phase • The Building Standard Law of Japan, Ministerial Ordinance, Notification, MLIT-J. • Ordinance of the Building Standard Law of Japan • Guideline to Improve Barrier Free Access for Public Transport Passenger Facilities for the Enforcement of 2006 Law N.19. Edited by Ministerial ordinance MLITT of Japan. • Railway Bureau Ministry of Land, Infrastructure, Transport and Tourism (2018). Technical Regulatory Standards on Japanese Railways • The American Association of State Highway and Transportation Officials (AASHTO). (2015) Load and Resistance Factor Design Operation Phase • Guideline to Improve Barrier Free Access for Public Transport Passenger Facilities for the Enforcement of 2006 Law N.19. Edited by Ministerial ordinance MLITT of Japan. • Railway Bureau Ministry of Land, Infrastructure, Transport and Tourism (2018). Technical Regulatory Standards on Japanese Railways

Subject	Philippine Codes and Standards	International Codes and Standards
	Operation Phase • Institute of Integrated Electrical Engineers of the Philippines. (2000). Philippine Electrical Code (PEC) • Philippine Society of Mechanical Engineers. (2002). Philippine Mechanical Engineering Code • DPWH DGCS Vol. 6 Public Buildings & Other Related Structures 2015 • DPWH-promulgated 2015 Philippine Green Building Code (PGBC) • Department of Energy (DoE) Guidelines on Energy Conserving • RA 6716 - rainwater collection • 2016 NBCP: Illustrated data compact disc (CD) applicable standards by other infrastructure agencies such as the Department of Transportation (DOTr) • Applicable DOTr standards • BP 344 - Accessibility Law and its IRR RA7277, The Magna Carta for Disabled Persons	
Fire Protection and Safety Evacuation Design	Design, Construction and Operation Phases • RA 9514 - Fire Code of the Philippines (FCP) and IRR of 2008 • Philippine Society of Mechanical Engineers. (2002). Philippine Mechanical Engineering Code • Institute of Integrated Electrical Engineers of the Philippines. (2000). Philippine Electrical Code • DPWH DGCS Vol. 6 Public Buildings & Other Rel. Structures 2015 • Bureau of Fire Protection (BFP) resolution regarding adherence to National Fire Protection Association Standard (NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems)	Design, Construction and Operation Phases • The Building Standard Law of Japan (Ministerial Ordinance, MLITT of Japan) • The Fire Law of Japan • Railway Bureau Ministry of Land, Infrastructure, Transport and Tourism (2018). Technical Regulatory Standards on Japanese Railways
Building Materials	Design and Construction Phases • 2013 DPWH Standard Specifications • DPWH Bureau of Research & Standards (BRS) certification, if applicable • Dept. of Trade & Industry (DTI) Bureau of Product Standards (BPS) product certification, if applicable	Design and Construction Phases • Japanese Industrial Standards (JIS)
Urban Planning and Environment	Design and Construction Phases • RA 7279 - Urban Development and Housing Act of 1992 • PD and IRRs (as applicable) such as: – PD 1586 (Environmental Impact Statement System) – PD 1216 (Open Spaces) – PD 1151 (Environmental Policy) – PD 1152 (Environmental Code) – PD 1067 Water Code) – PD 957 (Subdivisions and Condominiums) – PD 953 (Tree Planting) – PD 856 (Sanitation Code) – PD 757 (Creation of the National Housing Authority) – PD 296 (clearing of waterways) • Duly-approved LGU Zoning Ordinance (ZO), with official zoning map (i.e., based on the duly-approved CLUP)	

Subject	Philippine Codes and Standards	International Codes and Standards
	• Special development-related LGU ordinances, as applicable • Environmental laws and regulations such as: – Clean Air Act (RA 8749) – Clean Water Act (RA 9275) – Ecological Solid Waste Management Act (RA 9003) – Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (RA 6969) – Climate Change Act of 2009 (RA 9729) – Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121) – National Heritage Act of 2009 (RA 10066) – Indigenous Peoples' Rights Act of 1997 (RA 8371) – Environmental Planning Act of 2013 (RA 10587) – Resettlement and socialized housing (BP 220) – DENR Administrative Orders – HLURB issuance (e.g., guidebooks, guidelines, standards, manuals, etc.) • DPWH DGCS Vol. 6 Public Buildings and other Related Structures 2015 • DOTr transportation planning studies Operation Phase • PD 1152 (Environmental Code) • PD 1067 (Water Code) • PD 856 (Sanitation Code) • Special development-related LGU ordinances, as applicable • Environmental laws and regulations such as: – Clean Air Act (RA 8749) – Clean Water Act (RA 9275) – Ecological Solid Waste Management Act (RA 9003) – Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (RA 6969) – Climate Change Act of 2009 (RA 9729) – Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121)	

6.7.2 Management of Hazardous Substances

926. All hazardous substances to be used/generated by the Project will be stored and handled in compliance with all applicable Philippine and international regulations. The DOTr and its Contractor are committed to preventing, to the greatest extent possible, both inadvertent release of these hazardous substances to the environment and accidents resulting from mishandling or mishap.

927. To ensure hazards or risks that may be posed by the Project during construction and operation are further minimized, the following measures are recommended:

- Appoint a pollution control officer (PCO) to monitor the compliance to the ECC conditions and monitor the project impact;
- Institute programs for employee training, facility inspection, periodic drills to test systems, and procedural review to address deficiencies, accountability, and continuous improvement

objectives;

- Actively work towards minimizing the generation of hazardous wastes by investigating alternatives to the use of hazardous materials, by recycling products and containers wherever feasible, and by treating wastes using state-of-the-art technologies before any release to the environment;
- All employees will be expected to comply with all applicable precautions and handling procedures about hazardous materials. Employees are also expected to report any concerns to their supervisors, the Health and Safety Committee, or senior site management. All staff is encouraged to bring forward suggestions for improvements that can be incorporated into procedure revisions as appropriate;
- Provide PPEs especially for working with any of the hazards discussed in the previous subsections; and
- Comply with all permitting requirements relating to generation, handling and disposal of hazardous substances such as the Hazardous Waste Generator's ID, Permit to Transport, Priority Chemical List, Chemical Control Order and other permitting that may be required.

928. There will be a detailed procedure on the management of hazardous substances/materials for the SBT Section to ensure the safe use, storage of disposal of hazardous substance in the Project. The following will be incorporated in the management procedure:

- Purchasing controls – control of shipping methods, appropriate packaging, shipping schedules, etc.,
- Inventory controls on site – periodic inventory of materials in storage on site to determine usage and to identify and manage any unexpected loss,
- Maintenance of current safe handling and storage procedures (i.e., Material Safety Data Sheet) and this will be available to those in contact throughout the operational site,
- Characterization of potential environmental hazards posed by hazardous substances,
- Allocation of clear responsibility for managing shipment, storage, handling and use of potentially hazardous substances,
- Defined methods for transport, storage, handling, and use,
- Identification of disposal methods for hazardous waste generated from use of these products,
- Preparation of contingency and EPRPs,
- Adequate type and delivery of training for management, workers, and Contractors whose responsibilities include handling potentially hazardous materials,
- Maintenance and review of records of hazardous material consumption and incidents in order to anticipate and avoid impacts on personal health and the environment, and
- Procedures to track and manage wastes generated through use of these products, including regular shipments of potentially hazardous waste to appropriate licensed disposal facilities following the provisions set forth by RA 6969.

6.8 RISK COMMUNICATION

929. Following the IEC framework as detailed in NSCR EPRMP (2015), identified hazards and risks that may impact public health and safety will be disclosed to affected communities throughout the project lifetime, which includes dissemination of information such as relevant plans and procedures (e.g., EPRP).

930. DOTr will ensure that its staff and contractors are aware of these hazards and risks, and all the guidelines, plans and procedures in place to minimize the associated impacts. Trainings will be provided

to all personnel, including contractor staff, through the induction programme before commencing work on site.

6.9 RISK MANAGEMENT PLANS AND PROCEDURES

931. The mitigation measures identified in the ERA will be further supported and implemented through a number of specific plans and procedures as outlined below. The primary objective of these plans is to establish an orderly and systematic approach in addressing an emergency situation and identified hazards to decrease injuries/fatalities and loss of property.

6.9.1 Emergency Preparedness and Response Plan

932. The DOTr Project Management Office (PMO) will develop an EPRP in order to define actions in preventing the occurrence of accidents and response procedure in case of accidents, fire and natural hazards. For the construction phase, each Contractor will be required to prepare the EPRP.

933. During the operation phase, the DOTr railway operator/concessionaire of the Project will also prepare a specific EPRP for its operations. The EPRP will be aligned with the mission¹⁶ of the DOTr on the strict implementation of precautionary, safety and security measures to ensure safe, fast, efficient, and reliable transportation services.

934. Possible causes of emergency situations due to man-made and natural hazards will be considered in the detailed design to reduce the chance of their occurrence. There are a number of design standards and codes that DOTr PMO will have to comply with and incorporate in its performance specifications. These standards are part of the requirements of the local agencies concerned in order to grant permits and licenses to DOTr.

935. Procedures for each of several emergency categories will be established. The procedures will specify necessary actions to be performed by appropriate personnel within a time or event sequence. The EPRP will at the minimum address the following categories:

- Natural disasters (geologic, climatic and atmospheric, geotechnical, etc.),
- Chemical and process hazards,
- Fire and explosion,
- Train derailment or collision,
- Structure failure,
- Security threats (bomb threat, criminal acts),
- Construction-related accidents, and
- Suicide/railway injuries or fatalities.

936. The plan will establish what constitutes an emergency and the procedure will be developed for the following:

- Emergency reporting,
- Notification of emergency response personnel,
- Dispatching of emergency response personnel and equipment to the site,
- Coordination of all emergency response activities,
- Protection of passengers/personnel, and equipment at the emergency site,

¹⁶ DOTr CARAGA Region (n.d.) Mission and Vision. Retrieved 07 April 2021 from <http://caraga.dotr.gov.ph/index.php/about-us/mission-vision>

- Evacuation of passengers/personnel,
- Communication to all passengers, employees, emergency response personnel;
- Restoration of normal operations, and
- Containment procedures for hazardous chemicals and dangerous goods.

937. Training of Contractors, employees and emergency response team will also be undertaken. Education of the riding public on emergency procedures and equipment as well as required passenger emergency response will also be included. These may be in the form of regular announcements, flyers/brochures, posters, or other forms of information dissemination. Facilities, equipment, and vehicles needed to cope effectively with emergency situations will also be required.

938. The proponent through its vision will adopt an active program of pursuing a healthy, safe and environment-friendly operation. DOTr/Operator guidelines on health and safety will be made clear to Contractors and all employees during construction and operations. An orientation briefing for Contractors and training for employees will be implemented.

6.9.1.1 Construction Phase

939. Emergency situations that may occur during construction are construction-related accidents and fire. The Contractor will set up safety measures required for the Works as follows:

- Provide and enforce wearing of PPEs such as hard hats, goggles, safety shoes and high visibility vests as these will be worn by all personnel while in the construction site;
- Submit for the approval of DOTr detailed proposals for safety regulations and emergency procedures;
- Approved copies of above plans, regulations and emergency procedures will be produced by the Contractor and distributed and displayed at each place of work, together with any other documents, posters, notices boards, or the like which are required by law. The Contractor will revise, replace, maintain, or remove the notices, regulations and the like as required by legislation;
- Provide adequate sign boards, barricades, and warning lights at all times during construction. Night visibility lighting will also be provided wherever and whenever needed;
- Ensure that all equipment is in good working condition;
- Provide at designated stations within the site emergency telephones, suitable accommodation (i.e., capacity is enough to accommodate 1 bed for every one hundred workers), and transport and first aid supplies and equipment including stretchers. A full time-first aider or occupational health nurse will be onsite depending on the number of workers and in compliance with requirements of the Philippine Occupational Safety and Health Standards;
- Provide adequate service for the protection against fire at the site in accordance with the local fire regulations; and
- Prepare a community emergency preparedness and awareness program to educate and prepare nearby communities on hazards or risks related to construction activities including but not limited to fire, explosion, and electrical hazards.

940. Upon issuance of Notice of Award, prepare, as part of the CEMMP, an EPRP as well as an OCHSMP that illustrate measures to be undertaken during emergency cases including spills, fire, structural failure, and other construction-related accidents, and a Pandemic Response Plan. Some examples of construction-related accidents are in **Table 6.9.1**.

Table 6.9.1 Examples of Construction-Related Incidents

Hazard	Incident
Mechanical	Injury due to powered or manually operated equipment which may either be minor (i.e., small cuts/grazes) or major (may result into removal of body part/s); These may include getting crushed, sheared, entangled, stabbed.
Electrical	Electrocution resulting into burns or death
Noise and Vibration	Ear related injuries (e.g., occasional or prolonged hearing loss); Hand-Arm Vibration System
Gravity	Slips, trips and falls
Motion	Getting hit by moving vehicles/equipment, injury due to repetitive stress

6.9.1.2 Operation Phase

941. For the operation stage, emergency situations that could occur and the recommended preventive measures are as presented in **Table 6.9.2**.

Table 6.9.2 Emergency Situations and Preventive Measures

Emergency Situation	Preventive Measures
Derailment	- Railway Operator will procure emergency re-railing and rescue equipment. These will be part of the depot equipment. - Railway Operator will inspect, maintain adjust and replace defective, excessively worn or broken running rails, cross ties, special track work components, ballast, direct fixation fasteners, and other track materials, related hardware and support equipment. - Railway Operator will also inspect and adjust the smoothness of the alignment and levels of the track geometry. There will be inspections for: - Track geometry and ride quality - Turnouts (which may be combined with regular lubrication and cleaning) - Ultra-sonic testing of rail joints and turnout components. These tests will be based on an annual test in each of the first two years and then scheduled as necessary according to the initial results.
Fire	The Fire Safety Enforcement Manual of the Bureau of Fire Protection Philippine Standards and NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems were principally used as the design criteria of this Project as imposed by the laws of the Philippines and by the Bureau of Fire Protection to be complied with.
Typhoon	Train speeds will be reduced during inclement weather based on the forecasted wind speeds by PAGASA.
Flood	All structures and facilities of the SBT Section will be elevated. Railway Operator will conduct periodic maintenance or when necessary, for its drainage and water systems.
Earthquake, Ground Setting and Liquefaction	[Guideway Structures] - Railway Operator will perform regular inspections by routine patrol of all structures and perform maintenance and repairs. A detailed structure inspection will be performed at least once per year. - The general condition of the structure as viewed from the track will be included in the item list of all route patrols, which are carried out on a regular basis. - All structures will be catalogued and numbered in a register of structures that records the conditions, inspection requirements, results and any corrective actions. - Main structures will be the subject to periodic structural inspections. These inspections will be designed and performed according to general practice according to the structure types, materials (steel or concrete), foundations, and any specific examination of components such as bearing and expansion joints. - Substations and Depot buildings will also be inspected using route patrolling and general route inspections. The inspections will be supplemented with fault reports made by the operational staff. - Should periodic inspection detect signs of ground movement, services will be suspended or be run at reduced speed. If services are allowed to continue, detailed monitoring of the site would be instigated. If services will be suspended, passengers would be de-trained at the next available station stop. Detailed investigation into the improvements required would be undertaken before services are recommenced or speed restrictions be lifted, and such works would be put in hand as soon as reasonably.

Emergency Situation	Preventive Measures
	[Tracks] • Railway Operator will inspect, maintain, adjust and replace defective, excessively worn or broken running rails, cross ties, special track work components, ballast, direct fixation fasteners, and other track materials, related hardware and support equipment. • Railway Operator will also inspect and adjust the smoothness of the alignment and levels of the track geometry. • In addition to the patrols described above, there will be inspections for: • Track geometry and ride quality • Turnouts (which may be combined with regular lubrication and cleaning) • Ultra-sonic testing of rail joints and turnout components. These tests will be based on an annual test in each of the first two years and then scheduled as necessary according to the initial results. • Should periodic inspection detect signs of ground movement, services will be suspended or be run at reduced speed. If services are allowed to continue, detailed monitoring of the site would be instigated. If services will be suspended, passengers would be de-trained at the next available station stop. Detailed investigation into the improvements required would be undertaken before services are recommenced or speed restrictions be lifted, and such works would be put in hand as soon as reasonably.
Failure of Structure	DOTr PMO will comply with international and national standards to ensure that the structures are designed and built in accordance with these safety standards.
Transport of Dangerous Goods	DOTr PMO has no immediate plans for the transport of dangerous goods. However, DOTr PMO and Railway Operator train crew and emergency re-rail and rescue crews would receive specific training on emergency procedures associated with the specific types of goods carried.
Medical attention required by passengers	For every station, security guards will be equipped with first aid kits. During extreme emergency cases, medical services including ambulance would be summoned to the nearest station by the central supervising station.
Medical attention required by personnel/workers due to occupation-related accidents	• Establish and implement an Occupational Health and Safety Management Plan. Proper training of personnel. Provision of PPEs, adequate warning signs and barricades. Ensure that equipment is in good working condition. Practice good housekeeping. • For every station, security guards will be equipped with first aid kits. During extreme emergency cases, medical services including ambulance would be summoned to the nearest station by the central supervising station.
Criminal Acts	Railway Operator will provide security services to ensure the safety of passengers, crew, and office workers.

942. DOTr PMO will produce an emergency procedural plan, which will include, but not be limited to, the following:

- policy, purpose, scope, and definitions,
- list of participating agencies and names of executives responsible for each agency,
- safety procedures during emergency situations,
- purpose and operation of Centralized Train Control (CTC) System and alternate CTC,
- purpose and operation of command post and auxiliary command post,
- communication facilities available for use during emergency cases,
- operating manuals of all specialized rescue equipment,
- maps and plans of complex areas of the system,
- community emergency preparedness and awareness program to educate and prepare nearby communities in case of project-related hazards or risk that may affect their area such as fire, explosion, electrical hazards, etc., and
- any additional information and data that the particular agencies require to have in the plan.

943. LGUs and other participating agencies within the locality will be coordinated with by DOTr PMO to cooperate and assist depending on the nature of an emergency, which will include the following:

- medical services,
- building department,
- fire department,
- police department,
- utility companies, and
- other transportation agencies.

944. Training for emergency response crew for the operation stage will be programmed to include the following:

- sponsored by equipment suppliers for the rescue equipment, firefighting equipment and the like,
- courses being offered by some government agencies and entities such as DSWD, Bureau of Fire Protection Special Rescue Unit (BFP-SRU), Philippine National Red Cross, DENR-EMB, Disaster and Risk Reduction Management offices etc., and
- evacuation of passengers from train to a point of safety along the guideway.

945. Emergency procedures will be controlled from the CTC within the Depot control center, including coordination of participating agencies such as fire service, police, ambulance, public works and utility companies, etc.

6.9.2 Occupational and Community Health and Safety Management Plan

946. An OCHSMP will be prepared for the SBT Section and the TSS-1 substation as part of the overall plan for NSCR Project. This will be aligned with the policy of the DOTr mandating the strict implementation of precautionary, safety, and security measures in every workplace to ensure safe, fast, efficient, and reliable transportation services.

947. The plan establishes the safety, health, and environmental protocols required to prevent and/or minimize potential risks to the Project's workers, contractors and the community during the construction and operation stage. The content of the OCHSMP will include, but not be limited to, the following:

- responsibility and delegation of authority,
- procedure for risk assessments and monitoring,
- control measures for workplace hazards and risks,
- coordination/communication system for reporting hazards and risks,
- maintenance of facilities and equipment,
- appropriate PPE for personnel undertaking maintenance, monitoring, and security work,
- accidents, first aid, and physical and mental ill-health,
- safe handling and use of substances,
- staff training, and
- applicable DOLE, DOH, and IATF guidelines related to OSH.

6.9.3 Climate Change Adaptation and Mitigation Plan

948. As discussed in **Section 6.5.2.2** (Climate Change and Hydrometeorological Hazards), a Climate Change Adaptation and Mitigation (CCAM) Plan will be established and updated regularly based on

latest predictions and technology in addition to the viaduct and drainage design of the SBT Section which incorporated climate change projections¹⁷. In particular, during construction phase, the Contractor will prepare the CCAM Plan as part of the CEMMP. During operation phase, the Concessionaire will prepare the CCAM Plan. Throughout the construction and operation phases, the CCAM plans will be periodically updated.

949. The CCAM Plan will adhere to climate change guidelines of the DOTr including commitments related to climate adaptation and mitigation, such as integration of climate change considerations into the Project's strategic plan and working with the LGUs and the Metro Manila Development Authority (MMDA) to develop policy changes that support adaptation and mitigation. In pursuit of meeting the project commitments to mitigate the risks associated with climate change, DOTr will:

- Identify climate-related risks and opportunities and develop responses that are implemented and monitored using management systems;
- Identify climate change risks as part of its implementation of environmental management systems and standards such as ISO 14001 (Environmental Management System (EMS) standard). Climate change risks will be incorporated into social and environmental management processes. The materials and methods used in the construction must take into consideration climate change impacts;
- Examine broad impacts of climate issues throughout the project life, particularly upfront in design and decision making;
- Identify measures to ensure sustained adequate supply, increasing the efficiency of water use through conservation practices, and looking for opportunities for reuse and recycling;
- Explore development projects that will require little or no use of scarce natural resources, strengthen community peace and security programs, build capacity of sound structural engineering, and develop government planning and emergency response.

950. If feasible, DOTr will explore opportunities to collaborate with the MMDA, the National Disaster Risk Reduction and Management Council (NDRRMC), Local Government Units (LGUs), and other rail and transportation systems in Metro Manila to share information and costs for climate adaptation, other supporting scientific or technical activities, best practices, and implementation of large-scale adaptation strategies. Opportunities may likewise exist for complimentary work across industries such as food and agriculture, mining, energy, and transportation.

951. The CCAM Plan will therefore contribute to one of the major outcomes of the Philippine CCAM-Disaster Risk Reduction (DRR) Roadmap 2018-2022 which is the "Increased Resilience of Critical Infrastructure", specifically under the program "Resilient Road and Other Transportation Network System".

¹⁷ The drainage design report for the SBT Section considered an average increase of rainfall intensities rounded up to 20% on the design based on the DPWH Design Guidelines, Criteria, and Standards (DGCS) Volume 3 (Water Engineering Projects) (2015) which projected an increase in rainfall intensities approximately at 10% to 20%. and based on DOST-PAGASA projections (2011) which suggested an increase in precipitation of 0.9 % to 63% for Luzon.

7 ENVIRONMENTAL MANAGEMENT PLAN

952. The potential impacts associated with the various environmental aspects and components during each project phase, the level of significance of each potential impact, and the proposed prevention, mitigation, or enhancement measures to address the impacts are summarized in the Environmental Management Plan (EMP) presented in **Table 7.1.1**. Responsible parties for the implementation and monitoring of the proposed measures along with estimated costs, guarantee/financial agreements, and the indicative implementation schedule are also presented in the EMP. Details of the environmental impacts and corresponding preventive or mitigating measures are described in Chapter 5.

953. The EMP was prepared with reference to previous EIA reports relevant to SBT Section, or “the Project”, including the Environmental Performance Report and Management Plan (EPRMP) for the North-South Commuter Railway (NSCR) Project (Malolos-Tutuban)¹ (2015) for consistency with overall NSCR Project EMP and the Environmental Impact Statement (EIS) for the NSCR Calamba Extension Project (2020) for consideration of items relevant to the SBT Section². The impacts in **Table 7.1.1** also focused on impacts associated with the study areas covered by the baseline surveys (Chapter 4) and environmental risk assessment (Chapter 6) of this Supplemental EIA Report including land (soil quality and contamination, terrestrial ecology, geohazards), water (surface water quality), air (air quality, noise, vibration), and people.

954. The DOTr is committed to meet the environmental standards required by Philippine law and JICA, and is fully responsible for the implementation of EMP. The Project will be constructed, operated, and decommissioned in accordance with applicable regulations as well as the JICA Guidelines for Environmental and Social Considerations (2010). The EMP, along with other relevant information in this Supplemental EIA Report, will be included in the specifications for Contractors to ensure that the Contractors implement the EMP of the Project. At the same time, Contractors are to provide various documents subject to the review and approval of the DOTr. Contractors are also required to submit a Construction Environmental Management and Monitoring Plan (CEMMP) prior to construction activities.

955. Basically, the EMP aims to achieve exemplary environmental performance in the pre-construction, construction and operation of the Project. In order to meet this goal, the following plans and related tasks are for implementation:

- Compliance with Environmental Policy;
- Application of Mitigation/ Management Measures;
- Conduct of Environmental Monitoring Program;
- Implementation of Emergency and Contingency Plan;
- Implementation of Social Development Program;
- Implementation of Information, Education and Communication Plan;
- Implementation and Supervision of Contractor’s Environmental Management Plan; and
- Implementation of Institutional Plan (including hiring of an Environmental/Safety Officer).

956. Regular consultations with the affected people and relevant offices/agencies are being conducted by the DOTr during pre-construction, by the Contractors during construction phase and by the DOTr during operation phase to ensure adequate and timely mitigation of project adverse environmental impacts. DOTr provides notification to DENR-EMB, and JICA on any unanticipated

¹ Project previously referred to as North-South Commuter Rail Project

² The Solis-Blumentritt (SB) Section was originally covered in the EIS and ECC for the NSCR Calamba Extension Project and amended to be included under the NSCR Project.

environmental risks or impacts that arise during construction, implementation, and/or operation of the project that were not considered in the Supplemental EIA Study Report and EMP.

957. This EMP is a live document for constant updating depending on project operations, change in technology, change in legislation, and current needs of the Project. The Project Management Office (PMO) of the DOTr for the overall NSCR Project is the primary entity responsible for the environmental management of the Project and is the main point of contact of DENR-EMB and JICA. Monitoring procedures for the environmental compliance of the Project are discussed in **Chapter 8**.

Table 7.1.1 Environmental Management Plan for the NSCR Project (Malolos-Tutuban) (SBT Section)

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
GENERAL							
Pre-construction, construction, operation activities	Land, Water, Air and People	-	-	Comply with relevant national and international environmental laws, guidelines, and standards³ - JICA Environment and Social Guidelines (2010). - Philippine Environmental Impact Statement System (PEISS). RA 6969: Storage, Transport, Handling, Treatment and Disposal of Hazardous Waste - Secure hazardous waste generator's ID from DENR-EMB. - Provide hazardous materials storage area. - Store hazardous materials/wastes in appropriate containers properly sealed and labelled. - Transport hazardous wastes by an accredited waste transporter - Treat hazardous waste by a registered waste treater (TSD Facility). RA 9003: Management and Disposal of Solid Wastes - Segregate, recycle and provide waste color coded bins, etc. - Provide Material Recovery Facility (MRF). - Regularly haul out solid wastes through the LGU or private contractor. RA 8749: Comprehensive Air Pollution Control Policy - Secure permit to operate all air pollution source installations (i.e genset). - Conduct regular inspection and preventive maintenance of heavy equipment, machineries and service vehicles to meet the DENR Emission Standards. - Conduct regular cleaning and clearing of construction access/site surfaces of spoils and debris from construction equipment and vehicles and wetting of ground soil in the construction site when necessary. - Control vehicle movement maintaining the speed limit within the construction site to <10kph and provide cover to loaded trucks.	Implement: - DOTr PMO - Contractors - Operators Monitor: - DOTr PMO - GC - LGUs - EMA, TPA - DENR-EMB	Contractor and operator's service fee on health, safety and environmental (HSE)management RA 6969: PhP 100,000 p.a. RA 9003: PhP 400,000 p.a. RA 8749: PhP 400,000 p.p.a. RA 9275: PhP 400,000 p.a. PD 442: PhP 6,000 per worker PD 856: PhP 50,000 p.a. Sanitary facility: PhP 200,000 per site Emergency Response Plan (ERP and Occupational and Community Health and Safety Management Plan): PhP 300,000 Health and Safety Desk or Medical Station: PhP 200,000 per site PhP 1,500 per man-hour	EGF/ Bid Documents/ Contract Agreement

³ Compliance to relevant laws, guidelines and standards but not limited to those presented here and those discussed in Chapter 3 of this Supplemental EIA Report.

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				RA 9275: Comprehensive Water Quality Management and for Other Purposes • Secure discharge permit. • Provide Wastewater Treatment Facility. PD 442: Labor Code of the Philippines, as amended (including Occupational Safety and Health Standards) • Consider gender equality in the hiring of workers • Include medical certificate in the requirements for hiring of workers to ensure that they are fit to work. Ensure that they are provided with proper training on construction, occupational health and safety, and emergency response procedure. • Provide appropriate personal protective equipment (PPE) to all construction workers, particularly to the personnel working on heights, heavy and electrical equipment. • Establish Health and Safety Desk or Medical Station at the active construction sites to monitor and safeguard the health of the workers and local residents and to provide immediate response during unexpected incidents/emergencies. • Closely coordinate with the nearest hospitals in the active construction site for immediate transfer and/or further evaluation and medical management of the patient. RA 8504: Philippine AIDS Prevention and Control Act of 1998 • Educate employees on standardized basic HIV/AIDS information and instruction. PD 856: Sanitation Code of the Philippines • Provide safe and clean water for drinking. • Provide appropriate sanitary facilities such as portable toilets and waste bins. Implementation of Emergency Response Plan (ERP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include but not limited to: • Distribute guidelines for employees and workers on HSE management. • Conduct orientation and continuous trainings of qualified workers, employees and/or operator/s on Environmental Management, Basic and Construction Occupational Safety and			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Health, Scaffolding Safety, Fire Safety and Safe Use of Chemicals at Work. • Conduct earthquake and fire drills with the participation of employees and workers. • Provide appropriate PPE for workers. • Provide security personnel. Note: Laws and regulations applicable to the Project are listed here given their relevance to multiple impacts.			
PRE-CONSTRUCTION / CONSTRUCTION PHASE							
BASELINE ENVIRONMENTAL QUALITY MEASUREMENTS							
Baseline Environmental Surveys	• Soil quality and contamination • Terrestrial ecology • Surface water quality • Air quality • Noise • Vibration			Pre-Construction • Conduct environmental baseline surveys where necessary such as TSS-1, temporary facilities and other locations indicated specified in the EMoP and design changes.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
Additional surveys	Land Health and safety			Pre-Construction • Conduct additional soil testing to verify the extent of soil contamination (arsenic and if any other concerns arise) in the project site. • Conduct traffic Impact assessment (TIA) for Blumentritt-Tutuban Section, if required. • Conduct building condition survey of Casitas de Tondo and other sensitive buildings if any. • Conduct engineering geological and geohazard assessment studies such as geotechnical investigation, three-dimensional groundwater modelling, liquefaction potential analysis and comprehensive study on West Valley Fault, if required. • Conduct rail safety assessment in compliance with NFPA 130 and other relevant national and international standards, including third-party audit.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
CONSTRUCTION ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (CEMMP)							
CEMMP (focusing on Contractor's Environmental Management Plan (CEMP))	EMP Implementation			Pre-Construction - Prior to start of site works and within 60 days upon receipt of the notice to proceed, the Contractors are to prepare a site-specific CEMP based on the updated EMP of this Supplemental EIA Report and submit to DOTr for JICA review. The CEMP that includes the following: - scope of works and schedule, construction methodology, facilities and site conditions, including sensitive receptors. - the detailed operational plan for the implementation of the EMP/CEMP with targets/indicators over a specific timeline that would be monitored for milestone highlights. - Include the preparation of the following specific management plans in the CEMP: - Pre-Construction Vegetation Clearing Plan - Vegetation and Ecology Management Plan - Spoil Management Plan (SMP) - Soil Contamination Management Plan (SCMP) - Erosion and Sediment Control Plan (ESCP) - Solid Waste Management Plan (SWMP) - Hazardous Waste Management Plan (HWMP) - Effluent Management Plan - Flood Management Plan (FMP) - Climate Change Adaptation and Mitigation (CCAM) Plan - Dust and Emission Control Plan - Noise and Vibration Management Plan - Labor Influx Management Plan or Worker's Camp Management Plan. - Public Access and Traffic Management-Plan (PATMP) or Traffic Management Plan (TMP) - Occupational and Community Health and Safety Management Plan (OCHSMP) - Emergency Preparedness and Response Plan (EPRP) - Pandemic Response Plan (PRP) - Cultural Resources Protection and Preservation Plan	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Social Development Plan (SDP) - Energy Conservation Program - Water Conservation Program - Abandonment Plan Note: Plans applicable to the Project are listed here given their relevance to multiple impacts. Specific measures under each plan are listed at the first citing of the plan or program.			
LAND							
Clearing of ROW and vegetation removal	Terrestrial vegetation and wildlife	• Habitat loss • Topsoil removal will have no impacts to wildlife as there are no fossorial or burrowing species recorded in the area.	B-	• Design, plan and implement the project that will minimize vegetation clearing, alteration of landform particularly in areas adjacent to flora of higher conservation significance (i.e., Antipolo, Is-is, Narra) and in the vicinity of ecological significant areas. • Prepare and implement pre-clearing plan will include the following: • 100% inventory of plants that may be affected by vegetation removal; • Determination of important species that will require relocation; • Marking of plants allowed to be cut or relocated; • Demarcation on the ground the limits of vegetation removal prior to any clearing activities to eliminate unnecessary cutting or clearing; and • Development of relocation procedure, post relocation care and maintenance, and protection. • Protocols on how to handle and manage potential wildlife that may be encountered during vegetation clearing. • Relocation/balling-out of endemic and/or threatened trees from the ROW. • Handling of debris from vegetation clearance and tree cutting. • Conduct 100% inventory of trees that may be affected by vegetation removal • Secure all statutory requirements following DAO 2020-06 relating to vegetation clearing or relocation (i.e. 100% Tree Inventory and Tree Cutting Permit) and RA 8048 (Coconut Preservation Act of 1995) from the DENR and PCA, respectively, before any vegetation clearing operations	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	[Tree Cutting] PHP 20,000 / ha Cost will include but not limited to pre-clearing plan, tree inventory, tree balling and transport, purchase of seedlings to replace relocated trees that will not survive, preparation of relocation cum off-set area, and monitoring cost. Seedling cost: using indigenous species with a density of 500 seedlings / ha at P12 seedling, P6,000/ ha. [Tree Relocation] PhP10,000/ha Cost will include but not limited to assessment and preparation of the relocation area per FMB TB #10-A). Detailed costs include: site validation, assessment and planning (PhP450/ ha);	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- During the inventory, potentially affected wildlife that may be occupying areas marked for vegetation clearing also need to be identified for cataloguing and for turnover to the local DENR for relocation to nearby suitable habitats. - Coordinate with DENR, PNR and LGU for trees not allowed to be cut and the relocation areas in lieu of the areas affected by vegetation clearing - Based on DMO 2012-02, apply appropriate uniform replacement ratio of 1:50 for affected planted trees in private lands and forest lands not exclusively established for tree plantations/ timber production purposes and 1:100 for affected naturally growing trees and non-surviving relocated plants - Demarcate the ground with the limits of vegetation removal prior to any clearing activities to eliminate unnecessary clearings - Prohibit use of hazardous chemicals/herbicides/pesticides for vegetation clearing/removal in any portion of the ROW. - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and management procedures of the cut logs and/or sustainable practices in disposing vegetation waste. - Implementation of RA 9003 and implementing the 5Rs (i.e., Refuse, Reduce, Reuse, Repurpose, and Recycle. all wastes will find a use if possible i.e. leaves from trees can be composted as natural soil improvers and all generated logs will be turned over to the local DENR and converted into furniture for government schools and offices. no burning of any type of solid wastes generated during the vegetation removal and tree cutting. Construction - Plant vegetation on vacant space within the project site as much as possible certain vegetation types (with due consideration of height restrictions) will be allowed to grow on selected portions of the project site through Assisted Natural Regeneration (ANR). - Select the relocation and replanting sites according to order of priority as follows: (1) within the project site (e.g., reintroduction within the ROW after construction phase); (2) public land outside the project site but within affected barangays; and (3) public land outside affected barangays but within the City of		site preparation and planting (PhP6,500/ ha); IEC/transportation/mobilization of partners (PhP1,000/ ha); and, maintenance and protection (PhP5,000/ ha/ year). PHP 20,000 / ha Cost will include but not limited to development and implementation of a pre-clearing plan. Perform detailed inventory/ survey of plants in the SBT ROW (not just trees and saplings). Relocate other plant growth forms that are equally important (threatened and/or endemic). PHP 10,000 / ha Post vegetation clearing activities. Care, maintenance, and protection of out-planted seedlings and relocated trees	

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Manila. DOTr will coordinate with Manila LGU to identify vacant public lands within its jurisdiction that can be used as relocation/replanting sites, subject to DENR evaluation and approval. Otherwise, DOTr will utilize the tree planting site/s outside Manila as recommended and approved by DENR. • In close coordination with DENR, ensure that the replanting site/s are designated for long term use and legally declared for protection and conservation • Planting within the project areas, especially in areas where heavy equipment movement is frequent, will have to commence when construction activities are completed to prevent damaging the replanted trees • Replant outside the project area may commence simultaneously with the construction activities once coordination and agreements with DENR and the LGUs are settled • Monitor the growth of replaced trees and ecosystem recovery/ establishment and disclose the results to the public. In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: • replace non-surviving replaced/ relocated trees with corresponding number of tree seedlings following DENR MO 2012-02 (usually 1:100 replacement ratio) that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis before planting and amend as necessary • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Make necessary adjustment based on result of soil nutrient analysis and investigation			
Clearing of ROW and vegetation removal	Terrestrial vegetation and wildlife	• Threat to abundance, frequency, and distribution of important species (Birds and other wildlife, particularly endemics		• Develop and implement a pre-clearing plan detailing the management of all endemic and/or threatened species found within the Project ROW from inventory, characterization, relocation or propagation, up to management. • Identify all endemic and/or threatened including selected native species will be identified, characterized, and relocated and if not practicable, seeds/wildlings for propagation will be collected/transferred.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA	Cost will include but not limited to development and implementation of a pre-clearing plan: PhP 1,500 per man-hour Perform detailed inventory/ survey of plants in the SBT ROW (not just trees and	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		species, will avoid the area due to loss of vegetation.) • Threat to existence and/or loss of important local species		- Minimise the cutting of the endemic and/or threatened species as much as possible. - Replacement seedlings will also consider local endemic and/or threatened species recorded during this baseline study. The use of native plants should be considered if green spaces are favored. Native plants especially pioneer species i.e. Alim (<i>Melanolepis multigalndulosa</i>), Anabiong (<i>Trema orientalis</i>), Hauli (<i>Ficus septica</i>), Is-is (<i>Ficus ulmifolia</i>), Binunga (<i>Macaranga tanarius</i>) etc. - The relocation and replacement planting site being considered that will be located outside the project area is the La Mesa Watershed Reservation in Quezon City. This site is the nearest natural habitat (relative to the ROW) for the recorded endemic and/or threatened trees, and there is land available to receive relocated trees and replacement seedlings. - The effectiveness of ecological mitigation measures will be monitored as described in "Habitat Loss by Vegetation removal. - Restricted access to location of threatened and/or endemic species within said areas will be implemented. Collection of plants and wildlife hunting will be strictly prohibited.	- NGAs/ LGU - DENR-EMB	saplings): ranges from PhP 100,000-500,000 for 100% tree inventory Relocate other plant growth forms that are equally important (threatened and/or endemic): PhP 100 per sapling	
Site Preparation and Development	Terrestrial vegetation and wildlife	Dust deposition on vegetation by anthropogenic activities	B-	Construction - Properly cover overfills, topsoil/ soils, spoils, and construction materials onsite as well as construction equipment, trucks and vehicles for the transport of materials to prevent escape of dust. - Strictly implement policies regarding safe driving and enforce the speed limit for vehicles along the access roads. - Execute water sprinkling in access roads and areas with exposed soils or dust-generating materials or equipment at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
	Terrestrial wildlife	Vehicular strikes to wildlife and vegetation	B-	Construction - Strictly implement policies regarding safe driving and enforce the speed limit for vehicles along the access roads. - Install proper signages to increase awareness and avoid accidents			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Intensified noise caused by anthropogenic activities	B-	Construction - Contain and monitor the effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards for all vehicles and heavy equipment to reduce effects of noise pollution - Intense producing noise activities will be minimized when birds are most active (i.e., 6:00-8:00 am and 3:30-5:30pm). - Both sides of the ROW will be fenced.			
		Increase in the intensity of artificial light by anthropogenic activities	B-	Construction - Contain and monitor the effects from source of artificial light at night during operation hours - Improve vegetation that creates barrier to limit the glare coming from the artificial light - Concentrate the light on operations using directional light - Install anti-glare to the source of artificial light to regulate glare - In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the project site and bring back into its natural habitat			
	Site Preparation and Development	Geologic hazard	C-	Pre-Construction - Design the earthquake loading capacity of structures to resist earthquake ground motion based on projected PGA values from the West Valley Fault as well as relevant national and international standards - Adhere to seismic and structure design standards including but not limited to the DPWH Guide Specifications Load and Resistance Factor Design (LRFD) - Bridge Seismic Design (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015) and AASHTO LRFD (2015). - Conduct IEC campaign on railway structure and geologic hazards for the workers, employees, and surrounding communities Construction - Implement the Emergency Preparedness and Response Plan (EPRP) to include emergency protocols, such as temporary suspension of construction activities - Ensure pile foundations are deep enough to reach the load bearing strata based on the geotechnical study conducted			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Conduct preventive maintenance/inspection on the integrity of structures; reinforce if necessary			
Earthworks (excavations for foundation, cut and fill, land grading, etc.)	Soil quality and contamination	Soil erosion and contamination due to generated excess soil or spoils	B-	Pre-Construction - Design slope protection/ soil erosion control to prevent or minimize slope failure during construction based on the results of the geohazard assessment and geotechnical investigation - Limit the removal of vegetation cover and topsoil to what is necessary for the works by marking up the vegetation removal area on site - Designate the spoil disposal area (SDA) where no future slides are to take place and be washed off in watercourses - Avoid locating the SDA on (1) irrigated rice fields, (2) slopes of more than 25 degrees, (3) where geological structure is unfavorable to stability, (4) on slopes that are subjected to stream erosions, (5) on areas identified to be protected or are special status habitats, (6) within 100 m from waterbodies or drainage line, whether permanent or seasonal, (7) on areas where adequate health and safety procedures are not in place, (8) areas of groundwater discharge, sources of drinking or irrigation water and (9) areas where permanent stabilization of disposal spoils will be difficult Construction - Implement the Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and sedimentation and Spoil Management Plan (SMP) to properly handle, transport and dispose spoils (including identification of haul routes, truck queuing and parking procedures for dust control and mud-tracking prevention) - Minimize ground subsidence, maintain stable cut and fill slopes at all times and install engineering interventions such as slope protection and drainage systems with sedimentation/erosion pond and temporary ditches around work areas to collect sediments from erosion or use bunds and silt fences to protect watercourses from soil run-off during the wet season - Schedule clearing and excavation activities in a speedy manner during dry season and minimize excavation during wet season - Place construction materials and excavated materials including excess soil/ spoils on appropriate staging site or spoils area with adequate containment away from waterways	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management Soil erosion control: PhP30,000 per m² Drainage system: PhP15,000 per meter	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- For stockpiles of excavated soil, cover and limit at height up to 2 m and install silt traps, deviation channels, mounting, barriers or trenches around the stockpiles. For spoils, immediately haul out and remove from the construction site and transport to the disposal site especially prior to expected rains. Ensure wet/damp soils are sufficiently dry prior to transport - For stockpiles of sand and gravel for construction, install fences around and reduce storage time in the work areas to minimize sediment transport during heavy rains - For excavation works, adequately brace the sides of the excavation, drive double steel sheet piles in the construction area near soil surface water sources, and use bentonite or polymer slurry for bored piles to prevent soil erosion or soft soil displacement and to stabilize uncased borings in loose soils - Regularly clean and clear the construction areas and road surfaces of scattered construction materials and scraps to avoid obstruction of natural flow especially during the wet season - For construction works during wet season that may require long-term storage, grade soil storage heaps to flat tops and cover or vegetate with soil stabilizing grasses for long-term storage - Monitor visible signs of erosion and implement the Erosion and Sediment Control Plan (ESCP) for the disposal and management of soil			
Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Soil quality and contamination	Soil contamination due to generation of solid wastes (including wastes from vegetation clearing and demolition)	B-	Construction - Implement the Solid Waste Management Plan (SWMP) - Minimize the production of wastes that must be treated or eliminated - Reuse leftover concrete and metals for suitable alternative projects - Repurpose cut logs and other usable wastes (e.g. convert into school chairs) - Recycle wastes including soil - Sort wastes for disposal, designate an appropriate temporary storage area and provide MRF - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				management procedures of the cut logs and/or sustainable practices in disposing vegetation waste - Engage only DENR and LGU-accredited companies in the tree cutting and vegetation removal procedures. Contractors to follow RA 9175 and chainsaws to be used for the tree cutting activities will have a Certificate of Registration from the local DENR - Ensure that collectors undergo the minimum standards and requirements for the collection, transport and handling of solid waste per DAO 2001-34 Rule 10, Section 1 - Provide 75-liter waste bins with covers and label at strategic locations in work areas for segregated storage of different types of solid wastes, including hazardous wastes - Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed - Dispose non-recyclable wastes (trash bags, non-recyclable plastic, glass, non-recyclable paper) to a sanitary landfill by a licensed contractor - Prohibit burning of any type of solid wastes generated during the vegetation removal and tree cutting - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal - Conduct soil quality monitoring and disclose the results to the public			
	Soil quality and contamination	Due to arsenic concentration, there are potential human health impacts if workers and community are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils	B-	Pre-Construction - Conduct additional testing prior to construction to verify extent of contamination and to properly manage contaminated soil - Prepare a Soil Contamination Management Plan (SCMP) based on the level of impacts detected during the additional sampling Construction - Implement the Soil Contamination Management Plan (SCMP) / Occupational and Community Health and Safety Management Plan (OCHSMP) which includes a Contact Management Plan with details on proper handling procedures - In case of contamination, clearly mark contaminated area and control the access	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		are disturbed, and dermal contact		• Inform workers and communities on potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil • Provide decontamination area where personnel can clean/sanitize themselves and encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves • Implement the Dust and Emission Control Plan to minimize dust generation, including water spraying to avoid dust clouds during dry season • Conduct continuous monitoring of arsenic level and disclose result to the public • Assess effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring			
	Soil quality and contamination	Soil contamination due to accidental spills of oil, lubricants, or other chemicals and other hazardous wastes	B-	Construction • Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) • Conduct safety induction training for the workers including personnel training on spills removal and emergency response procedures • Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes and ensure that hazardous wastes are the transporter and TSD facility are accredited by the DENR-EMB • Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) • Conduct regular maintenance of all vehicles and machinery • Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials • Establish and maintain an inventory of chemicals and hazardous wastes for documentation and monitoring • Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				spillage protection. If necessary, provide proper roofing and concrete-paved floor with proper chemical-proofing. Immediately use and remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. • During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks • Properly handle and dispose potential contaminants coming from construction sites through DENR-accredited hazardous waste haulers. For residual wastes, put inside sacks and other bags that don't leak and bring to residuals containment areas of the LGU • Regularly monitor and inspect handling of chemicals and hazardous substances including storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks, spills and other related emergencies from occurring • In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and Hazardous Waste Management Plan (HWMP) or contact the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities			
THE WATER							
Earthworks (excavation for foundation, cut and fill, land grading, etc.)	Surface water quality	Siltation and sedimentation of waterways during construction of SBT Section, including TSS-1	B-	Pre-Construction • Minimize vegetation removal as much as practicable • Plan earthwork activities in consideration of weather conditions especially during wet season Construction • Implement applicable erosion prevention and sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in construction site entrances and exits) based on Erosion and Sediment Control Plan (ESCP) • Construct the new drainage channel prior to re-training to avoid siltation and impeded flows and construct temporary facilities above flood levels and place machineries in a dry storage area at all times	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				• Install and maintain drainage channels to prevent drainage capacity overflow due to excess water during construction • Limit stockpile height of loose earth up to 2 m only, cover stockpiles and immediately remove loose earth materials from the site especially before expected heavy rains • Periodically remove sediments from the sediment traps and properly dispose off-site. If sediments have entered the surrounding waterways from surface runoff and streambank erosions, conduct dredging and clean up the waterways • Monitor visible signs of siltation and sedimentation and disposal activities • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
Site Preparation (Demolition and removal of existing structures along the ROW including TSS-1) and Development	Surface water quality	Contamination of waterways with solid waste and domestic wastewater from construction sites and construction camps	B-	Construction • Implement the Effluent Management Plan • Install, maintain and monitor a temporary septic tank system and/or the sanitation facilities (e.g. portalets) • Dispose wastewater through DENR-accredited waste haulers • Prohibit the local community, construction workers, and personnel from disposing wastes in South Antipolo Canal and Antipolo Creek • Secure temporary discharge permits as necessary for the disposal of construction wastewater • Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal to the waterways • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
Use of oil, lubricants, and other chemicals during construction activities	Surface water quality	Contamination of waterways through accidental spills of oil, lubricants, and other chemicals	B-	Construction • Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) • Prepare a procedural manual for workers to prevent oil and chemical spills and conduct safety induction training for all workers and personnel on proper handling potential contaminants and prevent accidental spills to the waterways	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Secure appropriate permits such as Permit to Transport and Hazardous Waste Manifest from DENR - Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) - Conduct regular maintenance of all vehicles and machinery - Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials - Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate spillage protection - Provide signages, fire extinguishers, barricades, and control access - During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks - Dispose used oil, lubricant and other chemicals by engaging DENR-accredited hazardous waste haulers - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	DENR-EMB		
Land development, earthworks, and civil works for SBT Section (including TSS-1) Realignment of South Antipolo Canal as part of road diversion requirements	Surface water quality	Contamination of waterways due to concrete and drilling wastewater spills	B-	Construction - Recondition and reuse bentonite slurries to lessen the amount of slurry to be disposed - Store concrete wastewater in large PTFE containers to avoid spillage on-site - Dispose wastes through a DENR-accredited wastewater hauler - Install settling tanks/drying ponds for concrete and drilling wastewater in the absence of wastewater haulers - Dispose dried waste in line with the project's Solid Waste Management Plan (SWMP) - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Flooding (including climate change induced flooding)	Flooding may be aggravated by excavation activities and siltation from earthworks	B-	Pre-Construction - Design all structures and supporting facilities in consideration of flood levels based on 100-year flooding hazard map to have a clearance of above established flood level - Design the channel for retraining larger than the existing canal to avoid flooding and overflow of drainage capacity - Design railway structures on elevated viaducts and supporting facilities to have a clearance of above established flood level Construction - Implement the Emergency Preparedness and Response Plan (EPRP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones in consideration of flooding induced by climate change such as extreme weather events - Implement the Flood Management Plan (FMP) to include details on the installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal into the waterways to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities - Install and maintain sufficient and effective drainage and/or dewatering system with drain channels and sumps to facilitate proper drainage of excess water and to regularly remove water that accumulate in pits, excavations, and other depressions. For a new drainage channel, construct prior to retraining to avoid siltation and impeded flows - Construct temporary facilities above flood levels, place machineries and equipment in dry storage area at all times and insulate electrical wirings and sources away from wet working areas and flood-prone zones - Conduct cleaning or de-clogging of waterways as necessary to avoid blockage of existing drains during construction or provide alternative drains should there be unavoidable blockage of existing drains	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Provide erosion and sediment controls such as slope protection, silt screens, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways especially during masonry and earthmoving activities - Properly handle waste bentonite slurry in accordance with RA 9003 and temporarily store in bentonite tanks to prevent siltation			
THE AIR							
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Climate change	Injury, property damage and disruption of activities due to flooding, strong wind, tropical cyclones, including events induced by climate change Systems failure/ Overheating of construction equipment due to projected increase in temperature due to climate change	B-	Pre-Construction - Climate change adaptation - conduct climate risk and vulnerability assessment (CRVA) to provide information useful to relevant stakeholders in understanding the vulnerability of the Project to climate change and to identify appropriate adaptation options for consideration in the Climate Change Adaptation and Mitigation (CCAM) Plan development - Climate change mitigation - Conduct greenhouse gas (GHG) inventory to determine the GHG emissions of the existing PNR in operation and projected GHG emissions during construction and operation and identify appropriate mitigation options for consideration in CCAM Plan development - Design a resilient railway infrastructure based on robust engineering design and construction standards in consideration of the national building code and other relevant standards as well as predicted climate changes Construction - Implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology - Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety (EHS)-related plans such as OCHSMP and EPRP (appropriate protocols for each PAGASA warning signal for tropical cyclones) especially during extreme weather events - Conduct regular inspection and proper maintenance of all construction equipment, machineries, and drainage systems - Track GHG emissions throughout project construction and regularly update GHG emission reduction targets	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary			
Earthmoving, demolition, and earth-balling Mobilization of equipment, machineries, and service vehicles Storage or stockpiling of construction materials (sand, aggregates, cement, bentonite, etc.) and solid wastes/debris from construction sites (excess soil/cement, bentonite slurry, spoils from excavation/drilling activities, etc.)	Air quality	Emissions of particulate and gaseous pollutants	A-	Pre-Construction - Require construction vehicles and equipment to undergo the mandatory government vehicle emission tests prior to the start of construction - Select and use low-emitting and fuel-efficient vehicles, machineries and equipment - Secure Permit to Operate (PTO) from DENR-EMB for stationary equipment (Air Pollution Source Installations (APSIs), monitor the APSIs based on the requirements stipulated in the PTO and place in strategic locations to ensure they are far from windows of houses and offices - Incorporate traffic management guidelines in the induction seminar for workers and EPC contractors Construction - Maximize fuel efficiency through scheduling of vehicle and equipment movements to minimize idle time and distances travelled - Conduct regular maintenance and annual emission testing of the vehicles to ensure that emissions are within acceptable limits - Closely monitor equipment dispatch to eliminate unnecessary use and to increase use efficiency - Regularly monitor ambient air quality (emissions of particulate and gaseous pollutants) and disclose all monitoring results to the public	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
		Fugitive dust emissions	A-	Pre-Construction - Install controls at the construction site exits to prevent build-up of mud and/or soil in vehicle wheels and public roads such as wheel and truck wash facilities and/or mud mats Construction - Implement a Dust and Emission Control Plan - Manage vehicle speeds and impose speed limits of 10 km/hr in construction areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/ municipal roads in accordance to JMC 2018-001 (Guidelines and Standards for the Classification of Roads,	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data) to trucks that carry materials - Cover overfills, topsoil/ soils, spoils, and construction materials onsite as well as construction equipment, trucks and vehicles for the transport of materials to prevent escape of dusts - Execute water sprinkling of access roads, stockpiles and areas with exposed soils or dust-generating materials or equipment whenever visible dust is observed or at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area - Provide workers with appropriate PPEs and implement safety protocols pursuant to RA 11058 and its IRR (DO 2018-198), and DOLE-BWC DO 1998-13 to protect them from disease associated with dusts - Regularly monitor fugitive dust emissions/ generation and disclose all monitoring results to the public			
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Ambient noise	Noise levels produced from general construction works affecting the amenity at nearby sensitive receptors.	B-	Pre-Construction - Select sites (i.e. ROW, construction yard, temporary facilities, access route) in consideration to sensitive receptors including ecologically significant areas (if any) likely to be affected. - Place noisy construction equipment such as generators, refuelling and laydown sites etc. as far away from sensitive receptors as possible.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
		Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	A-	- Minimize activities like alteration of topography and removal of vegetation which generate noise. - Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works. Also establish Grievance Redress Mechanism to handle complaints on noise during construction if any and monitor the actions taken to resolve the complaints - Schedule noise-generating construction activities during the day where feasible. - Reassess the future construction noise level based on final design and location of temporary facilities and validate noise mitigation measures. - Conduct baseline surveys for areas outside the ROW where noise-generating temporary construction facilities and sources			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				will be located and reassess future construction noise level based on final design and once location of temporary facilities and access roads are identified. Construction • Prepare and Implement the Construction Noise and Vibration Management Plan (CNVMP) covering noise and vibration abatement / control, monitoring, public information and complaint response including but not limited to the following: • Maintain 10-m working distance from construction activities. • Conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes). • Locate heavy vehicles and activities as far from sensitive buildings as possible through design coordination and project layout • Implement construction activities in consideration of time, duration, and scale to optimize the use construction equipment, machineries, and vehicles in accordance to noise emission standards; For instance, operation of vibration hummer and other noisy equipment will be scheduled at limited time. Undertake noisy construction activities at the same time or within a restricted area to reduce the number of sensitive receptors exposed to noisy works. In case out-of-hours works are necessary, secure permits for specific work activities and seek permission from the PMO and concerned LGU. • Construct walled enclosures around especially noisy activities or clusters of noisy equipment 50 m from sensitive receptors. • Locate site buildings or barriers/ enclosures around especially noisy activities or clusters of fixed noisy construction equipment • Select quieter construction equipment where practicable; fit construction equipment with silencers, acoustic enclosures or other noise attenuation measures, where possible. Properly maintain machinery to minimize noise. • Where practicable, limit heavy construction vehicle movements to normal working hours and design traffic routes to limit the amount of accelerating and braking and avoid local roads, where practicable. Also minimise blowing of horn and limit speed when passing through residential areas			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				• Install 3 m noise barrier with additional noise barrier walls, or panels instead of noise barrier sheets to further reduce construction noise. Install additional sound barrier curtain or sound barrier window at sensitive receptor (e.g., Melchora Aquino Elementary School) in the immediate vicinity of the construction area. • Install noise control devices such as mufflers and noise suppressors for all construction equipment and machineries. Use of electric instead of diesel-powered equipment, hydraulic tools instead of pneumatic tools. • Disclose construction activities and schedule to public and issue advance notices to the public at least 24 hours before the start of construction activities especially if the noise is expected to exceed acceptable level. In case of complaints, follow the GRM/ complaint response procedure to urgently respond to the complaints and resolve the problem. • Encourage nearby communities to use acoustic insulation or sound proofing installation at most noise sensitive indoor areas, and installation of sound barrier curtains at the windows of nearby schools and places of worship specially during daytime when construction noise generated is higher. • Monitor noise levels at identified nearby sensitive receptors (residential, school and hospital areas) including ecologically and culturally significant area/s (if any) likely to be affected and compliance with WBG EHS criteria and Japanese Guidelines and disclose the result to public. Evaluate effectiveness of the noise reduction measures provided and revised as necessary.			
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Ambient vibration	Vibration from construction works causes human disturbance and structural damage to buildings sensitive to vibration	B-	Pre-Construction • Conduct building condition survey of those with culturally significant and buildings adjacent to the alignment to provide proper protection measures and to conduct continuous monitoring of vibration impacts. Prepare and submit work plan for building and structures of historic concerns and obtain approval from cultural agencies • Inform local communities on potential vibration impacts and proposed work schedule	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

			Construction • Implement the Construction Noise and Vibration Management Plan (CNVMP) to avoid cosmetic damage to sensitive structures • Locate heavy vehicles and activities as far from sensitive buildings as possible through design coordination and project layout • Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance • Plan the demolition and construction schedule such that high levels of vibration only occur during the day where feasible and consider time, duration, and scale of construction to optimize the use construction equipment, machineries, and vehicles with minimal vibration generation • Select construction equipment and machineries matching the scale of the construction and with minimal vibration generation if possible • Maintain 10-m working distance from construction activities; In areas where safe working distances cannot be maintained, demonstrate compliance or trigger further mitigation measures to reduce vibration where levels exceed acceptable FTA thresholds • For works closer than 10 m from a sensitive receptor (e.g. school, church, residential, historical structures), conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes) • Substitute construction methods to emit lower vibration levels where feasible • Strictly control construction activities close to historical/archaeological sites • If construction activities will cause continuous vibration, especially foundation excavation, it is necessary to reduce energy at each excavation • Require vehicles transporting construction materials and equipment to follow traffic rules strictly and limit speed not to exceed 30 kph and the load shall not exceed 25 tonnes if passing communities, commercial or sensitive areas (e.g.			
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Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				health premises, schools, educational institutions or religious institutions such as temples, mosques and churches) Monitor vibration levels at the sites of sensitive receptors (i.e. affected ecologically and culturally significant areas), temporary facilities and construction especially during initial piling and vibratory roller activities at the closest sensitive receptors to verify predicted vibration levels, evaluate effectiveness of/ refine mitigation measures. Document and clearly state the methodology and results in required monitoring reports accessible to the public			
Site Preparation (Demolition and removal of existing structures along the ROW including TSS-1) and Development	Ambient noise and vibration	Noise and Vibration generated by construction works impact on workers	B-	Construction - Provide training on noise and vibration mitigation and require workers to wear appropriate PPE including ear plugs or ear mufflers - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole body vibration (e.g. operating excavators) and reduce exposure duration for high vibration tasks; If loud work is unavoidable, assign restricted areas to limit noise exposure; Rotate workers and organize work schedules so worker exposure to hazardous noise is limited - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload - Substitute high vibration tools for vibration-reduced tools where possible - Regularly maintain vehicles, machineries and other equipment as well as surface conditions of access roads - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers and Contractors	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
PEOPLE							
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs	Public Participation and Information Disclosure	Social acceptability and conflict of interest	A-	Pre-Construction Inform project stakeholders who are likely to be affected by the project on the construction schedule and activities, potential environmental impacts, mitigation measures and grievance redress procedure through public meetings	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Construction activities				- Establish the approved grievance redress mechanism in coordination with the contractors prior to commencement of site works Construction - Continue public involvement activities on the framework for public involvement and disclosure - Conduct regular consultations with affected people and relevant offices/agencies by the contractor during construction phase - Install notice boards outside the construction sites that indicate the contact details of the DOTr helpdesk - Act on complaints reported by the affected person(s) based on the following RAP and HSE GRM Procedure levels - RAP: (1) Local Help Desk/Central Help Desk (Local/Central GRM Team), (2) TWC/ROW Site Acquisition Committee or DOTr Legal Department, (3) Court of Law - HSE: (1) Local Help Desk/ Central Help Desk, (2) PMO HSE, HSEC or TPA, (3) EGF Committee / DENR Pollution Adjudication Board, (4) Court - If not resolved, elevated to DENR-EMB Regional Office for environment-related grievances and DOTr management for health and safety-related grievances - If still not resolved to DENR for environment related and Court of Justice for health and safety grievances - Monitor the activities and effectiveness of GRM and disclose the monitoring results to the public - Monitor if public involvement and information dissemination are conducted in terms of target stakeholders, information provided, means of dissemination/involvement, and timing involved/disseminated	- GC - TPA, EMA - NGAs/ LGU - DENR-EMB		
Land Acquisition for the Project ROW	Land use and classification	Incompatibility with existing land use and development plan	C-	Pre-Construction/ Construction - Maximize the use of existing PNR ROW and minimize land acquisition - Coordinate with the affected LGU to align and ensure that SBT Section is integrated in the updating of land use plan and zoning ordinance - Coordinate with the lot owners, LGUs, relevant agencies and concerned stakeholders in acquiring and/or securing the ROW in accordance with RAP	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA	Contractor's service fee on Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Coordinate with PNR, affected LGU and other concerned parties in relation to the Casita de Tondo (refer to Cultural Heritage)	NGAs/ LGU DENR-EMB		
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs	Land acquisition and utilization and involuntary resettlement	- Displacement of PAPs (informal settler families (ISFs) and other non-landowners; and), - Removal/ relocation of project affected structures - Conflict in land ownership, change in land use and relocation of landowners	A-	Pre-Construction - Maximize the use of existing PNR ROW and minimize additional land acquisition - Update and implement a Resettlement Action Plan (RAP) with Livelihood Restoration and Improvement Program (LRIP) to compensate for loss of assets at replacement cost and to assist displaced persons restore or improve their pre-project living standards, income-earning capacity and production levels - Coordinate with the LGU for the updating of land use classification and local zoning - Coordinate with other stakeholders such as MERALCO for the existing substation and DPWH for other infrastructure projects - Implement Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder groups - Conduct monitoring to track whether the planned compensation are provided, resettlement activities for the PAPs and LRIP are delivered and whether the planned activities in the RAP achieved the desired outcomes, and disclose the result to public - Conduct meaningful public consultations and information disclosure Construction - Continue the implementation of RAP, LRIP, SDP and GRM - Continue conduct of meaningful public consultations and information disclosure	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
	Land use and classification	Potential conflict among PAFs and other government infrastructure projects	A-	Pre-Construction Prepare and implement RAP with close coordination on financial assistance arrangements with DPWH, and other agencies with ongoing infrastructure projects that share impact areas with the SBT Section in terms of PAFs and ROW. Ensure PAFs/PAPs are compensated the same entitlements for SBT Section. Where required, DOTr is to top up the gap to meet the entitlement of the SBT Section.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA	RAP Cost/ Construction cost/ DOTr IEC Cost PhP 1,500 per man-hour	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Monitor compliance of land acquisition and displacement activities to the RAP Construction - If PAFs raise an issue, ensure prompt response and resolution per established GRM - Monitor compliance of land acquisition and displacement activities to the RAP	- NGAs (DPWH)/ LGU - DENR-EMB		
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs Construction activities	Local economy, employment and livelihood	Disruption of livelihood, local business and economy Generation of livelihood, employment and business opportunities	A+/-	Pre-Construction - Prepare and implement the LRIP in coordination with the LGU and other government agencies - Identify relocation sites for those to be displaced within the same LGU or as close as possible to their current residence where if feasible so that PAPs can maintain their current livelihood Construction - Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs - Provide alternative livelihood program in coordination with the LGU and relevant government agencies - Monitor until the LRIP is complete so that the PAPs achieve the same livelihood status or better than prior to the project - For business establishments for permanent removal, provide fair compensation measures to ensure continued economic activity and/or the restoration and/or improvement of livelihood - Provide alternative access for affected businesses and directional signboards to ensure continuous business operations. In case of disturbances on income earnings and capacity, consult with the affected and make necessary arrangements to ensure livelihoods are maintained or improved - Undertake construction activities at the shortest possible time to restore normal business operations immediately - Monitor compliance to manpower requirements in terms of local hiring, gender and vulnerable groups	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs (DSWD, DOLE, DTI, TESDA)/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	In-migration	Encroachment/ proliferation of ISFs, influx of construction labor force	B-	Pre-Construction - Minimize encroachment of informal settlers taking advantage of the relocation package for ISFs through setting of cut-off dates under RAP - Train local workers within a reasonable timeframe to meet project requirements on manpower and skill level and prioritize employing skilled and unskilled local residents. In the inadequacy of local workers, accommodate incoming non-local workers in dedicated construction camps or other affordable accommodation options with appropriate trainings, supervision, and security to maintain public order and minimize unlawful conduct - Closely coordinate with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx - Shorten the time between the pre-construction and construction Construction - Adequately fence the SBT ROW and assign security personnel to limit access or entry of unauthorized persons - Implement the Labor Influx Management Plan or Workers' Camp Management Plan - Employ skilled and unskilled local residents and accommodate non-local workers in case of inadequate local workers. Monitor compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public - Continue close coordination with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
	Cultural / lifestyle change	Cultural and lifestyle change of community members of the localities where the Project will be situated and where the PAPs will be resettled	B-	Pre-Construction - Undertake comprehensive development planning with integration of concerns on cultural and lifestyle change and integrate in the Social Development Plan (SDP) for SBT Section in line with the NSCR Project SDP and LGU SDP - Coordinate with the receiving LGU to discuss and agree on the financial assistance for the relocates to cover any of the following: - Health services, facilities and/or infrastructure	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Educational services, facilities and/or infrastructure - Services, logistics or equipment for the maintenance of peace and order - Provision of transport services or improvement thereof - Solid waste management - Implementation of the LRIP (alternative livelihood programs vocational trainings, employment in local communities, soft loans to establish business) • Identify and provide relocation sites for those displaced within same LGU if feasible so that social and cultural environments can be maintained Construction • Provide financial assistance to the receiving LGU for off-city socialized housing site to prevent adverse impacts of sudden increase in population in receiving LGUs specifically to compensate for the strain on social infrastructure	• DENR-EMB		
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Vulnerable groups, gender issues and children's rights	Greater challenges in re-establishing living standards, Additional hardship due to vulnerability	A-	Pre-Construction • Conduct meaningful, gender-responsive and response public consultations tailored to the needs of disadvantaged and vulnerable groups • Update and implement RAP in consideration of gender equality and vulnerable groups including livelihood and skills training program with support from the LGU, DSWD and TESDA • Prepare and implement the Social Development Plan (SDP) aligned with LGU SDP integrated with gender-responsive and socially inclusive programs, projects and activities to deal with risks, issues and concerns raised during public participation activities • Consider the rights and welfare of children in the preparation of the SDP and coordinate with the City Council for the Protection of Children and conduct awareness campaign programs geared towards protecting children's rights • Design and install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. work environment and facilities for women and PWD like toilet, changing room, access ramp)	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Integrate GAD-related information in existing railway transport management information system to ensure that relevant gender statistics and sex-disaggregated data are regularly collected, analyzed and used as inputs for planning, budgeting, programming and policy formulation Construction - Continue the implementation of the LRIP ensuring the provision of gender equal job opportunities in line with national laws and regulations - Maintain access to government welfare programs and provide support to help family members needing special assistance and/or medical care before and during resettlement activities and/or and nurses or social workers - Immediately replace the social/barangay facilities (clinic, chapel, barangay hall, grotto, basketball court) affected by project ROW (if any) and strategically locate in in safe areas within the affected community - Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities - Monitor provision of entitlements for PAPs classified under RAP as vulnerable groups and compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public - Immediately report to appropriate authorities' incidents involving children-in-conflict-with-law (CICL) and street children around the project premises while respecting their rights			
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and	Cultural heritage	Damage/ destruction risk to physical cultural/ archaeological resources	B-	Pre-Construction - Prior to the relocation of the Casitas de Tondo in Tutuban Station, undertake the actions agreed with NHCP and PNR - Incorporate the structure into the design of the Tutuban Station - Prepare necessary detailed design/ relocation documents and plans including but not limited to architectural and structural plans, specifications, and dismantling and reconstruction methodologies, terms of reference (TOR) for conservation works, conservation management plan, protection plan, etc.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs (NM, NCCA, NHCP)/ LGU	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Site Development				- Submit all relevant documentation and seek the approval of the cultural agencies (CAs) • During the relocation of the Casitas de Tondo, undertake the following agreed with NHCP and PNR: - Implement the approved plans for the Casitas de Tondo and closely coordinate the relocation activities with the CAs - Implement historical heritage protection plan including noise and vibration measures as applicable • Follow the procedure for the preservation of historic structures/ buildings during construction developed for NSCR Ex: - Determine temporary facilities and access routes to be affected by vibration impacts due to pile driving, concrete/rock breaking activities and movement of heavy equipment, machineries and trucks - Identify historical structures or buildings within the vibration impact standard distance of 0.10 km from temporary construction yards, facilities and access routes - Inform the CAs about identified historical structures or buildings adjacent or close to the temporary construction facilities with significant vibration source and conduct baseline condition surveys or other any other additional surveys as the CAs require in consultation with the building owner - Implement the approved historical heritage protection plan in case of any new assets found to be adjacent or close to the Project ROW and temporary construction facilities and access routes with vibration source • Prepare and implement the Construction Noise and Vibration Management Plan (CNVMP) to consider measures to address damage risks to historical structures due to construction noise and vibration • Coordinate with relevant CAs and NGO/CSO to monitor and protect the structures outside the SBT ROW in close proximity to the temporary construction facilities and access routes Construction • Implement CNVMP to address damage risks to historical structures • Carry out mitigation and traffic management in the area of the buildings to not exceed allowable vibration level at the building	• DENR-EMB		

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Regularly monitor and measure vibration level at concerned buildings identified prior to construction and ensure public disclosure of results - Conduct archaeological watch in close coordination with NM for accidental finds - In the event that an archaeological site or chance finds, immediately cease all earthmoving activities until the CA decides the project to continue			
Site Preparation (Demolition and removal of existing structures along the ROW) Site Development (including relocation or realignment of affected electric poles and wires as well as water supply systems)	Public infrastructure and utilities	Relocation or realignment of affected public utilities and disruption of utility services	B-	Pre-Construction - Prepare and implement a Utility Conflict and Relocation Plan with close coordination with affected LGU and utility companies. Negotiate the appropriate relocation compensation and replacement for the affected community facilities and/or public utilities - Consider affected structures including community facilities and public utilities in the RAP - Divert or relocate utilities overhead high voltage cables, telephone and communication cables, underground water pipes and other utilities prior to construction to minimize service interruption - Issue public notices or announcements in advance regarding temporary disruption of services	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
		Increase in demand for resources	C-	Pre-Construction - Closely coordinate with utility companies for the relocation of existing utilities within Project ROW as well as power, water and other utility requirements Construction - Timely coordinate with public utility companies to prevent service interruption in nearby communities and to arrange utility requirements for construction - Issue public notices or announcements in advance regarding temporary disruption of services if any - Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section - Use back-up generator sets during power interruption	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Implement Energy/Water Conservation Program. Monitor power and water consumption and install energy-efficient equipment and water saving fixtures. - Monitor fuel consumption and solid waste generation and disposal			
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Public infrastructure and utilities (social services)	Disruption of social services due to removal or relocation of social infrastructure (schools, hospitals, barangay halls, religious institution, etc.)	B-	Pre-Construction - Issue public notices or announcements in advance regarding temporary disruption of social services - Negotiate with the local government for the compensation and replacement intervention for the affected social infrastructure and facilities - Consider employees of affected social infrastructure and facilities in livelihood restoration measures (alternative livelihood programs) to mitigate economic impacts of displacement - Coordinate with utility companies for power, water and other utility requirements for the facilities Construction - Provide listing of alternative social infrastructure or facilities available and accessible to the affected communities - Build the social infrastructure and facilities near the original location	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
		Increase in demand for social infrastructure in the relocation site	B-	Pre-Construction - Issue public notices or announcements in advance regarding temporary disruption of services - Provide financial assistance to LGUs offering the off-city socialized housing sites to cover social services required for the increased population caused by the project such as health, educational, religious and institutional services, facilities and/or infrastructure - Closely coordinate with national government agencies together with the sending and receiving LGUs Construction - Provide listing of social infrastructure or facilities available and accessible to the affected communities	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Closely coordinate with the LGU and national government agencies (DSWD, DOH, DepEd, and CHED, etc.) to ensure the delivery of social services			
Site Preparation Site Development	Occupational and community health and safety	Risk of construction-related accidents	B-	Pre-Construction - Integrate health, safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP - Inform the public on work schedule, planned activities and potential impacts - Conduct safety and security training for the workers Construction - Implement an Occupational and Community Safety and Health Management Plan (OCSHMP) in compliance to OSH and the WB-IFC EHS Guidelines - Implement an Emergency Preparedness and Response Plan (EPRP) to include emergency protocols and post-event monitoring for safety and well-being of workers - Assign security guards and safety officers in strategic posts and coordinate with the Philippine National Police (PNP) or LGU for police visibility - Install fencing of the construction site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public. Install and utilize security cameras at strategic places within the ROW - Provide sufficient lighting system and safety measures such as ventilation, monitoring, and emergency rescue procedures - Provide safety signages and warnings throughout all construction-affected areas especially those that are accessible to the general public - Prohibit unauthorized personnel to access the work area unless coordinated with security personnel at least one day before the visit - Conduct regular inspection and maintenance of work areas. - Place a first aid centre and provide first aid kits in strategic areas at the construction site - Hire safety officers to monitor the health and safety of the local community. If any complaints arise, immediately identify the causes and evaluate built-in measures	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan will be prepared and compliant with the applicable legal guidelines (e.g. DOH) - Limit exposure to elements, suspend construction activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin - Implement the GRM (complaints management system) including setting up of help desk - Regularly monitor and report construction-related accidents and make information available to the public			
		Exposure to contaminated soil via incidental ingestion and/or dermal contact	B-	Pre-Construction - Inform nearby communities and construction workers on the potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil Construction - Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and/or Soil Contamination Management Plan (SCMP) in consideration of arsenic exposure and incorporated with Contact Management Plan (CMP) for proper handling procedures - Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin - Implement a Dust Emission Control Plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
		Transmission of communicable diseases	B-	Pre-Construction/ Construction Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and the Pandemic Response Plan (PRP) based on international and national guidelines (i.e. IATF guidelines) to effectively respond to COVID-19 and other	Implement: - DOTr PMO - Contractor Monitor:	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

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SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				communicable diseases including protocols on personal hygiene - Implement proper solid waste management practices (e.g. regular cleaning of waterways) and awareness campaigns not only among workers but also the among the nearby communities in close coordination with the LGU - Implement daily health check (temperature, health condition, symptoms) of workers, use of PPEs, disinfection (hands, venue, equipment, etc.), social distancing - Integrate health and safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP and conduct trainings for the workers and the community - Require workers to submit medical clearances and to certify their fitness to work - Regularly maintain and sanitize work areas to help reduce bacteria, viruses, and their carriers - Lessen interaction with nearby community unless needed - Coordinate with the DOH to obtain the status and potential health risks of communicable diseases within the vicinity of the project area - Coordinate with the LGU and barangays for the preventive actions against the transmission of communicable diseases - Comply with working condition requirements in RA 11058, DOLE DO 198-2018 and DO No. 13 - Prohibit the nearby community and workers to wade or swim in floodwaters or standing water to avoid diseases	- DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB		
		Nuisance of receptors including nearby communities and construction workers due to dust, noise and vibration	B-	Construction - If loud work is unavoidable, assign restricted areas to limit noise exposure - Ensure equipment is properly maintained - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers - Provide PPEs and regular safety trainings and supervise the proper use of PPEs	Construction Implement: - Contractors - DOTr PMO Monitor: - DOTr PMO - GC	To be included in the overall project construction cost	Bid documents/ Contract agreements, EGF

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Organize work schedules and shifts to limit workers exposure to dust, noise and vibration - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible - Maintain the surface condition of access roads to reduce vibrations being transferred to plant operators - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload	- MMT/TPA, EMA - DENR-EMB		
Land Acquisition of the Project ROW	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads	A-	Pre-Construction - Maintain access or acquire the remaining land in case the residual community loses access due to the project - Compensate for additional land acquisition (including all affected structures, improvements and crops) as a result of landlock, access provision or required setback as similarly provided in the RAP entitlement matrix; Likewise, apply all relevant entitlements to eligible families and businesses to be displaced as provided for in the RAP - Conduct consultation meetings on public access arrangements and construction schedule with affected barangays and residents Construction - Provide and maintain access to the public and maintain the existing public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of construction activities, in case of any temporary closure during construction - Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs - Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts, Assign traffic guides to provide assistance to road users when necessary - Install boundary fence and restrict public use and access of the ROW. Only allow authorized personnel to access the	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				construction sites and temporary construction yards and facility areas as well as “off-limits”/ danger zones areas • Apply RAP in case of permanent loss of public access. • Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures			
Mobilization of heavy machineries and equipment and transportation of construction Workers and materials	Public access and traffic management	• Traffic congestion • Traffic accidents	B-	Pre-Construction • If required, update Traffic Impact Assessment (TIA), prepare and implement a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to construction activities (movement of construction vehicles, haulage trucks, and equipment) is minimized • Publicize the access arrangements and construction schedule to community as well as wider public for potential user of roads in the area • Coordinate with the LGU, DPWH and MMDA to ensure alternative public access for pedestrians and vehicles • Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas • Coordinate with the traffic police or employ flag persons for traffic management Construction • Disseminate information to the general public, host barangays, and LGUs on the potential impact of the project to the existing access and provide mitigating measures • Implement the Public Access and Traffic Management Plan (PATMP) to reduce traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment • Provide traffic advisory signs stating that construction is in progress and that road narrows in some sections • Provide sufficient lighting at night within and in the vicinity of the construction sites • Prohibit prolonged side street parking of construction trucks.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

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Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Schedule delivery and transport of construction materials and spoils during non-peak hours			
	Landscape value, quality	- Temporary visual blight or visual pollution due to construction facilities that may cause nuisance to people - Degradation of landscape quality due to improper handling of excavated soils	B-	Pre-Construction - Secure the necessary approvals and permits prior to establishment and operation of construction-related facilities - Coordinate with LGUs to identify minimization options, including identification of available public land where possible for access roads, material storage areas, construction yards, etc. - Select construction camps and other construction facilities at least 300m from sensitive receptors such as residential housing areas, hospitals, schools, religious and cultural sites - Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures - Record the condition of the urban landscape, roads, and other infrastructure prior to transporting materials to the project site and construction activities Construction - Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) by contractor strictly in accordance with RA 9003 - Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the construction site/yard tidy and clean and rehabilitate after construction - Use cover-ups (e.g., vertical sheets of plywood or metal fencing) and hoarding around the boundary/vicinity of the construction area. For project structures, use combination of embankment, fencing, seeding of bare soils where sites are in proximity to aesthetically sensitive sites - Implement Social Development Plan (SDP) including waste management	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
OPERATION PHASE							
THE LAND							
Train operation and maintenance	Soil quality and contamination	Soil contamination due to generation of solid wastes	B-	- Implement the Solid Waste Management Plan (SWMP) - Establish and enforce daily site clean-up procedures	Implement: Railway Operator	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Minimize the production of wastes that must be treated or eliminated - Properly sort wastes for disposal and designate an appropriate temporary storage area - Provide a Materials Recovery Facility - Provide 75-liter waste bins with covers and label at strategic locations in work areas (i.e. one every 80 square meters) for segregated storage of different types of solid wastes including hazardous wastes - Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed - Recycle wastes including soil, as much as possible - Reuse leftover concrete and metals for suitable alternative projects - Dispose non-recyclable wastes (trash bags, non-recyclable plastic, glass, non-recyclable paper) to a sanitary landfill by a licensed contractor - Conduct soil quality monitoring and disclose results to the public	Monitor: - DOTr - LGUs	(PHP 50,000/ year)	
	Soil quality and contamination	Soil contamination due to accidental spills of oils, lubricants or other chemicals, handling of generated hazardous wastes	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) for handling accidental spills and training personnel to ensure safety in the workplace and surrounding environment - Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes - Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities - Remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. Use temporary waste storage to avoid spills - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Prohibit the use of unapproved toxic materials and use properly-rated machines and equipment with certification appropriate for the task and regularly maintain all vehicles and machinery	Implement: - Railway Operator Monitor: - DOTr - LGUs TPA	To be included in the regular operation and maintenance budget (PHP 50,000/ year)	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 'Guidelines governing occupational safety and health in the construction industry' - Collect leakage during fuel refilling and repairs using containers/drip trays/drums - Regularly monitor and inspect the handling of chemicals and hazardous substances to prevent spills and other related emergencies from occurring - In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and Hazardous Waste Management Plan (HWMP) or contact the local authority for appropriate response			
	Soil quality and contamination	Due to arsenic concentration, there are potential human health impacts if humans are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	B-	- Prepare and implement the Soil Contamination Management Plan (SCMP) / Occupational and Community Health and Safety Management Plan (OCHSMP) which includes a Contact Management Plan with details on proper handling procedures - Inform workers on potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil - Provide decontamination area where personnel can clean/sanitize themselves - Encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves - Implement the Dust and Emission Control Plan to minimize dust generation - Conduct water spraying to avoid dust clouds during dry season - Conduct regular monitoring of soil contamination or visual inspection to assess the effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
Revegetation of selected areas of the SBT Section ROW	Terrestrial wildlife and vegetation	Increase biodiversity due to retention/provision of urban green spaces	C+	Implement vegetation regeneration on portions that have been completed to allow vegetation growth on some portions until the whole area (where vegetation is allowed) is re-vegetated and rehabilitated.	Implement: Railway Operator	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Train operation and maintenance		along the Project alignment ROW		- Plant in portions of the alignment where vegetation could thrive following safe operation procedures to allow plant growth and propagation naturally and/or through Assisted Natural Regeneration (ANR) for aesthetics, vegetation connectivity and wildlife passage. - Restrict access and conserve remaining vegetation within the ROW to protect remaining threatened and/or endemic species - Maintain remaining vegetation and/or vegetation that may regenerate (with due consideration of safe operations) within the ROW to provide green spaces and wildlife habitat for local biodiversity. - Conduct continuous monitoring for the following and disclose the results to the public: - project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability - the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species - In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis - Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on the result of soil nutrient analysis and investigation	Monitor: - DOTr - LGUs		
		Increase in the intensity of artificial light	B-	- Contain and monitor the effects from source of artificial light at night during operation hours - Improve vegetation that creates barrier to limit the glare coming from the artificial light - Concentrate the light on operations using directional light - Install anti-glare to the source of artificial light to regulate glare			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the project site and bring back into its natural habitat			
		Dust deposition on vegetation	B-	- During dry season, execute water sprinkling to access roads and other exposed soils at least twice in the morning and twice in the afternoon or as needed - Cover properly (with tarp) overfills and/or topsoil for transport to prevent escape of dust			
		Vehicular strikes to existing wildlife and vegetation	B-	- Strictly enforce the speed limit for vehicles along the access roads - Strictly implement policies regarding safe driving - Install proper signages to increase awareness and avoid accident			
		Intensified noise caused by anthropogenic activities	B-	- Contain effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards of all vehicles and equipment to reduce effects of noise pollution			
Train operation	Geohazard susceptibility to ground shaking and liquefaction (entire alignment is highly susceptible to liquefaction) including volcanic hazards	Liquefaction in the event of an earthquake may result to bearing failures, floatation of embedded structures, damage to overlying structures, which can lead to casualties, property damage, and disruption of operations	C-	- Conduct preventive maintenance/inspection on the integrity of structures; reinforce if necessary - Implement an Emergency Preparedness and Response Plan (EPRP) to include emergency and evacuation protocols and post-event monitoring of major ground shaking events - Conduct IEC campaign on railway structure and geologic hazards for the workers/employees, railway passengers and surrounding communities	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
THE WATER							
Train operation and maintenance	Surface water quality	Contamination of waterways with solid waste and wastewater	B-	- Implement the Effluent Management Plan - Maintain and monitor wastewater management system and the sanitation facilities - Dispose wastewater through DENR-accredited waste haulers	Implement: Railway Operator	To be included in the regular operation and maintenance budget	EGF / Operational Budget

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Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Prohibit the local community and employees from disposing wastes in South Antipolo Canal and Antipolo Creek - Secure necessary discharge and/or wastewater permits from DENR - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal to the waterways - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Monitor: - DOTr - LGUs		
	Surface water quality (especially Antipolo Creek during TSS-1 maintenance)	Contamination of waterways due to accidental spills of oils, lubricants or other chemicals, and generation of hazardous wastes	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) - Prepare a procedure manual for workers to prevent oil and chemical spills and also provide regular training to workers on proper handling and disposal to keep working and surrounding environment in good condition - Properly handle and dispose potential contaminants through DENR-accredited hazardous waste haulers - Secure DENR permits such as Discharge Permit (DP), Hazardous Waste Generator ID HWID), Permit to Transport (PTT) and Hazardous Waste Manifest from DENR prior to disposal - Prohibit the use of unapproved toxic materials - Use properly-rated machines and equipment appropriate for the task and regular proper maintenance of all vehicles and machinery - Collect leakage during fuel refilling and repairs using containers/drip trays - Provide oil and water separator or spill containment to address possible impact of oil spill and leaks from oil-filled substation (TSS-1) components (e.g., transformer, reactors, regulators) - Store bulk waste oils and lubricants (i.e., 110% of waste volume capacity) in properly labelled containers - Conduct IEC campaign and community awareness initiatives in partnership with the LGU to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities (residential areas and commercial establishments) along waterways	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget (PHP 50,000/ year)	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP - Provide signages, fire extinguishers, barricades and controlled access - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
	Flood hazard susceptibility	Potential flooding affecting TSS-1 operations	B-	- Conduct regular inspection and clearing of drainage to avoid blockage of existing drains - Implement the Flood Management Plan (FMP) to include details on the installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures - Enhance the capacity of the drainage system or provide alternative drains to prevent drainage overflow and prevent floodwaters from encroaching TSS-1 - Conduct IEC campaign and community awareness initiatives in partnership with the LGU to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities (residential areas and commercial establishments) along waterways - Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
THE AIR							
Train operation	Climate change	Overheating, thermal expansion, signalling problems and heat stress due to temperature increase Drainage overflow, slower drainage, ground	C-	- Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology - Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety plans such as EPRP and OCHSMP - Establish and maintain a GHG inventory database to track GHG emissions during operation and to keep GHG emission reduction targets and mitigation options updated throughout the project duration	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		subsidence, flooding and train operation disruption and restrictions due to precipitation increase Infrastructure damage, drainage overflow and train operation disruption and restrictions due to more frequent and intensified extreme weather events		• Conduct regular inspection and proper maintenance of all operation equipment, machineries, facilities (e.g. drainage system) and other railway assets (e.g. tracks, substation, viaduct piers) to ensure optimum working condition • Plant vegetation in open spaces along the SBT Section • Install improvements to the railway system to be more resilient to climate change impacts in case of significant damages during operation • Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary including but not limited to comprehensive management systems to address climate adaptation, risk-identification processes and climate-related risks and mitigating measures integrated into the project's decisions throughout the project life			
		GHG emissions reductions due to modal shift	A+	• Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology • Provide incentives and/or IEC activities on the benefits of the Project in reducing GHG emissions to encourage commuters to use rail transit • Establish and maintain a GHG inventory database to track GHG emissions during operation and to keep GHG emission reduction targets and mitigation options updated throughout the project duration • Develop strategies to further reduce GHG emissions that include addressing the anticipated traffic congestion expected to occur in areas adjacent to the SBT Section that links Solis, Blumentritt and Tutuban stations due to pick-up and drop off of passengers by transport vehicles • Monitor and ensure continual improvement of railway services including increasing trips to increase train ridership and conduct regular inspection and proper maintenance of the railway system and facilities to ensure the efficient transport of goods and services, to encourage the use of environmentally	Implement: • Railway Operator Monitor: • DOTr • LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				sustainable transport and to reduce public dependence on motor vehicles Conduct energy/ water conservation program such as use energy efficient products (i.e. LED lights) and monitor carbon footprint			
	Air quality	Degradation of air quality in the vicinity of the SBT Section and increase in vehicle exhaust emissions and entrained dust due to increased movement of people Emissions of fugitive dusts, particulate and gaseous pollutants	A-	- Use fuel-efficient and properly-rated stationary equipment or facilities - Conduct regular maintenance and check up of equipment, machineries, service vehicles and facilities such as generator sets to meet the DENR Emission Standard - Conduct regular cleaning and clearing of internal roads from dirt and spoils and frequent wetting of ground in TSS-1 area or where vehicles frequent within the project vicinity - Comply with environmental permitting requirements and provide appropriate PPE for the concerned personnel - Control service vehicle movement by maintaining the speed limit - Monitor air quality at the identified sampling stations and disclose the result to the public. Evaluate effectiveness of the mitigation measures provided and apply further mitigation measures and/ or revise current measures	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
Train operation (including TSS-1)	Ambient noise	The operation of the rail corridor causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	B-	- Optimize the number of train operation and train speed at night time to reduce generated noise. - Use ballastless track with elastic and absorbent sleeper supports to minimize noise generation from train operation - Provide noise control device such as muffler to all stationary sources (i.e. generator set) - Install traffic signs in the areas before and after passing SBT Section, e.g. directional signs, speed limit signs, no blowing of horn signs, etc. - Install a 1.5-meter-high sound-absorbing noise barrier extending the length of the SBT project alignment. Locate barriers on both sides of each rail viaduct to achieve compliance with project criteria at nearby residential receptors. Ensure that the inward facing wall of the barrier are acoustically absorptive to reduce reflections.	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Conduct regular inspection, proper maintenance and reconditioning of trains and tracks. - Monitor noise levels at identified sampling points including nearby sensitive receptors likely to be affected by the operation and evaluate effectiveness of the noise reduction measures provided and modify as needed. Disclose results to the public. - Monitor the complaints and resolutions taken based on the established GRM.			
		The operation of the TSS-1 causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	B-	- Design to ensure that fixed mechanical plant and equipment associated with the substation can achieve the WBG EHS, whichever is more stringent - Enclose significant noise generating equipment within sealed concrete enclosure - Duct supply air fans (i.e. not mounted on the facade or roof) - Seal well the doors that open to the environment - Conduct regular monitoring and compliance to WBG for rail operation and disclose results to the public - Evaluate effectiveness of the noise reduction measures provided and apply further mitigation measures and/ or revised current measures			
	Ambient vibration	Vibration at sensitive receptors generated by the operation of Project causes human disturbance.	C-	- Regularly check and maintain vibration-reducing elastic sleeper track - Conduct regular inspection, proper maintenance and reconditioning of trains and tracks such as rail grinding, slip-slide detectors and maintenance or replacement of suspension system, brakes and wheels - Monitor vibration levels including identified nearby sensitive receptors, historical heritages including ecologically significant area/s (if any) likely to be affected by the operation and evaluate the compliance with the FTA criteria and disclose the results to public - Evaluate effectiveness of the vibration reduction measures provided and apply further mitigation measures as recommended in the FTA Manual (i.e., standard and non-standard methods) if current measures are ineffective	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		The operation of the TSS-1 causes an increase in vibration affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	C-	Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance			
THE PEOPLE							
Train operation	Public Participation and Information Disclosure	Conflict of interest and low social acceptability	A-	Conduct regular consultations with affected people and relevant offices/agencies during operation phase to ensure adequate and timely mitigation of adverse project impacts	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget PhP 1,500 per work hour	EGF / Operational Budget
	Land acquisition and utilization and involuntary resettlement	Displacement of PAPs (informal settler families (ISFs) and other non-landowners Removal/ relocation of project affected structures Conflict in land ownership, change in land use and relocation of landowners	A-	- Maximize the use of existing PNR ROW and minimize additional land acquisition - Continue to implement and monitor the Resettlement Action Plan (RAP) with Livelihood Restoration and Improvement Program (LRIP) to ensure assistance to displaced persons through restoration or improvement of their pre-project living standards, income-earning capacity and production levels. Disclose result to the public. - Coordinate with the LGU for the updating of land use classification and local zoning - Coordinate with other stakeholders such as MERALCO for the existing substation and DPWH for other infrastructure projects - Implement Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder groups - Conduct meaningful public consultations and information disclosure	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Land acquisition and utilization	Potential conflict among PAFs and other government	A-	Continue implementation of RAP with close coordination on financial assistance arrangements with DPWH, and other agencies with ongoing infrastructure projects that share impact	Implement: Railway Operator	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	and involuntary resettlement	infrastructure projects		areas with the SBT Section in terms of PAFs and ROW. Ensure PAFs/PAPs are compensated the same entitlements for SBT Section. Where required, DOTr is to top up the gap to meet the entitlement of the SBT Section. - If PAFs raise issues, ensure prompt response and resolution per established GRM - Conduct monitoring to ensure that land acquisition and displacement activities are conducted in compliance to the RAP	Monitor: - DOTr - LGUs		
	Visual aesthetics	Impairment of visual aesthetics	C-	Planting of trees to minimize the visual impact by the Project and harmonize with the surrounding environments in open areas within the ROW to create a green corridor	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	In-migration	Encroachment/ Proliferation of ISFs	B+/-	- Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW - Only allow authorized personnel to access the ROW - Timely inspect the condition of the boundary fence	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Cultural/ lifestyle change	Cultural and lifestyle change of community members of the localities where the Project will be situated and where the PAPs will be resettled	C-	- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Continue to monitor and coordinate with the sending LGU and receiving LGU for assistance arrangements to ensure the restoration and/or improvement of the livelihood and living conditions of the PAPs	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		Paradigm shift to a low-carbon and eco-efficient lifestyle due to a more environment-friendly and efficient transport	A+	- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Pursue policy interventions and new market mechanisms to motivate citizens and companies to shift from a business-as-usual economic setting to a sustainable and climate-resilient economy	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Local economy, employment and livelihood, in-migration	Generation of local employment and business opportunities	A+	- Prioritize hiring qualified locals as employees of the TSS-1 in coordination with the host LGU - Ensure equal participation of women and men in all employment/ business opportunities arising from the Project - Monitor the implementation and effectiveness of the LRIP and project impact to the local economy as applicable: - Eligible PAPs assisted in finding new location for business and in availing soft loans - Businesses for relocation and PAPs with movable business asset provided with transportation allowance and/or assistance - Vulnerable households assisted in re-establishing their livelihood in the relocation site - Eligible PAPs/businesses losing income during transition period (not exceeding 6 months) provided with income loss compensation	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Vulnerable groups, gender and children's rights	Threat to train safety and accessibility and convenience to all users	A-	- Provide train system (station and trains) to account for the needs of women, allocation of trains for women (especially those pregnant), senior citizens, children, and persons with disability including allocation of visible security officers - Provide adequate security personnel and sufficient lighting to ensure safety and security - Install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. CCTV system and sufficient lighting for security purposes) - Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation - Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities - Monitor the train user environments, LRIP, work environment / employment status. If measures is not effective, revise and provide supplement measures	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Cultural heritage	Damage / destruction risk to physical cultural resources	B-	- If cultural resources are discovered during operation that are within the standard distance of 0.10 km from the ROW, prepare an outline protection plan including methodology and drawings showing discovered cultural resource/ historical structure and proposed protection to prevent damage risk due to railway vibration and seek the approval of CAs and PNR - Conduct baseline vibration survey or any additional survey upon the request of CAs to determine appropriate mitigating measure and implement periodic monitoring of impacts to cultural resources - Continue conservation activities of old PNR structures in coordination with PNR and LGUs	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Public utilities	Disruption in public utility services, Increased demand for local resources, resource depletion (solid waste generation)	C-	- Timely coordinate with affected utility companies to avoid service interruption in nearby communities during operation as the railway system will heavily rely on electricity supply - Issue public notices or announcements in advance regarding temporary disruption of services - Install energy-efficient equipment and water saving fixtures - Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section - Use back-up generators during power interruption - Implement Energy/Water Conservation Program - Monitor power, fuel and water consumption and solid waste generation and disposal	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Occupational and community health and safety	Risk of railway accidents	B-	- Prepare and implement train safety operations plan - Train workers and staff on implementation of the operations particularly in TSS-1 operations - Conduct drills on emergency situations at least once a year through professional experts - Conduct internal safety audits at least every six months. - Conduct full audit of the fire protection system every month and conduct daily random checks - Implement the GRM (complaints management system) with complaint desks at all stations	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		Exposure to contaminated soil	B-	Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and/or Soil Contamination			

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		via incidental ingestion and/or dermal contact		Management Plan (SCMP) in consideration of exposure to contaminated soil and incorporated with Contact Management Plan (CMP) for proper handling procedures Implement a Dust Control Plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures			
		Transmission of communicable diseases	B-	- Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers - Prepare and implement Occupational and Community Health and Safety Management Plan (OCHSMP) and Pandemic Response Plan (PRP) compliant with national and international guidelines - Ensure working conditions comply with RA 11058, DOLE DO 198-2018 and DO No. 13			
		Nuisance to receptors due to dust, noise and vibration	B-	- Provide protection walls and/or noise barriers - Install a 1.5-meter-high sound-absorbing noise barrier extending the length of the SBT project alignment. - Develop and prepare Operational Noise and Vibration Management Plan and secure out-of-hours permit as necessary - Conduct public consultation and information disclosure and prepare/implement GRM procedures			
Train operation (Operation of the access road to MERALCO substation and realigned Old Antipolo Street)	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads improved public accessibility due to opening of access roads affected during construction	B-	- Ensure accessibility and avoid blocking existing access roads traversing the SBT Section ROW (Hermosa Street, Solis Street and Raxabago/Yuseco Street) as well as the surrounding public access roads including access roads which were temporarily closed during construction - Restrict public use and access of SBT Section ROW except road crossings - Update the Public Access and Traffic Management Plan (PATMP) for the SBT Section / NSCR Project and coordinate with the LGU for the incorporation of public access and traffic management concerns into the LGU TMP - Maintain the relocated Old Antipolo Street and the new access road for MERALCO substation and Triangle Area in coordination with DPWH and other concerned agencies.	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Conduct public consultation and information disclosure and prepare/implement GRM procedure			
		Traffic congestion due to road crossings surrounding the SBT Section that links Solis, Blumentritt and Tutuban stations	B-	- Participate in interagency cooperation and coordination between and among LGU, DOTr, DPWH, and other NGAs in the updating the overall LGU TMP covering identification of alternative traffic routes and traffic flow schemes and closely coordinate with barangay LGUs (BLGUs) on concerns that may affect the traffic flow - Prepare and implement a Public Access and Traffic Management Plan (PATMP) in consideration of the TIA for the project and in consultation with concerned traffic agencies, local officials and the general public - Coordinate with the PNP and LGU for traffic management especially during peak hours			
		Improved interoperability and connectivity	A+				
	Landscape value, quality	Temporary visual blight or visual pollution due to construction facilities that may cause nuisance to people Change in landscape quality and value	B-	- Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures - Ensure that the railway structures aesthetically blend with the general landscape of the area in scale, color, and shape - Ensure cleanliness of facilities and substation area through the implementation of Solid Waste Management Plan (SWMP) - Consider the rail corridor in Transit-Oriented Development (TOD) of nearest stations to increase land use efficiency, discourage urban sprawl leading to informal settlements along the ROW and promote sense of uniqueness of the place	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
ABANDONMENT PHASE							
THE LAND							
Demolition of railway structures and abandonment	Soil quality and contamination	Soil erosion and contamination due to generated excess soil or spoils	B-	- Implement the Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and sedimentation and Spoil Management Plan (SMP) to properly handle, transport and dispose spoils (including identification of haul routes, truck queuing and parking procedures for dust control and mud-tracking prevention) - Minimize ground subsidence, maintain excavated/demolished materials at all times and install engineering interventions such as slope protection and drainage systems with sedimentation/ erosion pond and temporary ditches around work areas to	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- collect sediments from erosion or use bunds and silt fences to protect watercourses from soil run-off during the wet season - Schedule clearing, excavation and/or demolition activities in a speedy manner during dry season and minimize demolition during wet season - Place excavated/demolition materials including excess soil/spoils on appropriate in spoils area with adequate containment away from waterways - For stockpiles of excavated soil and materials, cover and limit at height up to 2 m and install silt traps, deviation channels, mounting, barriers or trenches around the stockpiles. For spoils, immediately haul out and remove from the demolition site and transport to the disposal site especially prior to expected rains. Ensure wet/damp soils are sufficiently dry prior to transport - Regularly clean and clear the demolition areas and road surfaces with dust/excavated/demolished materials and scraps to avoid obstruction of natural flow especially during the wet season - In case long-term storage is required during wet season, grade soil storage heaps to flat tops and cover or vegetate with soil stabilizing grasses - Monitor visible signs of erosion for the disposal and management of spoils			
		Generation of solid wastes	B-	- Prepare and implement a Solid Waste Management Plan (SWMP) as part of Abandonment Plan - Establish and enforce daily site clean-up procedures - Minimize the production of wastes that must be treated or eliminated - Properly sort wastes for disposal and designate an appropriate temporary storage area - Provide a Materials Recovery Facility - Provide 75-liter waste bins with covers and label at strategic locations in work areas (i.e., one every 80 square meters) for segregated storage of different types of solid wastes, including hazardous wastes - Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed in these	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Recycle wastes including soil, as much as possible - Reuse leftover concrete and metals for suitable alternative projects - Dispose non-recyclable wastes through a licensed contractor. - Conduct soil quality and contamination monitoring and disclose all monitoring results to the public			
	Soil quality and contamination	Due to arsenic concentrations, there are potential human health impacts if humans are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	B-	- Inform workers and community on potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil - Provide decontamination area (i.e. area where personnel can clean/sanitize themselves) - Encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves - Implement a Dust and Emission Control Plan to minimize dust generation and assess effectivity of dust control measures to prevent exposure to contaminated soil. Undertake immediate action to reduce health hazard. - Conduct water spraying to avoid dust clouds during dry season. Conduct regular monitoring or visual inspection to assess effectivity of dust control measures - Prepare and implement Soil Contamination Management Plan (SCMP), Contact Management Plan (CMP) and Occupational and Community Health and Safety Management Plan (OCHSMP) as part of the Abandonment Plan - Conduct regular monitoring of soil contamination and visual inspection to assess the effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Use of oil, lubricants, and other chemicals during abandonment activities	Soil quality and contamination	Soil contamination due to accidental spills of oil, lubricants, or other chemicals Generation of hazardous wastes	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) as part of the Abandonment Plan - Properly handle and dispose potential contaminants coming from demolition sites through DENR-accredited hazardous waste haulers	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes - Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Prohibit the use of unapproved toxic materials - Use properly-rated machines and equipment with applicable certification appropriate for the task and regularly maintain all vehicles and machinery - Deploy heavy equipment operators with certification and conduct safety induction and training for the workers - Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 - Use oil and grease traps, and drip containers or trays to prevent leaks during fuel refilling, repair or demolition activities - In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and WMP or contact the local authority for appropriate response			
Demolition of railway structures and abandonment	Terrestrial wildlife and vegetation	Dust deposition on vegetation	B-	- Properly cover overfills, topsoil/ soils, spoils, and demolition materials onsite as well as equipment, trucks and vehicles for the transport of materials to prevent escape of dust - Execute water sprinkling in access roads and areas with exposed soils or dust-generating materials or equipment at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Terrestrial wildlife and vegetation	Vehicular strikes to wildlife and vegetation	B-	- Strictly enforce the speed limit for vehicles along the access roads - Strictly implement policies on safe driving - Install proper signages to increase awareness and avoid accidents	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

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North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Demolition of railway structures and abandonment	Terrestrial wildlife	Intensified noise caused by anthropogenic activities	B-	- Contain effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards of all vehicles and heavy equipment to reduce effects of noise pollution	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Terrestrial wildlife	Increase in the intensity of artificial light	B-	- Contain and monitor the effects from source of artificial light at night during demolition work hours - Improve vegetation that creates barrier to limit the glare coming from the artificial light - Concentrate the light on operations using directional light - Install anti-glare to the source of artificial light to regulate glare - In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the demolition site and bring back to its natural habitat	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Clearing of ROW and re-vegetation of selected areas of the SBT Section ROW	Terrestrial wildlife and vegetation	Increase biodiversity due to retention/provision of urban green spaces along the Project alignment ROW	C+	- Restrict access and conserve remaining vegetation within the ROW to provide protection for the remaining threatened and/or endemic species - Monitor the following and disclose the results to the public: - project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability - the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species - In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis - Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on result of soil nutrient analysis and investigation	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
THE WATER							
Demolition of railway structures	Surface water quality	Siltation and sedimentation of waterways due to debris and demolition works	B-	- Implement applicable erosion prevention and sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in demolition site entrances and exits) based on Erosion and Sediment Control Plan (ESCP) - Construct temporary facilities above flood levels and place machineries in a dry storage area at all times - Maintain and protect drainage channels to prevent drainage capacity overflow due to excess water during demolition - Limit stockpile height of dust/ excavated/ demolished materials to 2 m only, cover stockpiles and immediately remove loose earth materials from the site especially before expected heavy rains - Periodically remove sediments from the sediment traps and properly dispose off-site. If sediments have entered the surrounding waterways from surface runoff and streambank erosions, conduct dredging and clean up the waterways - Monitor visible signs of siltation and sedimentation and disposal activities - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Use of oil, lubricants, and other chemicals during demolition activities	Surface water quality	Contamination of waterways due to accidental spills of oil, lubricants, or other chemicals and generation of hazardous wastes	B-	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) as part of the Abandonment Plan - Properly handle and dispose potential contaminants coming from demolition sites through DENR-accredited hazardous waste haulers - Secure appropriate DENR permits such as Discharge Permit (DP), Hazardous Waste Generator ID (HWID), Permit to Transport (PTT) and Hazardous Waste Manifest prior to disposal of hazardous wastes - Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities - Provide proper roofing and concrete-paved floor with proper chemical-proofing to avoid permeation of chemicals. Remove petroleum products and other hazardous chemicals and transfer	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

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Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				to a localized area as much as possible. Use temporary waste storage to avoid spills • Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills • Prohibit the use of unapproved toxic materials • Use properly-rated machines and equipment with applicable certification appropriate for the task and regularly maintain all vehicles and machinery • Deploy heavy equipment operators with certification and conduct safety induction and training for the workers • Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 • Provide oil and grease traps • Collect leakage during fuel refilling and repairs using containers/drip trays • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
Demolition of railway structures	Flood hazard susceptibility	Flooding during demolition works	B-	• Implement the Emergency Preparedness and Response Plan (EPRP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones in consideration of flooding induced by climate change such as extreme weather events • Implement the Flood Management Plan (FMP) to include details on proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures • Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal into the waterways to prevent water pollution, flooding and drainage overflow • Install and maintain sufficient and effective drainage and/or dewatering system with drain channels and sumps to facilitate proper drainage of excess water and to regularly remove water that accumulate in pits, excavations, and other depressions • Construct temporary demolition facilities above flood levels, place machineries and equipment in dry storage area at all	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				times and insulate electrical wirings and sources away from wet working areas and flood-prone zones • Conduct cleaning or declogging of waterways as necessary to avoid blockage of existing drains or provide alternative drains should there be unavoidable blockage of existing drains • Provide erosion and sediment controls such as slope protection, silt screens, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways • Properly handle waste bentonite slurry in accordance with RA 9003 and temporarily store in bentonite tanks to prevent siltation			
THE AIR							
Demolition of railway structures and abandonment	Climate change	Injury, property damage, or disruption of activities due to susceptibility to flooding, tropical cyclone or strong wind	C-	• Prepare and implement a CCAM Plan and/or an Emergency Preparedness and Response Plan (EPRP) as part of the Abandonment Plan in consideration of climate change impacts and including appropriate operation protocols for each PAGASA warning signal for tropical cyclones • Conduct CRVA to provide information useful to relevant stakeholders to understand vulnerability of climate change and adaptation options • Monitor implementation of CCAM Plan as necessary	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Use of equipment and other dust-generating demolition activities	Air quality	Emissions of fugitive dusts, particulate, and gaseous pollutants	B-	• Implement Dust and Emission Control Plan (DECP) • Incorporate traffic management guidelines in worker's and EPC contractor's induction seminar • Provide workers with appropriate PPEs and implement safety protocols pursuant to RA 11058 and its IRR (DO 2018-198), and DOLE-BWC DO 1998-13 to protect them from disease associated with dusts • Manage vehicle speeds and impose speed limits of 10 km/hr in demolition areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/ municipal roads in accordance to JMC 2018-001 (Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data) to trucks that carry materials • Maximize fuel efficiency through scheduling of vehicle and equipment movements in order to minimize both idle time and distances travelled • Prohibit trucks and vehicles to idle on site or roads while waiting	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Closely monitor equipment dispatch in order to eliminate unnecessary use and to increase efficiency of use - Undergo the mandatory government vehicle emission tests for contractors' vehicles and demolition equipment - Properly maintain the vehicles to ensure that emissions are within air pollution targets - Execute water sprinkling of access roads, stockpiles and areas with exposed soils or dust-generating materials or equipment whenever visible dust is observed or at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area - Provide adequate buffer zones and install perimeter fence and screens - Put covers on excavated soil and hauling trucks - Regularly monitor emissions of fugitive dusts, particulate and gaseous pollutants) and disclose all monitoring results to the public			
Demolition activities and mobilization of heavy machineries and equipment	Ambient noise	General demolition works produces noise levels that affect the amenity at nearby sensitive receptors	B-	- Prepare and implement a Noise and Vibration Management Plan as part of the Abandonment Plan, including good practice noise and vibration management techniques - Locate site buildings or walled enclosures around especially noisy activities or clusters of fixed noisy demolition equipment - Where practicable, limit heavy demolition vehicle movements to normal working hours and design traffic routes to limit the amount of accelerating and braking and avoid local roads, where practicable - Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works - Monitor noise levels and evaluate compliance with WBG EHS and Japanese Guidelines and disclose all monitoring results to the public	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Ambient vibration	Vibration from demolition works causes human disturbance, and	B-	- Implement a Noise and Vibration Management Plan (to be included as part of the Abandonment Plan), including good practice noise and vibration management techniques - Plan the demolition schedule such that high levels of vibration only occur during the day where feasible	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

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Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		structural damage to buildings		- Substitute demolition methods to emit lower vibration levels were feasible, e.g. smaller vibratory rollers - Design coordination and project layout so that heavy vehicles and activities are located as far from sensitive buildings as possible - Conduct pre-condition assessments of residential and other sensitive assets prior to demolition works where these works are located within 10 meters of buildings sensitive to vibration (greater distances may need to be considered if the abandonment plan changes) - Conduct compliance monitoring where safe working distances cannot be maintained to demonstrate compliance or trigger further mitigation measures to reduce vibration where levels exceed acceptable thresholds - Regularly monitor vibration levels, evaluate compliance with WBG EHS and FTA guidelines and disclose all monitoring results to the public			
	Ambient noise and vibration	Noise and vibration generated by demolition works and impact on workers	B-	- Provide training on noise and vibration mitigation and require workers to wear appropriate PPE including ear plugs or ear muffs - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole body vibration (e.g. operating excavators) and reduce exposure duration for high vibration tasks; If loud work is unavoidable, assign restricted areas to limit noise exposure; Rotate workers and organize work schedules so worker exposure to hazardous noise is limited - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload - Substitute high vibration tools for vibration-reduced tools where possible - Regularly maintain vehicles, machineries and other equipment as well as surface conditions of access roads - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers and Contractors	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
THE PEOPLE							
Demolition of railway structures and abandonment	Land use and classification	Incompatibility with existing land use, Change in land use	C-	- Conduct public consultations for the appropriate use and management of the ROW after the demolition - Reinstate the land to agreed conditions in coordination with the lot owners, LGUs, other relevant agencies and concerned stakeholders in acquiring and/or securing the ROW	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Public participation and information disclosure	Conflict of interest or low social acceptability	A+	- Prepare a detailed Abandonment Plan for DENR/EMB approval - Conduct regular consultations with the affected LGU, community and relevant government agencies to ensure adequate and timely mitigation of adverse project impacts - Conduct public consultation and information disclosure activities on demolition schedule and potential impacts using all media - Implement the Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve complaints of the communities and stakeholder groups - Install notice boards at the demolition site that indicate the contact details of the responsible party tasked to receive and document complaints	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Local economy, employment and livelihood	Disruption of livelihood, local business and economy Generation of livelihood, employment and business opportunities	A+/-	- Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs - Establish a referral system prior to retrenchment and closure. - Provide alternative livelihood or employment program in coordination with the LGU and relevant government agencies for affected railway employees - Provide alternative access for affected businesses and directional signboards to ensure continuous business operations - Undertake demolition activities at the shortest possible time to restore normal business operations within the project vicinity	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	In-migration	Encroachment/proliferation of ISFs	B-	- Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW even after the completion of demolition works - Implement proper land use planning (designation to new land use, as needed), and turnover of ROW to LGU or relevant NGA for management	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				Closely coordinate with the host LGUs specifically at the barangay level regarding the hiring of regular workers to ensure that the workers are considered as legitimate residents in the area			
	Vulnerable groups, gender and children's rights	Greater challenges in re-establishing living standards, Additional hardship due to vulnerability	A-	- Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation - Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the demolition activities - Monitor compliance to manpower requirements in terms of work environment / employment status and disclose all monitoring results to the public	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Occupational and community health and safety	Risk of demolition-related accidents	B-	- Prepare and implement Occupational and Community Health and Safety Management Plan (OCHSMP) and Emergency Preparedness and Response Plan (EPRP) to include safety and security policies and procedures - Install fencing of the demolition site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public - Use proper PPEs and install signages within the demolition area - Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan will be prepared and compliant with the applicable legal guidelines (e.g. DOH) - Provide sufficient lighting system and safety measures such as venting, monitoring, and emergency rescue procedures - Limit exposure to elements, suspend demolition activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin - Appoint an environment, health, and safety officer to supervise the implementation of environmental mitigation measures and to ensure that health and safety measures are strictly implemented at the demolition site and immediate vicinity	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

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SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Establish Health and Safety Desk or Medical Station at strategic sites to monitor and safeguard the health of the workers and local residents (if applicable) and provide immediate response as per Emergency Preparedness and Response Plan (EPRP) during emergencies - Implement the GRM (complaints management system) including setting up of help desk - Monitor demolition-related accidents among the workers and the community and disclose results for appropriate action - Immediately inspect areas where accidents happen, determine/ investigate the cause and apply corrective actions to prevent similar events in the future			
		Exposure to contaminated soil via incidental ingestion and/or dermal contact	B-	- Prepare and implement a Soil Contamination Management Plan (SCMP) and Occupational and Community Health and Safety Management Plan (OCHSMP) incorporated with Contact Management Plan (CMP) as part of Abandonment Plan - Inform nearby communities and workers on the potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil - Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin - Implement a dust control plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
		Transmission of communicable diseases	B-	- Prepare and implement OCSHMP and Pandemic Response Plan (PRP) compliant with national and international guidelines. - Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers. - Comply with working condition requirements or guidelines governing occupational safety and health - Interact less with nearby community unless needed and following appropriate protocols	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Require workers to undertake/ submit fitness-to-work certification prior to demolition works and medical clearances will be required after a sick leave - Conduct health and safety trainings for workers - Ensure adequate health and safety considerations in the Social Development Plan (SDP) for the community			
		Nuisance to receptors due to dust, noise and vibration	B-	- Implement Noise and Vibration Management Plan and Dust Emission Control Plan - If loud work is unavoidable, assign restricted areas to limit noise exposure - Ensure equipment is properly maintained - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers - Provide PPEs and regular safety trainings for workers and supervise the proper use of PPEs - Organize work schedules and shifts to limit workers exposure to dust, noise and vibration hazards - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible - Maintain the surface condition of access roads to reduce vibrations being transferred - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads	A-	- Provide and maintain public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of demolition activities in case of any temporary road closure - Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts - Restrict public use and access of the ROW by Installing boundary fence and "off-limits"/ danger zones areas - Only allow authorized personnel to access the demolition site - Assign traffic guides to provide assistance to road users when necessary - Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures			
		Traffic congestion and accidents	B-	- Implement a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to demolition activities (movement of construction vehicles, haulage trucks, and equipment) is minimized - Disseminate information on potential impacts, mitigation, access arrangements and construction schedule to community as well as wider public for potential user of roads in the area - Coordinate with the LGU, DPWH and MMDA to ensure alternative public access for pedestrians and vehicles - Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas - Coordinate with the traffic police or employ flag persons for traffic management - Provide traffic advisory signs stating that demolition is in progress and that road narrows in some sections - Provide sufficient lighting at night within and in the vicinity of the construction sites - Prohibit prolonged side street parking of demolition trucks. - Schedule delivery and transport of demolition materials and spoils during non-peak hours	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
Demolition of railway structures	Landscape value, quality	Temporary visual blight or visual pollution due to	B-	Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) in accordance with RA 9003	- DOTr - Contractor	To be included in the Contractor's service fee	Contract Agreement

Environmental Aspect	Environmental Component	Potential Impact	Impact Significance	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
and abandonment		demolition activities Degradation of landscape quality and value due to improper handling of excavated soils		• Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the demolition area clean and rehabilitate after demolition/ before abandonment • Use cover-ups (e.g., vertical sheets of plywood or metal fencing) around the demolition area, as necessary, that will aesthetically blend with the general landscape of the area or use seeding of bare soils where sites are in proximity to aesthetically sensitive sites • Implement Social Development Plan (SDP) including waste management		as part of the Abandonment Cost	

Note:

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

8 ENVIRONMENTAL COMPLIANCE MONITORING

958. The section describes the framework for environmental compliance monitoring and environmental performance indicators to be implemented for the SBT Section as required by DENR Administrative Order 2003-30 (DAO 2003-30), Implementing Rules and Regulations of Presidential Decree No. 1586, Establishing the Philippine Environmental Impact Statement System, and DENR Administrative Order 2017-15 (DAO 2017-15), Guidelines on Public Participation under the Philippine Environmental Impact Statement System. The framework covers the Self-Monitoring Plan or the Environmental Monitoring Plan (EMoP) of the DOTr, the engagement of a Third-Party Auditor (TPA) to comply with PEISS requirements and the External Monitoring Agency (EMA) to comply with JICA Guidelines. The establishment of an Environmental Monitoring Fund (EMF) and Environmental Guarantee Fund (EGF) is also covered as part of the commitments of DOTr.

959. The objective of conducting environmental monitoring for the Project is to ascertain compliance with conditions in the Environmental Compliance Certificate (ECC), applicable environmental standards and policies, management plans, and other commitments made in this EIS. The monitoring program also determines any changes in the baseline data and serves as a feedback mechanism for mitigation measures that may require corrective actions if found inadequate or unsuitable based on the requirements of Philippines regulations and JICA safeguard policies. In addition, any changes in the project design and specifications are required to be reflected on this live document. The EMoP for the SBT Section is integrated in the overall EMoP for NSCR Project (Annex H-1). Along with the Environmental Management Plan (EMP), the EMoP is for inclusion in the bidding documents for the Project to ensure complete implementation and full compliance of the Contractors.

8.1 ENVIRONMENTAL MONITORING REPORT REQUIREMENTS

960. **Table 8.1.1** summarizes the environmental monitoring reports, its frequency, and the persons responsible in preparation thereof. Six types of reports are to be prepared and submitted; one to the contractor, three to the DENR-EMB, and two to JICA. Succeeding sections detail the requirements for the reports.

Table 8.1.1 Environmental Monitoring Report Requirements

Report type	Description	Responsible party	Frequency	Submit to
Walkthrough Report	Internal audit of the Contractor's implementation of CEMMP on site	Consultant/PMO (during construction)	Monthly	Contractors
Self-Monitoring Report (SMR)	Information about the Project's compliance with environmental standards specific to environmental laws.	Contractor (during construction); Concessionaire/ Operator (during operation)	Quarterly	DENR-EMB
ECC Compliance Monitoring Report	Information about the Project's performance in terms of its ECC conditions, EMP, and performance against the monitoring of actual impacts as against predicted impacts in the EIA and as related to current project operations	PMO/DOTr	Semi-annually	DENR-EMB
Audit Report (instead of CMVR)	- Compliance with ECC, EMoP, E/IMP; Conditionalities during construction including advance works - Proponent's conduct of self-monitoring and Contractor's compliance on the approved CEMMP during construction including advance works	TPA & PMO	Semi-annually, quarterly	DENR-EMB
Project Status Report (PSR) for Social and Environmental Considerations	Information about the Project's compliance to its EMP and EMoP	PMO	Quarterly	JICA

Report type	Description	Responsible party	Frequency	Submit to
External Environmental Monitoring Report (EEMR) or External Monitoring Audit Report (EMAR)	Independent verification of the project's compliance with its EMP/EMoP, ECC conditions, JICA Guidelines (2010) and WBG EHS Guidelines	TPA/EMA à PMO	Semi-annually	JICA

Source: Department of Transportation (2022)

8.2 SELF-MONITORING PLAN

961. Project proponents who have been issued Environmental Compliance Certificates (ECCs) are primarily responsible for monitoring their projects as per the Revised Procedural Manual for DAO 2003-30 (EMB MC 2007-002). The DOTr implements a monitoring program for the SBT Section as part of the overall monitoring program for the NSCR Project, to ensure that the identified project impacts comply with the proposed management measures and relevant regulatory requirements. Monitoring activities are conducted by trained specialists in each discipline.

962. Two types of monitoring reports are required to be submitted to DENR-EMB once the Project commences. These include:

- Self-Monitoring Report (SMR) – The SMR provides information about the Project's compliance with environmental standards specific to environmental laws. It is submitted on a quarterly basis to DENR-EMB; and
- ECC Compliance Monitoring Report (CMR) – The CMR provides information about the Project's performance in terms of its ECC conditions, its Environmental Management Plan (EMP), and its performance against the monitoring of actual impacts as against predicted impacts in the EIA and as related to current project operations. The CMR is submitted to the DENR-EMB semi-annually. The first CMR is submitted mid-year after the start of project implementation, except for ECC commitments/conditions, which need to be submitted prior to project start-up.

963. The CMR and SMR during the construction phase and operation phase are prepared and submitted by the Contractor and the Concessionaire/Operator, respectively, to the DOTr for review and evaluation. The DOTr submits the CMR and SMR to the DENR-EMB. The CMR and SMR are attached to the Compliance Evaluation Report (CER) of the EMB. The CER documents EMB's evaluation findings and is prepared semi-annually. The second semi-annual CER includes a summary evaluation of the trend analysis and cumulative environmental performance of the project proponent, as validated by the TPA (see Section 8.2).

964. **Table 8.2.1** presents the proposed Self-Monitoring Plan for the SBT Section. The overall Self-Monitoring Plan for the NSCR Project (incorporating the SBT Section) is presented in Annex H-1. The monitoring plan identifies the critical aspects of the environment that would be monitored periodically throughout the various phases of the Project, along with the scope of activities to be conducted, the timetable for the activities, and the responsible parties for each activity. DOTr reports key information on the results of all monitoring activities to JICA and discloses to the public for transparency. The monitoring results are also available on the DOTr website.

Table 8.2.1 Environmental Monitoring Plan for the North-South Commuter Railway Project (Malolos-Tutuban) (SBT Section)

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
PRE-CONSTRUCTION PHASE								
Land								
Soil Quality and Contamination (Baseline, Additional Testing)	Exposure to contaminated soil (arsenic)	Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb Other parameters may be measured as needed	Method • Visual and odor observation • Composite sampling for surface layer and subsurface layer (0.5 m) Frequency • Once prior to construction	Sampling sites (SS01, SS02) from where soil samples detected with arsenic level exceeding US EPA RSL Other sampling stations within/adjacent to the SBT Section ROW if necessary to verify extent of soil contamination	DOTr PMO and Contractor	Contractor's Service Cost	Alert • Visible staining in soil Action • Soil laboratory results exceed USEPA RSL (> 3.0 mg/kg) – to be agreed with DENR-EMB Limit • At least 25 m3 of soil exceeded DIV (> 76 mg/kg) – to be agreed with DENR-EMB	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis Action • Soil exposure management • Implement Contact Management Plan Limit • Conduct Site Assessment and Remediation • A risk-based approach in the management of potentially contaminated site is recommended • If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
	Soil contamination (baseline)	Soil fertility • pH, OM, total Kieldahl N, available P, extractable K Soil contamination • As, Ba, Cu, Z, Cd, Cr⁺⁶, Cr, Fe, Pb, Mg, Mn, Hg, Se, Ni, CN-, F, PCBs, O&G, mineral oils	Method • Composite sampling Frequency • Once prior to construction	In case of any potential contaminated sites within/adjacent to SBT Section ROW as well including temporary facilities.	DOTr PMO and Contractor	Contractor's Service Cost	• Exceeded BSWM standard for soil fertility • Exceeded DIV and/or US EPA standards for soil contamination	• Follow EIA process and secure the ECC
Terrestrial Vegetation and Wildlife (Baseline)	• Vegetation removal and habitat loss • Threat to existence and/or loss of important local species • Threat to abundance.	Issuance of DENR-issued tree cutting permit (TCP) and implementation of Pre-Vegetation Clearing Plan Map showing designated areas for clearing.	Method • Visual inspections of all areas approved for tree cutting. • Manual count of cut trees versus the number of trees approved for cutting.	In all areas that were approved by the DENR for tree cutting	DOTr Contractor	PHP 300,000.00	The Tree Cutting Permit is specific and provides in detail the exact location of individual trees, their common and scientific names, and the number of individuals allowed to be cut. Actual trees on the ground approved for cutting are also clearly marked and geo-tagged. Hence, cutting or removal (either accidental or intentional) of even just one tree	Investigate conditions on the ground and personnel that lead to and/or involved with unauthorized tree cutting. Determine cause of unauthorized tree cutting. Always improve and make sure that all markings on the ground showing limits of areas for clearing are visible and understood. Make sure that all tree individuals approved for cutting are clearly marked and understood by the contractor. Perform daily orientation of contractors to

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	frequency, and distribution of important species	Areas on the ground marked and scheduled for clearing. Trees on-site marked for cutting in conjunction with geo-tagged trees indicated on the TCP. List of approved trees for cutting including their identification, location, and number of individuals to be cut.	Frequency During all tree cutting activities				not included in the Tree Cutting Permit should not occur.	discuss areas to be cleared and individual trees to be cut.
Terrestrial Vegetation and Wildlife	- Vegetation removal and habitat loss - Threat to existence and/or loss of important local species - Threat to abundance, frequency, and distribution of important species	For relocated earth-balled trees: survival rate and growth rate. For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate. For the Relocation-cum-Offset area (to monitor overall improvement in ecology as affected by earth-balled trees and/or out-planted seedlings): vegetation species list; vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	Method - Periodic (Measurement) - Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) - Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency - Semi-annual (two seasons)	Planted area within the SBT Section ROW Relocation-cum-Offset area (preferably near the affected area) in lieu of the vegetation loss along the SBT Section ROW	DOTr PMO and Contractor	PHP 300,000	Alert 10% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW - Mortality of at least 3 individuals of endemic plants balled-out and relocated in the planting site Action 20% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW - Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out and relocated in the planting site Limit 30% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW 100% mortality of endemics and threatened plant species balled-out and relocated in the planting site	Alert - Replace seedlings and relocated plants that did not survive. - Conduct visual observations and interviews of locals to determine potential cause of mortalities for both out-planted seedlings and relocated plants. - Test other plant species (by allowing them to grow) that are more adaptable to the site. Action - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality. - Make necessary adjustment based on result of soil nutrient analysis and investigation. Limit - Replace seedlings and relocated plants that did not survive using species more adaptable to the site.

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- Review and revise relocation and revegetation plan to improve plant survival. - Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality.
Water								
Surface Water Quality (Baseline)	Contamination of waterways	Color, temperature, pH, DO, conductivity, BOD, TSS, surfactants (MBAS), As, Cd, Cr ⁶⁺ , CN-, Pb, Hg, O&G (petroleum ether extracts), nitrate as NO ₃ -N, phosphate as P (total, reactive), phenolic substances and phenols, TC, FC, Cl-, Cu (dissolved, total), Organophosphate as Malathion	Method - Grab sampling Frequency - Once prior to construction for two seasons	Waterways within/adjacent to the SBT Section ROW and temporary facilities not covered by the WQ1, WQ2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded water quality standards (DAO 2016-18, DAO 2021-19)	Follow EIA process and secure the ECC
Air								
Air Quality (Baseline)	Air pollution due to emissions of particulate and gaseous pollutants	TSP, PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO, O ₃ , Pb	Method 24-hour and 1-hour sampling Frequency - Once prior to construction for two seasons	Selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section ROW and temporary facilities not covered by the ANV1, ANV2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded air quality standards (DAO 2000-81, DAO 2020-14)	Follow EIA process and secure the ECC
Noise (Baseline)	Increase in noise level	Noise level	Method 24-hour and 1-hour sampling Frequency - Once prior to construction	Selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section ROW and temporary facilities not covered by the ANV1, ANV2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded NPCC, WBG-EHS and/or Japan standards	Follow EIA process and secure the ECC
Vibration (Baseline)	Increase in vibration level	Vibration level	Method 24-hour sampling	Selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard	Follow EIA process and secure the ECC

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency • Once prior to construction	ROW and temporary facilities not covered by the ANV1, ANV2				
People								
Public Participation and Information Disclosure	Conflict of interest and social acceptability	Status, issues and concerns or complaints on: • Information, Education and Communication (IEC) activities – IEC meetings – Project awareness campaign materials – Information disclosure (online, mass media) • Public Participation activities – Public and stakeholder consultations – Focus group discussions (FGDs) – Key informant interviews (KIIs) – Perception Survey • Social Development Plan (SDP) Implementation	Method • Documentation, recording and report monitoring • Perception/ Social acceptability survey Frequency • Quarterly or immediately upon receipt of complaints	Barangays impacted by the Project, and relocation sites	DOTr PMO and Contractor in coordination with LGU	Contractor's Service Cost	Alert/Action • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities Limit • Issues, concerns and complaints raised by the public and stakeholders thru the DOTr Helpdesk • Low social acceptability based on perception survey	Alert/Action • Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit • Resolve issues, concerns and complaints thru the Helpdesk or GRM • Evaluate the reasons for the low social acceptability based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary
Land Acquisition and utilization and Involuntary Resettlement	Displacement of legal PAPs/ landowners	Status of land acquisition and resettlement: • Land area (m ²) acquired • Compensation amount paid for affected land, structures and improvements, households, crops and trees of legal PAFs (amount paid in php) • Legitimate landowners or legal PAPs displaced and assisted for resettlement (no.) • Issue and concern raised	Method • Area measurement, counting and progress reporting Frequency • Monthly until ROW is fully compensated and acquired (in case of court case, until the case closed)	Within and adjacent to SBT Section ROW	DOTr PMO (RIC, LIAC)	RAP Cost	Alert • Grievance to be resolved at the GR Officer Level Action • Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit • RAP-related grievance (appeal to second level decision) to be resolved by the PIAC, as necessary	Alert • Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) • Implement corrective actions as necessary Action • Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) • Implement corrective actions as necessary Limit • Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) • Ensure resolution of complaints/conflicts as soon as possible

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Displacement of eligible ISFs and other non-landowners	Status of acquisition and resettlement/ relocation: • Compensation paid for affected structures and improvements, households, crops and trees if applicable (amount paid in php) • Resettlement area completed (unit) • Housing units allocated and reserved for PAFs (no.) • ISFs and non-landowner PAPs displaced and/or relocated (no.) • Other relocation assistance provided	Method • Counting, area measurement, counting and progress reporting Frequency • Monthly until ISFs are all relocated	Within and adjacent to SBT Section ROW, Resettlement site (receiving LGU)	DOTr PMO (LIAC)			
Local Economy, Employment and Business	Disruption of livelihood, local business and economy	Status of LRIP: • Number of affected persons/households including vulnerable groups local communities by type of livelihood/income (land based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) • affected household members and business compensated for livelihood (amount in peso and no.) • LRIP training type provided and record of training (no.) • Number of affected persons and local communities employed by	Method • Survey, recording, and progress reporting Frequency • Quarterly until the end of livelihood restoration program	Impacted barangays and LGU and resettlement sites	DOTr PMO (RIC and LIAC)			

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		the project (no by gender and vulnerability)						
		Status of local economy: • Employment rate • Poverty incidence • Business renewal/registration • Capital investment • Tax revenue	Method • Data gathering in coordination with affected Barangay and LGU Frequency • Quarterly					
Cultural Heritage	Damage/ destruction risk to physical cultural/ archaeological resources	Affected historic structures and buildings within SBT Section ROW: Status of relocation of Casas de Tondo based on agreements with CAs and PNR	Method • Progress reporting and meetings with CAs and PNR Frequency • monthly	The existing site of Casita de Tondo and its relocation site (NSCR Project Tutuban Station)	DOTr PMO and Contractor	Contractor's Service Cost	Any significant change in the relocation of the Casas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures to be incorporated to the CMP
		Other affected historic structures and buildings based on SBT Section ROW and identified locations of temporary facilities and access routes	Method • Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency • Once prior to construction	Historical structures and buildings adjacent or close to the location of SBT Section ROW and temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard for vibration	Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
		Accidental finds encountered prior to construction	Method • Documentation and reporting to Cas • Interviews with local residents Frequency • Monthly and immediate in case of any found or informed	Within the SBT Section ROW and temporary facilities	DOTr PMO and Contractor	Contractor's Service Cost	Any accidental finds encountered	• Follow the procedure for archaeological watch or artifacts and archaeological remains chance finds to be agreed with and approved by CAs including but not limited to the following: • Secure the area of concern and report to the concerned CA (e.g. NM) any accidental finds upon the advice of the archaeologist • Immediately cease all earthmoving activities subject to the assessment of CA • Closely coordinate with CAs on the appropriate course of action in protecting the archaeological find

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								Continue construction activities if no cease and desist order is issued
Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Number of accidents involving local communities - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - monthly - Immediately in case of accidents Immediately upon receipt of complaint	Affected barangays and properties	DOTr PMO and Contractor	Contractor's Service Cost	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit Follow HSE GRM Level 3-4 Procedure(EGF Committee or DENR PAB)
CONSTRUCTION PHASE								
The Land								
Soil Erosion	Soil erosion due to generated excess soil or spoils	Occurrence of soil erosion Status of soil/ spoil management: - Volume of excess soil/ spoils - Stockpile height limit - Disposal method and management of soil/ spoils against the	Method - Ocular inspection - reporting, - meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and meeting or as needed	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Alert - noticeable soil erosion in active construction sites Action - Increased occurrence of soil erosion in active construction sites Limit - Excessive soil erosion in active construction sites and immediate vicinity	Alert - Investigate and report the areas with occurrence of soil erosion. Action - Investigate and report the areas with increased occurrence of soil erosion. Identify the cause of soil erosion and improve control measures. Limit - Investigate and report the areas with excessive soil erosion. Identify the cause of soil erosion and fortify control measures and barriers.
			Method - Ocular inspection, - reporting, - meeting with Contractor/s Frequency - Daily visual inspection					

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		approved Spoil Management Plan (SMP)	- Monthly reporting and meeting or as needed - Immediately in case of spill					
Soil Quality and Contamination	Soil contamination due to accidental spills of oil, lubricants or other chemicals	Visible soil staining	Method - Visual and odor observation/ immediate reporting of accidental spills and inspection of work site Frequency - Twice a week to daily - Immediately in case of spill	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Hydrocarbon staining or nauseating odor, reported spills/ leaks from the workers and community	- Isolate the work site, stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance HWMP, SPMP, SCMP and Contact Management Plan - Report to the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities
		- Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb - Other parameters may be measured as needed	Method - Composite sampling Frequency - Quarterly - Immediately in case of accidental spill	SS01, SS02 and the construction sites and the location of temporary facilities especially areas that exceeded soil contamination standards during baseline sampling	DOTr PMO and Contractor	Construction Cost	Alert - Visible soil staining/ reported accidental spill Action - Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit - Soil laboratory results exceed DIV – to be agreed with DENR-EMB	Alert - Conduct soil sampling and verify heavy metal concentration through laboratory analysis Action - Conduct soil exposure management - Implement Contact Management Plan Limit - Conduct Site Assessment and Remediation - A risk-based approach in the management of potentially contaminated site is recommended - If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
Soil Quality and Contamination	Soil contamination due to generation of solid wastes	Management of solid wastes against the approved Solid Waste Management Plan (SWMP) - Status of solid waste generation and collection: - Solid wastes generated (cu.m.)	Method - Ocular inspection - Regular reporting, and meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Alert At least two non-compliances that have not been closed out after one succeeding audits	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of non-compliances and sanction involved parties

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Solid wastes collected (cu.m.) - Solid waste storage and collection • Solid waste disposal method (transport and disposal)	• Quarterly or semi-annually - Regular audits				Action • At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits	as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Soil contamination due to generation of hazardous wastes	• Management of chemicals and hazardous substances/ wastes against the approved Hazardous Waste Management Plan (HWMP) and Spills Prevention and Management and Emergency Response Plan (SPMERP) - Stock inventory - Waste chemicals/ hazardous wastes generated - Handling of hazardous wastes (storage, treatment) - Hazardous waste disposal method • Physical soil condition (e.g., presence of hydrocarbon staining) • Fuel condition of construction heavy equipment and other machineries	Method • Visual and odor observation, reporting, and meeting with Contractors; Inspection of fuel storage sites, hazardous materials storage, generator set area for visible signs of leakage along with general inspection of work sites, inspection of spill clean-up logs and audit of actions taken • Composite sampling Frequency • Daily to Twice a week visual observation, • Monthly reporting and meeting; Regular inspections (e.g., quarterly or semi-annually) • Immediately in case of accidental spill until regular sampling until fully detoxified	Construction areas (including sites of temporary facilities)	DOTr PMO and Contractor	Construction Cost	Alert • At least two non-compliances that have not been closed out after one succeeding audit Action • At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits	Alert • Engage lead person and discuss non-compliances and corresponding action items to address them Action • Investigate the root-cause of non-compliances and sanction the involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
Soil Contamination	Health impacts to workers / communities due to exposure to arsenic	• Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb • Other parameters may be measured as needed	Method • Visual and odor observation	• SS01, SS02 (especially areas that exceeded soil contamination)	DOTr PMO and Contractor	Construction Cost	Alert • Visible staining in soil	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	and other heavy metals		- Toxicity Characteristic Leaching Procedure (TCLP) Frequency - Daily - Monthly until fully detoxified.	standards during baseline sampling (e.g. SS02 for As) Construction site and disposal site (including sites of temporary facilities)			- Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action - Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit - Cd, Pb, Cr (VI), As: 5 mg/L; - Hg: 0.2 mg/L; Se: 1 mg/L; - F and B – no standard– to be agreed with DENR-EMB	- Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action - Soil exposure management - Implement Contact Management Plan Limit - Conduct Site Assessment and Remediation - A risk-based approach in the management of potentially contaminated site is recommended
Terrestrial Vegetation and Wildlife	- Vegetation removal and habitat loss - Threat to existence and/or loss of important local species - Threat to abundance, frequency, and distribution of important species	- For relocated earth-balled trees: survival rate and growth rate, mortality rate, Provision of corresponding number of tree seedlings - For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate, mortality rate, provision of corresponding number of tree seedlings - For monitoring of improvement in ecology : vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	Method - Periodic (Measurement) - Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) - Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency - Semi-annual	- Planted area within the SBT Section ROW - Relocation-cum-Offset area (preferably near the affected area) in lieu of the vegetation loss along the SBT Section ROW - Near the affected areas along the SBT Section ROW	• DOTr PMO and Contractor	PHP 300,000	Alert 10% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW - Mortality of at least 3 individuals of endemic plants balled-out and relocated in the planting site Action 20% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW - Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out and relocated in the planting site Limit 30% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW 100% mortality of endemics and threatened plant species balled-out and relocated in the planting site	Alert - Replace seedlings and relocated plants that did not survive. - Conduct visual observations and interviews of locals to determine potential cause of mortalities for both out-planted seedlings and relocated plants. - Test other plant species (by allowing them to grow) that are more adaptable to the site. Action - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality. - Make necessary adjustment based on result of soil nutrient analysis and investigation. Limit - Replace seedlings and relocated plants that did not survive using species more adaptable to the site.

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- Review and revise relocation and revegetation plan to improve plant survival. - Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality.
Geologic Hazards	Ground subsidence	Level of ground subsidence/change in ground level	Method - Visual observation - Level survey Frequency - Daily visual observation - Weekly level survey or as needed	In and around the excavation and temporary facilities	DOTr PMO Contractor	Construction Cost	Alert - Complaints within impact area Action - Visually observed subsidence or minor damage to above ground structures Limit - Verified occurrence of subsidence and damage associated with project activities	Alert - Investigate complaints if attributable to project activities Action - Implement corrective actions as necessary if the observed subsidence poses threat to the workers and community Limit - Temporarily stop work to recalibrate works and legitimate complainants agreed on resolution
THE WATER								
Surface Water Quality	Siltation and sedimentation	Visual indication of siltation, sedimentation and clogging of drainage canals (e.g. turbidity, accidental spills)	Method - Ocular inspection Frequency - Daily during rainy season	WQ1, WQ2, and other established surface water quality sampling stations (effluent discharge point) near active construction sites, temporary facilities (e.g. construction drainage canals)	DOTr PMO and Contractor	PHP 10,000 estimated laboratory fees per monitoring event for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, and PHP 25,000 sampling fee and expenses Around PHP 140,000 for four quarterly	Alert - Observed presence of concentrated flows from construction sites to drainage canals which causes siltation - Compare observed in-situ parameters from the baseline data. Action - Observed presence of concentrated flows from construction sites to drainage canals which causes siltation - For ambient surface water quality: DAO 2016-08 / DAO 2021-19 Water Quality Guidelines (WQG) for Class C waters	Alert - Check and monitor the performance of the sediment control equipment/ facilities installed. - Check equipment, construction activities, or facilities considered as source of leakage, and halt operations for inspection and maintenance. Action - Investigate if changes in water quality is attributable to the construction activities. - Once identified and verified to be part of the project activities, temporarily halt the specified activity. Apply mitigating measures to stop/attenuate the water quality changes observed. Limit - Investigate if changes in water quality is attributable to the construction activities.
	Contamination of waterways with solid wastes and domestic wastewater	Status of Surface water quality: - Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, Ammonia, Chloride, Oil and grease, Cyanide, Phenols, Surfactants (MBAS), Trace metals (As, Cu, Cd, Cr⁶⁺, Pb, Hg) - Other parameters may be measured as needed	Method - For temperature, pH and DO – <i>in-situ</i> measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease,					

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		such as at the event of accidental spill	nitrates, phosphates, and fecal coliform • Other parameters may be sampled as needed			monitoring events	Limit • Visually evident changes in surface water quality, such as increased siltation, concentration flows of wastewater, and oil/grease sheet forming above the water. • Complaints from the community due to water pollution attributable to the Project. • For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	• Once identified and verified to be part of the project activities, temporarily halt construction activities to identify main sources of pollution, leaks, or any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed. • Respond to complaint through the Project's Grievance Redress Mechanism
Surface Water Quality	Contamination of waterways by accidental spills of oil, lubricants, and other chemicals and concrete / drilling wastewater spills	• Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform • Other parameters may be measured as needed by type of spill	Method • In-situ measurements and grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency • Immediately in case of accidental spill	South Antipolo Canal and drainage within project area	DOTr PMO and Contractor			
Hydrology	Flooding	• Daily record of stream flow and water level • Visible signs of clogged cross drainage structure) • Reports of complaints related to flooding from nearby communities	Method • Ocular inspection and in-situ measurement • Check PAGASA weather bulletin Frequency • Daily • Immediate in case of weather warning.	South Antipolo Canal and drainage within project area	DOTr PMO Contractor in coordination with LGU/ PAGASA	Construction Cost	Alert • Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action • Occurrence of 10cm to 30 cm flooding not subsiding after rainfall event Limit • Occurrence of more than 30cm flooding not subsiding after rainfall event	Alert • Investigate and check drainage clearance Action • Investigate and clear drainage system Limit • Temporary stop work until flooding has subside (clearing/creating new drainage system or pump out water)
THE AIR								
Air Quality	Air pollution due to emissions of particulate and gaseous pollutants as well as fugitive dust	• Particulate Pollutants: TSP, PM ₁₀ , PM _{2.5} , Pb • Gaseous Pollutants: SO ₂ , NO ₂ , CO, O ₃	Method • 24-hour monitoring for: • TSP: High volume, Gravimetric • PM ₁₀ : high volume with PM ₁₀ inlet, Gravimetric • PM _{2.5} : High volume with PM _{2.5} inlet, Gravimetric	ANV1, ANV2 other established sampling stations dust-generating temporary facilities/ construction yards outside the ROW	DOTr and Contractor	PHP 50,000 per monitoring event: 24-hour monitoring of TSP, PM ₁₀ , PM _{2.5} , SO ₂ , and NO ₂ : PHP 30,000	Alert • 75% of DENR Limit Action • 85% of DENR Limit Limit • Complaint lodged by comm TSP: 230 ug/NCM; • PM ₁₀ : 150 ug/NCM; • PM _{2.5} : 50 ug/NCM;	Alert • Continue monitoring and investigate possible causes of increase of particulates and gaseous pollutants, determine, and address the root cause Action • Check efficiency and conduct routine preventive maintenance of dust suppression systems

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			• SO₂: Gas bubbler, Colorimetric Pararosaniline • NO₂: Gas bubbler, Griess Saltzman Reaction Frequency • Quarterly or as required by EMB • Immediate if complaints received			Mobilization/ Demobilization Cost: PHP 20,000	• SO₂: 180 ug/NCM; • NO₂: 150 ug/NCM uni	• Investigate cause of complaint and determine and address the root cause. • Increase frequency of dust suppression Limit • Consider modifications to dust suppression system (i.e., changes to spray nozzle type, upgrade to air-and-water dust suppression system, etc) • Conduct smoke emission tests of vehicles and construction equipment, as necessary • Review traffic management guidelines
		Dust generation	Method • Visual inspections • Interview with residents of affected barangays and pedestrians Frequency • Daily • Monthly interview and Immediate if complaints received	• Construction area and storage and/or stockpiles • Access road, dust-generating facilities/ construction yards outside the ROW • Sensitive receptors nearby project area			Alert • Visually evident dryness Action • Noticeable dust suspension/deposition, and/or presence of haze Limit • Complaint lodged by community	
Noise	General construction works produces noise levels that affect the amenity at nearby sensitive receptors Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	Noise level (L _{Aeq,T} , dB)	Method • Ocular observation • In-situ measurement using sound meter • Interview with residents of affected barangays Frequency • Daily and Monthly • Immediate In response to complaints or a significant change of construction work methodology:	ANV1, ANV2 and, In and around construction sites, temporary facilities, affected barangays and nearby sensitive receptors including socially ecologically significant area/s (if any) likely to be affected	DOTr PMO and Contractor	Monthly monitoring 200,000 Attended measurements in response to a public complaint (2 hours per month) PHP 55,000	Alert • Noise monitoring identifies levels (L_{Aeq}, (1hr), dB) that are within 5 dBA of noise criteria outlined in the WBG (EHS) Guidelines: Residential or institutional receptor: Daytime (07:00 - 22:00) 50 dBA/ Night time (22:00 - 07:00) 40 dBA Or background level Whichever is higher. Action • Complaint lodged by community or Noise monitoring identifies levels (L_{Aeq}, (1hr), dB) that are occasionally above the noise criteria outlined in the WBG (EHS) Guidelines:	Alert • Continue monitoring and investigate possible causes of increased noise emissions Action • Investigate and identify cause of complaint and determine suitable noise control in accordance with the approved CNVMP. Limit • Determine suitable noise control in accordance with the approved CNVMP.
			Method • 24 hours • 1-5 minutes of monitoring for a source producing	• ANV1, ANV2 and/or other established sampling locations closest				

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			steady continuous noise levels 5-15 minutes of monitoring for a source producing variable or impulsive noise levels Frequency 24-hour monitoring to occur monthly at most impacted receptors - Monthly at most impacted receptors or immediately in response to complaints or a significant change of construction work methodology is conducted for each event	to sensitive receptors (e.g. schools, daycare centers) along the ROW impacted by the works being undertaken at the time of monitoring Other sensitive receptors along noise-generating temporary facilities, construction yards and access roads outside the ROW			Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA/ Nighttime (22:00 - 07:00) 45 dBA Or background level +3 dB Whichever is higher. Limit Noise monitoring identifies levels (LAeq (1hr), dB) that are continuously above the noise criteria outlined in the WBG (EHS) Guidelines: Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA/ Nighttime (22:00 - 07:00) 45 dBA or background level +3 dB Whichever is higher.	
Vibration	Vibration from construction works causes human disturbance and structural damage to buildings sensitive to vibration	Vibration level VdB (vibration)	Method - Site observation - Interview with residents of affected barangays Frequency - Daily monitoring for continuous works that generate vibration - Monthly interview - Immediate In response to complaints or a significant change of construction work methodology:	- In and around construction sites, temporary facilities, - affected barangays including socially ecologically significant area/s (if any)	DOTr and Contractor	Quarterly monitoring PHP 70,000 Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.	Alert - Vibration monitoring identifies levels that are higher than 75% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:75 VdB (re 10-6 mm/s) Action - Complaint lodged by community or Vibration monitoring identifies levels that are higher than 90% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:90 VdB(re 10-6 mm/s) Limit - Vibration monitoring identifies levels that are higher than 95% of the vibration criteria outlined	Alert - Continue monitoring and investigate possible causes of increased vibration emissions Action - Investigate and identify cause of complaint and determine suitable vibration control in accordance with the approved CNVMP. Limit - Investigate and identify cause of complaint and determine suitable vibration control in accordance with the approved CNVMP.
			Method 24-hour monitoring 1 – 5 minutes of monitoring for a source producing steady continuous vibration levels 5 – 15 minutes of monitoring for a source	ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors (e.g. Casas de Tondo until relocated)				

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			producing variable or impulsive vibration levels Frequency • 24 hours to occur quarterly at most impacted receptors • immediately in response to complaints or a significant change of construction work methodology is conducted for each event.	along the ROW impacted by the works being undertaken at the time of monitoring • Other sensitive receptors along vibration-generating temporary facilities, construction yards and access roads outside the ROW			in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:100 VdB(re 10-6 mm/s)	
THE PEOPLE								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on Project: • SDP Implementation • IEC Meetings • Stakeholder Consultations - Public consultations - FGDs - KIIs • Project awareness campaign materials • Information disclosure - Online - Mass media • GRM	Method • Documentation, • recording • report monitoring Frequency • Quarterly, • immediate received complaints	• Impact barangays and relocation sites	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management)	Alert/ Action • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities and through helpdesk Limit • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities • Negative feedback from participants/ recipients	Alert/Action • R Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit • Resolve issues, concerns and complaints thru the Helpdesk or GRM • Evaluate the reasons for the low social acceptability rate based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
Land Acquisition and Utilization and Involuntary Resettlement	Displacement of legal PAPs/ landowners	Status of land acquisition and resettlement: - Land area (m²) acquired - Compensation amount paid for affected land, structures and improvements, households, crops and trees of legal PAFs (amount paid in php) - Legitimate landowners or legal PAPs displaced and assisted for resettlement (no.) - Issue and concern raised	Method - Area measurement, counting and progress reporting Frequency - Monthly until ROW is fully compensated and acquired (in case of court case, until the case closed)	Within and adjacent to SBT Section ROW	DOTr PMO (RIC, LIAC)	RAP Cost	Alert - Grievance to be resolved at the GR Officer Level Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit - RAP-related grievance (appeal to second level decision) to be resolved by the PIAC, as necessary	Alert - Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) - Implement corrective actions as necessary Action - Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) - Implement corrective actions as necessary Limit - Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) - Ensure resolution of complaints/conflicts as soon as possible
	Displacement of eligible ISFs and other non-landowners	Status of acquisition and resettlement/ relocation: - Compensation paid for affected structures and improvements, households, crops and trees if applicable (amount paid in php) - Resettlement area completed (unit) - Housing units allocated and reserved for PAFs (no.) - ISFs and non-landowner PAPs displaced and/or relocated (no.) - Other relocation assistance provided	Method - Counting, area measurement, counting and progress reporting Frequency - Monthly until ISFs are all relocated	Within and adjacent to SBT Section ROW, Resettlement site (receiving LGU)				
Local Economy, Employment and Business	Disruption of livelihood, local business and economy	Status of LRIP: Number of affected persons persons/households including vulnerable groups local communities by type of livelihood/income (land	Method - Survey, recording, and progress reporting Frequency - Quarterly until the end of livelihood restoration program	Impacted barangays and LGU and resettlement sites	DOTr PMO (RIC and LIAC)			

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) • affected household members and business compensated for livelihood (amount in peso and no.) • LRIP training type provided and record of training (no.)						
		Status of local economy: • Employment rate • Poverty incidence • Business renewal/registration • Capital investment • Tax revenue	Method • Data gathering in coordination with affected Barangay and LGU Frequency • Quarterly until the end of livelihood restoration program					
Local Employment and Business	Generation of local employment Influx of construction labor (increase of migrants)	Status of employment of PAPs and local communities: • Construction manpower required by job position (no.) • PAPs, Local and non-local manpower hired and their position (no. & percentage) and salary paid • Employees hired by gender and vulnerability (no. & percentage) • Construction camps provided for non-local manpower (no.) • Working environment provided in consideration of gender equality and needs of vulnerable group	Method • Recording and progress reporting Frequency • monthly until the end of construction	SBT Section ROW	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management)	Alert • 70% of the employees are local residents (based on the skills and capacity) Action • 60% of the employees are local residents (based on the skills and capacity) Limit • 50 % of the employees are local residents (based on the skills and capacity)	Alert • Increase employability of local residents by undertaking skills training prior to job hiring Action • Investigate the reasons for not meeting the % local resident employment • undertaking skills training prior to job hiring Limit • Investigate the reasons for not meeting the % local resident employment • skills training prior to job hiring

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
Public Utilities	Disruption in public utility services by relocation	- Affected public utility lines, poles or structures relocated (no.) - Affected households per barangay affected by the relocation of public utilities (no.) - Status of relocation of public utility lines, poles or structures - Extent of disturbance and actions taken - Complaints received during relocation activities	Method - Coordination with the LGU - Interviews with affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity	SBT Section ROW	DOTr PMO and Contractor	Construction Cost / RAP Cost	Alert - Planned power outage or water service interruption due to relocation of facilities Action - Complaints on failure to restore power and water on the given ETR Limit - Complaints on uninformed / unplanned power outage or water service interruption caused by factors that are beyond the control of the public utility companies	Alert - Provide advisory to the affected barangays at least 72 hours before the actual time of service interruption and provide estimated time of restoration (ETR) Action - Coordinate with public utility companies to implement contingency measures such as deployment of generator sets and water tankers to affected areas and conduct rationing - Provide regular updates to the public on electricity and water supply conditions Limit - Coordinate with public utility companies to investigate the cause, assess the damage and necessary repair - Implement contingency measures if the repair or service restoration may take a while
	Increased demand for local resources, resource depletion	- Electricity, fuel and water consumption - Complaint received	Method - Meter readings, utility bills, leaks monitoring - Reporting - meetings Frequency - Daily, monthly, annually	Construction sites, yards, camps and offices barangays	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert 1% increase in consumption/ utility expenditures Action 5% increase in consumption/ utility expenditures Limit 10% in consumption/ utility expenditures	Alert - Implement conservation measures and monitor for possible leaks Action - Implement conservation measures and monitor for possible leaks Limit - Conduct calibration testing of utility meters and submeters - If found defective, replace the meters/submeters - Continue implementation of conservation measures
Social Infrastructure	Disruption of social services	- Affected public social/ community facilities relocated (no. and location) - Status of relocations	Method Coordination with the LGU	SBT Section ROW	DOTr PMO and Contractor	RAP Cost	Alert - Grievance to be resolved at the GR Officer Level - Action	Alert - Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) - Implement corrective actions as necessary

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Extent of disturbance and action taken - Complaint received	- Interviews to affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity				- Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit - RAP-related grievance (appeal to second level decision) to be resolved by the PIAC, as necessary	Action - Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) - Implement corrective actions as necessary Limit - Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) - Ensure resolution of complaints/conflicts as soon as possible
Cultural Heritage	Damage / destruction of physical cultural and archaeological resources	Status of relocation of Casitas de Tondo based on agreements with CAs and PNR	Method - Progress reporting and meetings with CAs and PNR Frequency - Quarterly	The existing site of Casita de Tondo and its relocation site (NSCR Project Tutuban Station)	DOTr PMO and Contractor	Contractor's Service Cost	Any significant change in the relocation of the Casitas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures to be incorporated to the CMP
		Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method - Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency - Monthly	Historical structures and buildings adjacent or close to the location of project temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard for vibration	Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
		Accidental finds encountered during construction	Method - Documentation and reporting to CAs Frequency - During excavation activities especially at pile cap sites	Within the SBT Section ROW and temporary facilities (excavation/ pile cap sites)	DOTr PMO and Contractor	Contractor's Service Cost	Any accidental finds encountered	- Follow the procedure for archaeological watch or artifacts and archaeological remains chance finds to be agreed with and approved by CAs including but not limited to the following: - Secure the area of concern and report to the concerned CA (e.g. NM) any accidental finds upon the advice of the archaeologist - Immediately cease all earthmoving activities subject to the assessment of CA - Closely coordinate with CAs on the appropriate course of action in protecting the archaeological find

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								Continue construction activities if no cease and desist order is issued
Occupational and Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - monthly - Immediately in case of accidents Immediately upon receipt of complain	Affected barangays	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on HSE management)	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Working Environment Measurement (WEM) Compliance with DOLE OSH Standards	Method - BWC-OSHC/ NIOSH method Frequency - Quarterly throughout construction phase	SBT Section ROW including sites of temporary facilities and construction yards	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Parameters for good working conditions are near DOLE OSH limits Action - Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit - Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive audits	Alert - Implement corrective actions - Review maintenance and housekeeping activities and revise as needed Action - Implement corrective actions - Conduct internal audit and monitoring after implementation Limit - Conduct third-party (external) audit of working environments - Update/Improve working environment
	Construction-related accidents	- Status of accident involving communities - Construction-related accident/s involving communities (no.) - Cause of accidents - Date and location of accidents	Method - Survey occurrence of accidents with local communities - monitoring - Coordination with LGU officials and police	Affected barangays	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on HSE management)	Alert HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA)

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Measure acted to mitigate future accidents	- Interview with affected communities Frequency - Daily or Immediately in case of accidents				Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Limit Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		- Status of accident involving workers - Construction-related accidents among the workers (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Occurrence of accidents related construction work - Monitoring - Documentation Frequency - Daily or immediately in case of accidents	SBT ROW / construction site and sites of temporary facilities, construction yards and access roads	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert/Action - External HSE Audit findings Limit - Unresolved External HSE Audit findings	Alert - Conduct safety re-training for workers involved in accident Action - Conduct departmental re-training of the workers on health safety rules and regulation Limit - Inspect the area where most accidents happen - Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations
	Transmission of communicable diseases	Status of affected communities - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Barangay health records - Interviews Frequency - Daily - Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on HSE management)	Alert - case counts are low but increasing Action - case counts are high and/or increasing Limit - case counts are high and/or increasing and area declared as critical zone	Alert/Action - Require workers and employees to conduct self-health check prior to going onsite - Require workers and employees with symptoms of a communicable disease to consult a doctor and stay home/ work from home - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								Limit - Temporarily suspend construction activities and require workers and employees for testing - Require workers and employees who tested positive and their close contacts as well as those with symptoms of a communicable disease to consult a doctor, isolate and take quarantine - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
		Status among the workers: - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Interview and health records of workers - Health check of workers Frequency - Daily or Immediately in case of confirmed cases	SBT Section ROW	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on HSE management) Construction Cost (Contractor's service fee on HSE management)	Alert 5% of workers experience symptoms of disease Action 10% workers are infected with disease Limit 15% of workers are infected with disease	Alert - Assess if illness is work-related; - conduct interview of sick employees and assess health condition by medical health doctor Action - Implement site-wide investigation of cause - Conduct IEC campaign for illness prevention - Monitor health conditions by medical doctor Limit - Implement site-wide investigation of cause, - isolate cases and prevent spread of illness; - Conduct IEC campaign for illness prevention - Continue monitoring by health doctor
	Nuisance to onsite construction workers and communities to	implementation and effectivity of PPE during workhours	Method inspection, strict reinforcement and maintenance of PPE	Within construction areas Sensitive receptors	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on	Alert Health problems reported by employees and workers on-site, or reported damaged PPE	Alert Determine equipment, machines, or activities that caused the complaints

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	construction noise and vibration and dust generation	health condition of workers	- Noise and vibration, air quality sampling/ measurement - Regular health check Frequency - Daily, monthly, immediately upon receipt of complaint or in case of any symptom			HSE management)	Action - Verbal or non-verbal complaints filed by employees and/or workers Limit - Multiple complaints filed by employees and workers on-site, and if the permissible noise levels, as suggested by DOLE, exceeded the limits.	Action - Coordinate with construction employees to address the root cause, or; coordinate with a health institution for necessary medical check-up Limit - Conduct maintenance of construction equipment or machineries or use equipment that produce lesser noise. - Schedule strategically shifts to integrate the permissible noise level exposure in the safety of the workers. - Conduct inspection and maintenance of PPE, and repair of damages (if repairable). - Implement strict wearing of PPE on- site. - Record equipment that produce harmful noise levels, and keeping its nearby area off-limits to workers
Public Access and Traffic Management	Restrictions to public access	- Public access closed (no.) - Public access for temporary closure and permanent closure (no. and location) - Barangays affected by public access restriction (no.) - Public access and traffic-related complaints from the community (no.)	Method - Record of complaints Frequency - Immediately	- SBT Section ROW - Public access (roads and pedestrian access) temporarily and permanently closed - Existing and temporary access roads utilized for the Project	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Temporary closure of public access for 3 months or more Action - Temporary closure of public access throughout construction Limit - Permanent closure of public access	Alert/Action - Inform/ Coordinate with affected barangays and residents - Provide alternate public access - Update Public Access and Traffic Management Plan (PATMP) Limit - Update Public Access and Traffic Management Plan (PATMP) in consultation/coordination with the LGU, affected barangays and residents - Compensate displaced families and businesses due to landlock or provision of access road or required setback
	Traffic congestion	Observed road traffic condition in public access roads within 200 m from the SBT ROW during incoming or outgoing trips:	Method - Survey traffic volume - Actual traffic observation and documentation	Main intersection near construction area and temporary facilities	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Grievance to be resolved at the GR Officer Level - Five (5) valid complaints per month	Alert - Resolve complaints based on GRM Action - Resolve complaints based on GRM

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Travel distance from origin to destination - Travel time from origin to destination - Roads with heavy traffic within 200 m from SBT Section - Number of hours, days that road is restricted/ closed. - Public access and traffic-related complaints from the community (no.)	Frequency Weekly monitoring of traffic condition	Existing and temporary access roads utilized for the Project			Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department - Ten (10) valid complaints per month Limit - Grievance to be resolved by the DOTr PMO, as necessary - Fifteen (15) valid complaints per month	- Review effectivity of PATMP and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update PATMP
OPERATION PHASE								
THE LAND								
Soil contamination	Soil contamination due to generation of solid wastes	Status of solid waste management: - Volume of solid wastes generated and collected - Condition of solid waste collection and storage area (segregation, collection, packaging) - Disposal method (including transport) and management of solid wastes against the approved Solid Waste Management Plan (SWMP)	Method - Visual observation, reporting, and meeting with Contractors; Audit of subcontractor Frequency - Daily - Twice a week visual observation, monthly reporting and meeting; Regular audits (e.g., quarterly or semi-annually)	SBT Section ROW including railway tracks and TSS-1 compound (including temporary onsite storage/ disposal facility/ area)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - At least two non-compliances that have not been closed out after one succeeding audit Action - At least two non-compliances that have not been closed out after two succeeding audits Limit - At least two non-compliances that have not been closed out after three succeeding audits	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit - Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Soil contamination due to accidental spills of oil, lubricants or other chemicals, generation of hazardous wastes and handling of contaminated ballasts	- Management of chemicals and hazardous substances/ wastes against the approved WMP and SPERMP – Stock inventory – Waste chemicals/ hazardous wastes generated	Method - Visual observation and reporting - Inspection of Vehicle, Equipment Parking, Storage Areas, generator set area for visible signs of leak, inspection of spill	SBT Section ROW including railway tracks and TSS-1 compound (including temporary onsite storage/ disposal facility/ area)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - At least two findings that have not been closed out after one succeeding inspection Action - At least two findings that have not been closed out after two succeeding inspections	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Handling of hazardous wastes (storage, treatment) - Hazardous waste disposal method • Physical soil condition (e.g., presence of hydrocarbon staining-dark stains, presence of rainbow or sheen)	clean-up logs and audit of actions taken • Composite sampling Frequency • Weekly or as needed. Presence of hydrocarbon staining on the surface soil should be reported immediately in order to determine the source and/or prevent further contamination into the subsurface soil • Regular inspections (e.g., quarterly or semi-annually) • Immediately in case of accidental spill until regular sampling until fully detoxified)				Limit • At least two findings that have not been closed out after three succeeding inspections	Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
Soil Contamination	Health impacts to workers / communities due to exposure to arsenic and other heavy metals	• Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb, • Other parameters may be measured as needed	Method • Composite sampling for surface layer and subsurface layer (0.5 m) Frequency • Semi-annual, • immediately (in case of spill)	SS01, SS02 and other potentially contaminated sites within SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • Visible staining in soil Action • Soil laboratory results exceed USEPA RSL (> 3.0 mg/kg) – to be agreed with DENR-EMB Limit • At least 25 m ³ of soil exceeded DIV (> 76 mg/kg) – to be agreed with DENR-EMB	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis Action • Soil exposure management • Implement Contact Management Plan Limit • Site Assessment/ Remediation • A risk-based approach in the management of potentially contaminated site is recommended • If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
Terrestrial Vegetation and Wildlife	Increase biodiversity due to retention/ provision of urban green	For relocated earth-balled trees: survival rate and growth rate. mortality rate, Provision	Method • Periodic (Measurement)	Planting sites within the SBT Section ROW and replanted sites	DOTr Concessionaire/ Operator	PHP 300,000.00	Alert • 10% mortality on seedlings	Alert • Replace seedlings and relocated plants that did not survive.

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	spaces along the Project alignment ROW	of corresponding number of tree seedlings For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate, mortality rate, provision of corresponding number of tree seedlings For monitoring of improvement in ecology : vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	• Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) • Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency • Semi-annual				• Mortality of at least 3 individuals of endemic plants balled-out individuals. Action • 20% mortality on seedlings • Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out individuals. Limit • 30% mortality on out-planted seedlings • Mortality of endemics and threatened plant species balled-out individuals.	• Conduct visual observations and interviews of locals to determine potential causes of mortality • Expand list of native species through screening (by allowing them to grow) that are more adaptable to the site. Action • Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Make necessary adjustment based on result of soil nutrient analysis and investigation Limit • Replace seedlings and relocated plants that did not survive using species more adaptable to the site. • Consider other sites. • Review and revise relocation and revegetation plan to improve plant survival.
Geologic Hazards	Ground subsidence	Level of ground subsidence/ change in ground level	Method • Visual observation / inspection, • Level survey as needed Frequency • Monthly visual observation • Semi-quarterly level survey or as needed	Railway structures and facilities	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • After any ground shaking event Action • Visually observed subsidence or minor damage to above ground structures Limit • Verified occurrence of subsidence and damage	Alert • Investigate possible damage due to event Action • Implement corrective actions as necessary if the observed subsidence poses threat to the workers and riders and nearby communities Limit • Implement corrective actions as necessary if the observed subsidence poses threat to the workers and riders and nearby communities

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
THE WATER								
Surface Water Quality	Contamination of waterways with pollutant transfer from contaminated ballasts	Status of Surface water quality: Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, fecal coliform, Ammonia, Chloride, Cyanide, Phenols, Surfactants (MBAS) - Trace metals (As, Cu, Cd, Cr⁶⁺, Pb, Hg) - Other parameters may be measured as needed such as at the event of accidental spill	Method - For temperature, pH and DO – in-situ measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be sampled as needed	WQ1, WQ2 and other established discharge points along SBT Section	DOTr Concessionaire/ Operator with third party sampling firm	Operation and Maintenance Cost Estimated cost of laboratory fees = PHP 40,000 annually (or PHP 10,000 per quarter)	Alert 75% of DENR limit Action 85% of DENR limit Limit - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	Alert - Check and monitor the performance of the sediment control equipment/ facilities installed. Check equipment, operation activities, or facilities considered as source of leakage for inspection and maintenance. Action - Investigate if changes in water quality is attributable to the operation activities. - Once identified and verified to be part of the project activities, apply mitigating measures to stop/attenuate the water quality changes observed. Limit - Investigate if changes in water quality is attributable to the operation activities. - Identify main sources of pollution, leaks, or any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed
	Contamination of waterways due to accidental spills of oil, lubricants, or other chemicals, and generation of hazardous wastes	- pH, TSS, BOD, color, and oil and grease - Other parameters may be measured as needed by type of spill	Method Visual inspection drainage leading to Antipolo creek. - For, pH– <i>in-situ</i> measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - For visual inspection -- weekly, as needed, or	WQ1, WQ2 and other established discharge points along SBT Section	DOTr Concessionaire/ Operator	Operation and Maintenance Cost Estimated cost of laboratory fees = PHP 40,000.00 annually (or PHP 10,000.00 per quarter)	Alert - Observed presence of oil films and concentrated flows from TSS-1 drainage to Antipolo Creek - Or 75% of DENR limit Action - Reported incident of spills or leaks. Visually evident oil films at drainage to Antipolo Creek - Or 85% of DENR limit - Complaints from the nearby communities due to water pollution attributable to the operation of TSS-1	Alert - Investigate if observed changes in visual appearance or water quality is attributed to maintenance activities - If attributable to the maintenance activities, engage responsible party and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of the reported leak or spill - Apply mitigating measures to stop/attenuate the water quality changes observed - Respond to complaint through the Project's Grievance Redress Mechanism

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			during maintenance activities • For water quality monitoring – quarterly				Limit • Reported incident of spills or leaks. Visually evident oil films at drainage to Antipolo Creek • For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	Limit • Investigate the root-cause of the reported leak or spill • Apply mitigating measures to stop/attenuate the water quality changes observed
Hydrology	Flooding	- Record of stream flow and water level - Visible signs of clogged cross drainage structure) - Reports of complaints related to flooding from nearby communities	Method - Ocular inspection and observation - Records on help/assistance desk - Check PAGASA weather bulletin Frequency - Daily during rainy season - Immediate in case of weather warning.	South Antipolo Canal and drainage within project area particularly in TSS-1	DOTr Concessionaire/ Operator in coordination with LGU/ PAGASA	Operation and Maintenance Cost	Alert - Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action - Occurrence of 10cm to 30 cm flooding not subsiding after rainfall event Limit - Occurrence of more than 30cm flooding not subsiding after rainfall event	Alert - Investigate and check drainage clearance Action - Investigate and clear drainage system Limit - If possible, conduct clearing or install new drainage system or pump out water
THE AIR								
Air Quality	Air pollution due to emissions of particulate and gaseous pollutants	- Particulate Pollutants: TSP, PM10, PM2.5 - Gaseous Pollutants: SO₂, NO₂,	Method 24-hour monitoring for: - TSP – High volume, Gravimetric - PM10 – high volume with PM10 inlet, Gravimetric - PM2.5 – High volume with PM2.5 inlet, Gravimetric - SO₂ – Gas bubbler, Colorimetric Pararosaniline - NO₂ – Gas bubbler, Griess Saltzman Reaction	ANV1, ANV2 and/or other established sampling stations	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert 75% of DENR Limit Action 85% of DENR Limit Limit - TSP: 230 ug/NCM; - PM10: 150 ug/NCM; - PM2.5: 50 ug/NCM; - SO₂: 180 ug/NCM; - NO₂: 150 ug/NCM	Alert - Continue monitoring and investigate possible causes of increase of point source emissions Action - Check efficiency of pollution control devices and conduct routine preventive maintenance until pollutant concentrations are down to acceptable levels. Limit - Check efficiency of pollution control devices and conduct routine preventive maintenance until pollutant concentrations are down to acceptable levels. - Implement corrective actions as necessary

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency • Quarterly or as required by EMB					
Noise	The operation of the rail corridor causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria The operation of TSS-1 causes an increase in noise affecting amenity at nearby sensitive receptors	Noise level $L_{Aeq,T}$, dB	Method • 24 hours of continuous monitoring. • Observations should be undertaken during monitoring to determine the accuracy of the measurements Frequency • Monitoring should be undertaken to confirm compliance with the project requirements within six months of commissioning	ANV1, ANV2 and other established sampling locations closest to sensitive receptors potentially impacted by the new rail corridor.	DOTr Concessionaire/Operator	Operation and Maintenance Cost	Alert • Noise monitoring identifies isolated incidents where levels are 5 dB below the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 60$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 65$ dB(A). Action • Noise monitoring identifies isolated incidents where levels are higher than the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 65$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 70$ dB(A). Limit • Noise monitoring identifies multiple incidents where levels are higher than the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 65$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 70$ dB(A).	Alert • Continue monitoring and confirm compliance with criteria. Action • Investigate and identify cause and determine if suitable noise controls can be implemented Limit • Implement site mitigation measures to manage continuous exceedances above criteria

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Vibration causing human disturbance at sensitive receptors generated by the project operation Vibration generated by TSS-1 causes human disturbance at close sensitive receptors	Vibration level VdB (vibration)	Method • 24 hours of continuous monitoring. • Observations should be undertaken during monitoring to determine the accuracy of the measurements Frequency • Monitoring should be undertaken to confirm compliance with the US FTA manual within six months of commissioning	A minimum of four vibration monitoring locations (may include ANV1 and ANV2) at closest sensitive receptors potentially impacted by the new rail corridor.	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • Vibration monitoring identifies vibration levels that are higher than 90% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 65 VdB (re 10-6 mm/s) Action • Vibration monitoring identifies isolated incidents where vibration levels are higher than the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 72 VdB(re 10-6 mm/s) Limit • Vibration monitoring identifies multiple occasions where vibration levels are higher than the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 72 VdB (re 10-6 mm/s)	Alert • Continue monitoring and investigate possible causes of elevated vibration levels Action • Investigate and identify cause and determine if suitable vibration controls can be implemented Limit • Implement site mitigation measures to manage continuous exceedances above criteria
THE PEOPLE								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on: • SDP Implementation • IEC Meetings • Stakeholder Consultations – Public consultations – FGDs – KIIs	Method • Documentation, recording and report monitoring Frequency • Semiannually	Impact barangays and relocation sites	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • 10% negative feedback from participants/ recipients Action • 20% negative feedback from participants/ recipients Limit • 30% negative feedback from participants/ recipients	Alert • Resolve complaints based on GRM • Review implementation of SDP and revise as needed Action • Resolve complaints based on GRM • Review implementation of SDP and revise as needed • Re-conduct SDP workshop

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Project awareness campaign materials - Information disclosure - Online - Mass media						Limit - Review implementation of SDP and revise as needed in coordination with LGU and relevant agencies - Implement corrective actions as necessary
Local economy, employment and business	Maintained and/or Improved living and livelihood conditions of PAPs)	Status of LRIP: - Number of affected persons persons/households including vulnerable groups local communities by type of livelihood/income (land based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) - affected household members and business compensated for livelihood (amount in peso and no.) - LRIP training type provided and record of training (no.)	Method - Social Survey, recording, and progress reporting Frequency - Semiannually until the end of monitoring period agreed with DENR and JICA	Impact barangays and relocation sites	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert 10% reduction in livelihood/ decrease in income Action 20% reduction in livelihood/ decrease in income Limit 30% loss of livelihood/ decrease in income	Alert - Review implementation of LRIP, SDP and revise as needed Action - Review implementation of LRIP. SDP and revise as needed - Re-conduct relevant workshops Limit - Review implementation of LRIP, SDP and revise as needed in coordination with LGU and relevant agencies - Implement corrective actions as necessary
Local economy, employment and business	Generation of local employment and business opportunities	- Composition of workforce - Operation manpower required (no.) - Local and non-local manpower hired (no. & percentage) - Female and male employees hired (no. & percentage) - Members of the manpower from vulnerable group members (no.) - Status of LRIP	Method - Recording and progress reporting Frequency - semi-annually until the end of monitoring period agreed with DENR and JICA	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert 60% of the employees are local residents (based on the skills and capacity) Action 55% of the employees are local residents (based on the skills and capacity) Limit 50 % of the employees are local residents (based on the skills and capacity)	Alert - Increase employability of local residents by undertaking skills training prior to job hiring Action / Limit - Investigate the reasons for not meeting the % local resident employment undertaking skills training prior to job hiring

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		-Eligible PAPs assisted in finding new location for business and in availing of soft loans; -Businesses who are to be relocated and PAPs with movable business asset provide with transportation allowance and/or assistance; -Vulnerable households assisted in re-establishing their livelihood in the relocation site; and -Eligible PAPs/businesses losing income during transition period (not exceeding 6 months) provided income loss compensation						
		• Status of local economy: • Employment rate • Poverty incidence • Business renewal/registration • Capital investment • Tax revenue	Method • Recording and progress reporting Frequency • semi-annually until the end of monitoring period agreed with DENR and JICA	Affected barangay and LGU				
Cultural Heritage	Damage / destruction of physical cultural and archaeological resources	Status of relocation of Casitas de Tondo based on agreements with CAs and PNR	Method • Progress reporting and meetings with CAs and PNR Frequency • semi-annually	The relocation site (NSCR Project Tutuban Station)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Any significant change in the relocation of the Casitas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures during operation

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method - Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency - semi-annually	Historical structures and buildings adjacent or close to the location of project with significant vibration source	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Limit Exceeded FTA standard for vibration	Limit Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
Occupational and Community Health and Safety	Threats to occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - Semi-annually - Immediately in case of accidents Immediately upon receipt of complain	Affected barangays	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Working Environment Measurement (WEM) Compliance with DOLE OSH Standards	Method - BWC-OSHC/ NIOSH method Frequency - Semi-annually	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Parameters for good working conditions are near DOLE OSH limits Action - Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit - Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive quarters	Alert - Implement corrective actions - Review maintenance and housekeeping activities and revise as needed Action - Implement corrective actions - Conduct internal audit and monitoring after implementation Limit - Conduct third-party (external) audit of working environments

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Operation-related accidents	Accidents involving railway (including accidents at TSS-1) employees and passengers (no.) • Cause of accidents • Date and location of accidents • Measure acted to mitigate future accidents	Method • Record of operation-related accidents (inc. incidents, near-misses) Frequency • Quarterly or immediately in case of accidents	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • Internal Audit findings Action • External or Third-Party Audit findings Limit • Unresolved external Audit findings	Alert • Investigate accident and prepare/ improve prevention plan • For railway employees: Safety re-training for workers involved in accident Action • Investigate accident and review effectiveness of prevention plan and revise as needed • For railway employees: Conduct departmental re-training of the workers on health safety rules and regulation Limit • Implement corrective actions as necessary • Coordinate with LGU and relevant agencies to implement accident prevention plan • For railway employees: Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations
	Threat to public health and safety due to transmission of communicable diseases	Status among railway passengers and communities • Confirmed cases (no.) • Undergoing treatment (no.) • Recovered (no.) • Deaths (no.) • Close contacts of confirmed case among the workforce (no.)	Method • Survey trend of epidemic disease • Barangay health records Frequency • Monthly • daily in case of outbreak • Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • case counts are low but increasing Action • case counts are high and/or increasing Limit • case counts are high and/or increasing and area routes of the railway are declared as critical zones or high risk areas	Alert/Action • Limit the passenger capacity of the train • Strictly implement minimum public health standards (PPE use, social distancing) • Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP Limit • Temporarily suspend railway operations and provide safe alternative means of transportation for healthcare / essential workers • Strictly implement minimum public health standards (PPE use, social distancing) • Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
	Threat to occupational (workers) health and safety to transmission of communicable diseases	Status among the workers: - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Barangay health records Frequency - Monthly - daily in case of outbreak - Immediately in case of confirmed cases	SBT Section ROW	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert 5% of employees experience symptoms of disease Action 10% employees are infected with disease Limit 15% of employees are infected with disease	Alert - Assess if illness is work-related; - conduct interview of sick employees and assess health condition by medical health doctor Action - Implement site-wide investigation of cause - Conduct IEC campaign for illness prevention - Monitor health conditions by medical doctor Limit - Implement site-wide investigation of cause, - isolate cases and prevent spread of illness; - Conduct IEC campaign for illness prevention - Continue monitoring by health doctor
	Nuisance from dust, noise and vibration	- Operational railway noise and vibration level - Complaints from sensitive receptors	Method - Noise and vibration monitoring - GRM/ Recording/ Tracking of complaints Frequency - Quarterly or as required by EMB - immediately upon receipt of complaint or in case of any symptom	Co-located with air quality monitoring stations (ANV1, ANV2 and other established sampling station Sensitive receptors	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Negative feedback from surrounding residential and commercial areas. Action - Formal complaints filed by surrounding residential and commercial areas. Limit - Multiple complains filed by nearby residential and commercial areas, or by Contractor/ss and employees.	Alert - Investigate the extent of the damages, and the root cause of the complaint. Action - Coordinate with the LGUs and relevant stakeholders to properly address the issue. Limit - Update the affected surrounding communities about the actions done to address their complaints through written statements and assemblies. - Conduct necessary health programs for vulnerable groups, and massive public information about mitigation measures to avoid damages caused by elevated noise levels.

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- Continue monitoring and documentation of complaints from residents to assess extent and gravity of disturbance. - Continue ambient noise level and vibration monitoring
Traffic Management	Traffic congestion	Traffic-related complaints from the residents and communities surrounding the SBT Section (no.)	Method - Record of traffic-related complaints against the project (physical or online feedback/help desk) Frequency - Monthly	Main intersection near SBT Section ROW	DOTr Concessionaire/Operator	Operation and Maintenance Cost	Alert - Five (5) valid complaints per month Action - Ten (10) valid complaints per month Limit - Fifteen (15) valid complaints per month	Alert - Resolve complaints based on GRM Action - Resolve complaints based on GRM - Review effectivity of Traffic Management Plan (TMP) and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update TMP
ABANDONMENT PHASE								
THE LAND								
Soil Quality and Contamination	Soil erosion and contamination due to debris or spoils	Occurrence of soil erosion	Method - Ocular inspection - reporting, - meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and meeting or as needed	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Alert - noticeable soil erosion in active sites Action - Increased occurrence of soil erosion in active sites Limit - Excessive soil erosion in active sites and immediate vicinity	Alert - Investigate and report the areas with occurrence of soil erosion. Action - Investigate and report the areas with increased occurrence of soil erosion. Identify the cause of soil erosion and improve control measures. Limit - Investigate and report the areas with excessive soil erosion. Identify the cause of soil erosion and fortify control measures and barriers.
	Soil contamination due to accidental spills of oil,	Visible soil staining	Method Visual and odor observation/ immediate reporting of accidental	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Hydrocarbon staining or nauseating odor, reported spills/ leaks from the workers and community	Isolate the work site, stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance HWMP, SPMERP, SCMP and Contact Management Plan

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	lubricants or other chemicals		spills and inspection of work site Frequency • Twice a week to daily					• Report to the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities
		- Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb - Other parameters may be measured as needed	Method - Composite sampling Frequency - Quarterly - Immediately in case of accidental spill	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Alert Visible soil staining/ reported accidental spill Action - Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit - Soil laboratory results exceed DIV – to be agreed with DENR-EMB	Alert - Conduct soil sampling and verify heavy metal concentration through laboratory analysis Action - Conduct soil exposure management - Implement Contact Management Plan Limit - Conduct Site Assessment and Remediation - A risk-based approach in the management of potentially contaminated site is recommended - If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
	Soil contamination due to generation of solid wastes	Management of solid wastes against the approved Solid Waste Management Plan (SWMP) - Status of solid waste generation and collection: - Solid wastes generated (cu.m.) - Solid wastes collected (cu.m.) - Solid waste storage and collection - Solid waste disposal method (transport and disposal)	Method - Ocular inspection - Regular reporting, and meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and - Quarterly or semi-annually Regular audits	Demolition area, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Abandonment Cost	Alert - At least two non-compliances that have not been closed out after one succeeding audits Action - At least two non-compliances that have not been closed out after two succeeding audits Limit - At least two non-compliances that have not been closed out after three succeeding audits	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit - Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Soil contamination due to accidental spills of oil, lubricants or other chemicals, generation of hazardous wastes	Management of chemicals and hazardous substances/ wastes against the approved Hazardous Waste Management Plan (HWMP) and Spills Prevention and Management and Emergency Response Plan (SPMERP) • Stock inventory • Waste chemicals/ hazardous wastes generated • Handling of hazardous wastes (storage, treatment) • Hazardous waste disposal method • Physical soil condition (e.g., presence of hydrocarbon staining) • Fuel condition of demolition heavy equipment and other machineries	Method • Visual and odor observation, reporting, and meeting with Contractors; Inspection of fuel storage sites, hazardous materials storage, generator set area for visible signs of leakage along with general inspection of work sites, inspection of spill clean-up logs and audit of actions taken • Composite sampling Frequency • Daily to Twice a week visual observation, • Monthly reporting and meeting; Regular inspections (e.g., quarterly or semi-annually) • Immediately in case of accidental spill until rregular sampling until fully detoxified	Demolition area, disposal site and sites of temporary facilities	DOTr and Contractor	Abandonment Cost	Alert • At least two non-compliances that have not been closed out after one succeeding audits Action • At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits • excavated soil is considered as hazardous waste as per DAO 2013-22	Alert • Engage lead person and discuss non-compliances and corresponding action items to address them Action • Investigate the root-cause of non-compliances and sanction the involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Health impacts to workers / communities due to exposure to arsenic and other heavy metals	• Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb • Other parameters may be measured as needed	Method • Visual and odor observation • Toxicity Characteristic Leaching Procedure (TCLP) Frequency • Daily • Monthly until fully detoxified.	• SS01, SS02 (especially areas that exceeded soil contamination standards during baseline sampling (e.g. SS02 for As) • demolition area and disposal site (including sites of temporary facilities)	DOTr PMO and Contractor	Abandonment Cost	Alert • Visible staining in soil • Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action • Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis • Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action • Soil exposure management • Implement Contact Management Plan Limit • Conduct Site Assessment and Remediation

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							Limit • Cd, Pb, Cr (VI), As: 5 mg/L; • Hg: 0.2 mg/L; Se: 1 mg/L; • F and B – no standard – to be agreed with DENR-EMB	• A risk-based approach in the management of potentially contaminated site is recommended • If excavated soil is considered as hazardous waste as per DAO 2013-22, soil should be treated/disposed of by accredited TSD facility
Terrestrial Vegetation and Wildlife	• Vegetation removal and habitat loss • Threat to existence and/or loss of important local species • Threat to abundance, frequency, and distribution of important species	For relocated earth-balled trees: survival rate and growth rate, mortality rate, Provision of corresponding number of tree seedlings For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate, mortality rate, provision of corresponding number of tree seedlings For monitoring of improvement in ecology : vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	Method • Periodic (Measurement) • Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) • Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency • Semi-annual	Rehabilitated/ revegetated abandoned site	DOTr and Contractor	Abandonment Cost	Alert • 10% mortality on seedlings • Mortality of at least 3 individuals of endemic plants balled-out individuals. Action • 20% mortality on seedlings • Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out individuals. Limit • 30% mortality on out-planted seedlings • Mortality of endemics and threatened plant species balled-out individuals.	Alert • Replace seedlings and relocated plants that did not survive. • Conduct visual observations and interviews of locals to determine potential causes of mortality • Expand list of native species through screening (by allowing them to grow) that are more adaptable to the site. Action • Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Make necessary adjustment based on result of soil nutrient analysis and investigation Limit • Replace seedlings and relocated plants that did not survive using species more adaptable to the site. • Consider other sites. • Review and revise relocation and revegetation plan to improve plant survival.

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
Geologic Hazards	Ground subsidence	Level of ground subsidence/ change in ground level	Method - Visual observation - Level survey Frequency - Daily visual observation - Weekly level survey or as needed	SBT Section ROW/ demolition area	DOTr and Contractor	Abandonment Cost	Alert - Complaints within impact area Action - Visually observed subsidence or minor damage to aboveground structures Limit - Verified occurrence of subsidence and damage associated with demolition activities	Alert - Investigate complaints if attributable to project activities Action - Implement corrective actions as necessary if the observed subsidence poses threat to the workers and community Limit - Temporarily stop work to recalibrate works and legitimate complainants agreed on resolution
THE WATER								
Surface Water Quality	Siltation and sedimentation	Visual indication of siltation, sedimentation and clogging of drainage canals (e.g. turbidity, accidental spills)	Method - Ocular inspection Frequency - Daily during rainy season	WQ1, WQ2, and other established surface water quality sampling stations near active demolition area, and discharge points	DOTr and Contractor	PHP 10,000.00 estimated laboratory fees per monitoring event for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, and PHP 25,000 sampling fee and expenses Estimated to be around PHP 140,000.00 for four quarterly monitoring events	Alert - Observed presence of concentrated flows from demolition sites to drainage canals which causes siltation - Compare observed in-situ parameters from the baseline data. Action - Observed presence of concentrated flows from demolition sites to drainage canals which causes siltation - For ambient surface water quality: DAO 2016-08 / DAO 2021-19 Water Quality Guidelines (WQG) for Class C waters Limit - Visually evident changes in surface water quality, such as increased siltation, concentration flows of	Alert - Check and monitor the performance of the sediment control equipment/ facilities installed. - Check equipment, demolition activities, or facilities considered as source of leakage, and halt operations for inspection and maintenance. Action - Investigate if changes in water quality is attributable to the demolition activities. - Once identified and verified to be part of the project activities, temporarily halt the specified activity. Apply mitigating measures to stop/attenuate the water quality changes observed. Limit - Investigate if changes in water quality is attributable to the demolition activities. - Once identified and verified to be part of the project activities, temporarily halt demolition activities to identify main sources of pollution, leaks, or any drastic
	Contamination of waterways with domestic wastewater and solid waste	Status of Surface water quality: - Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be measured as needed such as at the event of accidental spill	Method - For temperature, pH and DO – <i>in-situ</i> measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be sampled as needed					

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Contamination of waterways by accidental spills of oil, lubricants, and other chemicals and concrete / drilling wastewater spills	- Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be measured as needed by type of spill	Method - In-situ measurements and grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Immediately in case of accidental spill				wastewater, and oil/grease sheet forming above the water. - Complaints from the community due to water pollution attributable to the Project. - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed. Respond to complaint through the Project's Grievance Redress Mechanism
Hydrology	Climate-induced flooding, aggravated by demolition works	- Daily record of stream flow and water level - Visible signs of clogged cross drainage structure) - Reports of complaints related to flooding from nearby communities	Method - Ocular inspection and in-situ measurement - Check PAGASA weather bulletin Frequency - Daily - Immediate in case of weather warning.	South Antipolo Canal and drainage within project area	DOTr and Contractor in coordination with LGU/ PAGASA	Abandonment Cost	Alert - Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action - Occurrence of 10 cm to 30 cm flooding not subsiding after rainfall event Limit - Occurrence of more than 30cm flooding not subsiding after rainfall event	Alert - Investigate and check drainage clearance Action - Investigate and clear drainage system Limit - Temporary stop work until flooding has subside (clearing/creating new drainage system or pump out water)
THE AIR								
Air Quality	Air pollution due to particulate and gaseous pollutants as well as fugitive dusts from demolition activities including: Use of heavy equipment, machineries, and service vehicles	- Particulate Pollutants: TSP, PM₁₀, PM_{2.5}, Pb - Gaseous Pollutants: SO₂, NO₂, CO₂, O₃	Method 24-hour monitoring for: - TSP: High volume, Gravimetric - PM₁₀: high volume with PM₁₀ inlet, Gravimetric - PM_{2.5}: High volume with PM_{2.5} inlet, Gravimetric - SO₂: Gas bubbler, Colorimetric Pararosanine - NO₂: Gas bubbler, Griess Saltzman Reaction	ANV1, ANV2 and other established sampling stations (including demolition area)	DOTr and Contractor	- PHP 50,000 per monitoring event: 24-hour monitoring of TSP, PM₁₀, PM_{2.5}, SO₂, and NO₂: PHP 30,000 - Mobilization/ Demobilization	Alert 75% of DENR Limit Action 85% of DENR Limit Limit - Complaint lodged by comm TSP: 230 ug/NCM; - PM₁₀: 150 ug/NCM; - PM_{2.5}: 50 ug/NCM; - SO₂: 180 ug/NCM; - NO₂: 150 ug/NCM uni	Alert - Continue monitoring and investigate possible causes of increase of particulates and gaseous pollutants, determine, and address the root cause Action - Check efficiency and conduct routine preventive maintenance of dust suppression systems - Investigate cause of complaint and determine and address the root cause. - Increase frequency of dust suppression

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Storage or stockpiling of solid wastes/debris from demolition sites		Frequency - Quarterly or as required by EMB - Immediate if complaints received			tion Cost: PHP 20,000		Limit - Consider modifications to dust suppression system (i.e., changes to spray nozzle type, upgrade to air-and-water dust suppression system, etc) - Conduct smoke emission tests of vehicles and demolition equipment, as necessary - Review traffic management guidelines
		Dust generation	Method - Visual inspections - Interview with residents of affected barangays and pedestrians Frequency - Daily - Monthly interview and Immediate if complaints received	- Demolition area and storage and/or stockpiles - Access road, dust-generating facilities outside the ROW - Sensitive receptors nearby project area	DOTr and Contractor	N/A	Alert - Visually evident dryness Action - Noticeable dust suspension/deposition, and/or presence of haze Limit - Complaint lodged by community	
Noise	Noise levels that affect the amenity at nearby sensitive receptors Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	Noise level ($L_{Aeq,T}$, dB)	Method - Ocular observation - In-situ measurement using sound meter - Interview with residents of affected barangays Frequency - Daily and Monthly - Immediate In response to complaints or a significant change of demolition methodology	ANV1, ANV2 and, In and around demolition area, temporary facilities, affected barangays and nearby sensitive receptors including socially ecologically significant area/s (if any) likely to be affected	DOTr and Contractor	- Monthly monitoring - PHP 200,000.00 - Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.00	Alert - Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are within 5 dBA of noise criteria outlined in the WBG (EHS) Guidelines: - Residential or institutional receptor: Daytime (07:00 - 22:00) 50 dBA / Nighttime (22:00 - 07:00) 40 dBA - Or background level - Whichever is higher. Action - Complaint lodged by community or Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are occasionally above the noise criteria outlined in the WBG (EHS) Guidelines: - Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA / Nighttime (22:00 - 07:00) 45 dBA	Alert - Continue monitoring and investigate possible causes of increased noise emissions Action - Investigate and identify cause of complaint and determine suitable noise control in accordance with the NVMP. Limit - Determine suitable noise control in accordance with the NVMP.
			Method 24 hours 1-5 minutes of monitoring for a source producing steady continuous noise levels 5-15 minutes of monitoring for a source producing variable or impulsive noise levels	ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors (e.g. schools, daycare centers) along the ROW impacted by the works being				

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency • 24-hour monitoring to occur monthly at most impacted receptors • Monthly at most impacted receptors or immediately in response to complaints or a significant change of demolition work methodology is conducted for each event	undertaken at the time of monitoring • Other sensitive receptors along noise-generating temporary facilities, and access roads outside the ROW			–Or background level +3 dB Whichever is higher. Limit • Noise monitoring identifies levels (LAeq,(1hr), dB) that are continuously above the noise criteria outlined in the WBG (EHS) Guidelines: –Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA / Nighttime (22:00 - 07:00) 45 dBA, or –background level +3 dB Whichever is higher.	
Vibration	Vibration from demolition works may cause human disturbance, and structural damage to buildings and other service structures	Vibration level VdB (vibration)	Method • Ocular observation • Interview with residents of affected barangays Frequency • Daily monitoring for continuous works that generate vibration • Monthly interview • Immediate In response to complaints or a significant change of demolition work methodology:	• In and around demolition area, temporary facilities, • affected barangays including socially ecologically significant area/s (if any)	DOTr and Contractor	Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.00 Quarterly monitoring PHP 70,000.00	Alert • Vibration monitoring identifies levels that are higher than 75% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:75 VdB (re 10-6 mm/s) Action • Complaint lodged by community or Vibration monitoring identifies levels that are higher than 90% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:90 VdB(re 10-6 mm/s) Limit • Vibration monitoring identifies levels that are higher than 95% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for	Alert • Continue monitoring and investigate possible causes of increased vibration emissions Action • Investigate and identify cause of complaint and determine suitable vibration control in accordance with the NVMP. Limit • Investigate and identify cause of complaint and determine suitable vibration control in accordance with the NVMP.
			Method • 24-hour monitoring • 1 – 5 minutes of monitoring for a source producing steady continuous vibration levels • 5 – 15 minutes of monitoring for a source producing variable or impulsive vibration levels	• ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors along the ROW impacted by the works being undertaken at the time of monitoring				

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency • 24 hours to occur quarterly at most impacted receptors • immediately in response to complaints or a significant change of demolition work methodology is conducted for each event.	• Other sensitive receptors along vibration-generating temporary facilities and access roads outside the ROW			structural damage:100 VdB(re 10-6 mm/s)	
THE PEOPLE								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on Project: • SDP Implementation • IEC Meetings • Stakeholder Consultations – Public consultations – FGDs – KIIs • Project awareness campaign materials • Information disclosure – Online – Mass media • GRM	Method • Documentation • Recording • Report monitoring Frequency • Quarterly, • immediate received complaints	Impact barangays and general public	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert/Action • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities Limit • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities and thru helpdesk • Negative feedback from participants/ recipients	Alert/Action • Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit • Resolve issues, concerns and complaints thru the Helpdesk or GRM • Evaluate the reasons for the low social acceptability rate based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary
Local Employment and Business	Generation of local employment Influx of demolition labor (increase in migrants)	• Demolition manpower required by job position (no.) • Local and non-local manpower hired and their position (no. &	Method • Survey, recording, and progress reporting Frequency • Quarterly until the end of demolition	SBT Section/ Demolition area	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert • 70% of the employees are local residents (based on the skills and capacity)	Alert • Increase employability of local residents by undertaking skills training prior to job hiring

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		percentage) and salary paid - Employees hired by gender and vulnerability (no. & percentage) - Working environment provided in consideration of gender equality and needs of vulnerable group					Action 60% of the employees are local residents (based on the skills and capacity) Limit 50 % of the employees are local residents (based on the skills and capacity)	Action - Investigate the reasons for not meeting the % local resident employment - Undertaking skills training prior to job hiring Limit - Investigate the reasons for not meeting the % local resident employment - skills training prior to job hiring
Public Utilities	Disruption in public utility services by relocation	- Affected public utility lines, poles or structures relocated (no.) - Households per barangay affected by the relocation of public utilities (no.) - Status of relocation of public utility lines, poles or structures - Extent of disturbance and actions taken - Complaints received during relocation activities	Method - Coordination with the LGU - Interviews with affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity	SBT Section ROW	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert - Planned power outage or water service interruption due to relocation of facilities Action - Complaints on failure to restore power and water on the given ETR Limit - Complaints on uninformed / unplanned power outage or water service interruption caused by factors that are beyond the control of the public utility companies	Alert - Provide advisory to the affected barangays at least 72 hours before the actual time of service interruption and provide estimated time of restoration (ETR) Action - Coordinate with public utility companies to implement contingency measures such as deployment of generator sets and water tankers to affected areas and conduct rationing - Provide regular updates to the public on electricity and water supply conditions Limit - Coordinate with public utility companies to investigate the cause, assess the damage and necessary repair - Implement contingency measures if the repair or service restoration may take a while
Public Utilities	Increased demand for local resources, resource depletion	- Electricity, fuel and water consumption - Complaint received	Method - Meter readings, utility bills, leaks monitoring - Reporting - meetings Frequency - Daily, monthly, annually	Demolition area, yards, camps and offices Barangays	DOTr PMO and Contractor	Abandonment Cost	Alert 1% increase in consumption/ utility expenditures Action 5% increase in consumption/ utility expenditures	Alert - Implement conservation measures and monitor for possible leaks Action - Implement conservation measures and monitor for possible leaks

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							Limit • 10% in consumption/ utility expenditures	Limit • Conduct calibration testing of utility meters and submeters • If found defective, replace the meters/submeters • Continue implementation of conservation measures
Cultural Heritage	Damage/ destruction risk to physical cultural/ archaeological resources	Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method • Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency • Monthly	Historical structures and buildings adjacent or close to the location of project temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Limit • Exceeded FTA standard for vibration	Limit • Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
Occupational and Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) • Complaints received • Action status against complaints, accidents	Method • Review of GRM implementation record • Review of records of operation-related accidents (inc. incidents, near-misses) • Interviews with LGUs, stakeholder representatives, and employees Frequency • Monthly • Immediately in case of accidents immediately upon receipt of complain	Affected barangays	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert • HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action • HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit • HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert • Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action • Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit • Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Working Environment Measurement (WEM) • Compliance with DOLE OSH Standards	Method • BWC-OSHC/ NIOSH method	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert • Parameters for good working conditions are near DOLE OSH limits	Alert Implement corrective actions • Review maintenance and housekeeping activities and revise as needed Action • Implement corrective actions

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency Quarterly throughout demolition/ abandonment phase				Action - Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit - Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive audits	- Conduct internal audit and monitoring after implementation Limit - Conduct third-party (external) audit of working environments - Update/Improve working environment
	Demolition-related accidents	- Status of accident involving communities - Demolition-related accident/s involving communities (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Survey occurrence of accidents with local communities - Monitoring - Coordination with LGU officials and police - Interview with affected communities Frequency - Daily or Immediately in case of accidents	Affected barangays	DOTr PMO and Contractor in coordination with the LGU	Abandonment Cost	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Demolition-related accidents among the workers (no.) - Demolition-related accidents among the workers (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Occurrence of accidents related demolition work - Monitoring - Documentation Frequency - Daily or immediately in case of accidents	SBT ROW / demolition area and sites of temporary facilities, and access roads	DOT and Contractor	Abandonment Cost	Alert/Action - External HSE Audit findings Limit - Unresolved External HSE Audit findings	Alert - Conduct safety re-training for workers involved in accident Action - Conduct departmental re-training of the workers on health safety rules and regulation Limit - Inspect the area where most accidents happen - Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Transmission of communicable diseases	Status of affected communities - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Barangay health records - Interviews Frequency - Daily - Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert - Case counts are low but increasing Action - Case counts are high and/or increasing Limit - Case counts are high and/or increasing and area declared as critical zone	Alert/Action - Require workers and employees to conduct self-health check prior to going onsite - Require workers and employees with symptoms of a communicable disease to consult a doctor and stay home/ work from home - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP Limit - Temporarily suspend demolition activities and require workers and employees for testing - Require workers and employees who tested positive and their close contacts as well as those with symptoms of a communicable disease to consult a doctor, isolate and take quarantine - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
		Status of transmission of communicable diseases among the workers: - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contact	Method - Survey trend of epidemic disease - Interview and health records of workers - Health check of workers Frequency - Daily or Immediately in case of confirmed cases	SBT Section ROW/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert 5% of workers experience symptoms of disease Action 10% workers are infected with disease Limit 15% of workers are infected with disease	Alert - Assess if illness is work-related; - conduct interview of sick employees and assess health condition by medical health doctor Action - Implement site-wide investigation of cause - Conduct IEC campaign for illness prevention

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		of confirmed case among the workforce (no.)						• Monitor health conditions by medical doctor Limit • Implement site-wide investigation of cause, • isolate cases and prevent spread of illness; • Conduct IEC campaign for illness prevention • Continue monitoring by health doctor
	Nuisance to onsite demolition workers and communities to demolition noise and vibration and dust generation	• implementation and effectivity of PPE during workhours • health condition of workers	Method • inspection, strict reinforcement and maintenance of PPE • Noise and vibration, air quality sampling/ measurement • Regular health check Frequency • Daily, monthly, immediately upon receipt of complaint or in case of any symptom	SBT Section ROW/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert • Health problem reported by employees and workers on-site, or reported damaged PPE Action • Verbal or non-verbal complaints filed by employee s and/or workers Limit • Multiple complaints filed by employees and workers on-site, and if the permissible noise levels, as suggested by DOLE, exceeded the limits.	Alert • Determine equipment, machines, or activities that caused the complaints Action • Coordinate with demolition team to address the root cause, or; coordinate with a health institution for necessary medical check-up Limit • Conduct maintenance of demolition equipment or machineries or use equipment that produce lesser noise. • Schedule strategically shifts to integrate the permissible noise level exposure in the safety of the workers. • Conduct inspection and maintenance of PPE, and repair of damages (if repairable). • Implement strict wearing of PPE on- site. • Record equipment that produce harmful noise levels, and keeping its nearby area off-limits to workers
Public Access and Traffic Management	Restrictions to public access	• Public access closed (no.) • Public access for temporary closure and permanent closure (no. and location)	Method Record of complaints Frequency Immediately	SBT Section ROW, Public access (roads and pedestrian access) temporarily and permanently closed	DOTr and Contractor	Abandonment Cost	Alert • Temporary closure of public access for 3 months or more Action • Temporary closure of public access throughout demolition	Alert/Action Inform/ Coordinate with affected barangays and residents Provide alternate public access Update Public Access and Traffic Management Plan (PATMP)

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Barangays affected by public access restriction (no.) - Public access and traffic-related complaints from the community (no.)		Existing and temporary access roads utilized for the demolition activities			Limit Permanent closure of public access	Limit Update Public Access and Traffic Management Plan (PATMP) in consultation/coordination with the LGU, affected barangays and residents Compensate displaced families and businesses due to landlock or provision of access road
	Traffic congestion	Observed road traffic condition in public access roads within 200 m from the SBT Section/demolition area during incoming or outgoing trips: - Travel distance from origin to destination - Travel time from origin to destination - Roads with heavy traffic within 200 m from SBT Section - Number of hours, days that road is restricted/ closed. - Public access and traffic-related complaints from the community (no.)	Method - Survey traffic volume - Actual traffic observation and documentation Frequency - Weekly monitoring of traffic condition	Main intersection near demolition area and temporary facilities Existing and temporary access roads utilized for the Project	DOTr and Contractor	Abandonment Cost	Alert - Grievance to be resolved at the GR Officer Level - Five (5) valid complaints per month Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department - Ten (10) valid complaints per month Limit - Grievance to be resolved by the DOTr PMO, as necessary - Fifteen (15) valid complaints per month	Alert - Resolve complaints based on GRM Action - Resolve complaints based on GRM - Review effectivity of PATMP and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update PATMP

8.2.1 NSCR PROJECT THIRD PARTY AUDITOR

965. Compliance monitoring for the overall NSCR Project (including the SBT Section) is conducted through a Third Party Auditor (TPA) in lieu of a Multi-Partite Monitoring Team (MMT). The use of a TPA was approved by the DENR-EMB Central Office last 6 November 2018, pursuant to Section 9.2 of DAO 2003-30. The specific functions of the TPA based on the functions of the MMT stipulated in Section 17 of DAO 2017-15 include:

- Formulate and update a Manual of Operations to serve as guide in planning its activities, operationalizing its functions and managing its performance
- Overseeing implementation of the EMP and EMoP of DOTr and the Contractor;
- Conduct quarterly ocular site visit to validate the proponent's compliance with the ECC conditions and the Environmental Management Plan and Environmental Monitoring Plan
- Conduct closing meetings wherein ocular site visit findings shall be discussed with representatives of DOTr PMO
- Observe sampling activities conducted by the project proponent as necessary
- Conduct self monitoring and submit corresponding reports regularly (e.g. auditing CMRs, SMRs, environmental sampling results, etc.)
- Prepare and submit its report to EMB-CO and EMB-RO concerned using EMB-prescribed format at least semi-annually not later than July 30 for the first semester report and January 30 for the second semester report
- Institute an environmental emergency and complaints receiving and management mechanism which shall provide systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts
- Coordinating with the Contractor's Pollution Control Officer (PCO) to ensure timely gathering of monitoring data for environmental parameters, and subsequent monitoring of such;
- Compiling monitoring data gathered by the Contractor and ensure timely submission of the Contractor's Self-Monitoring Report to DOTr;
- Notifying DOTr and the GC about any act or activity by the Contractors that are deemed as violations to the stipulations in the ECC, EMP or EMoP including any amendments issued, and recommend immediate courses of action to avoid or mitigate any violation to the relevant stipulations; and
- Gathering relevant information to facilitate determination of validity of complaints or concerns about the Project and recommend measures to the DOTr and the GC to address the complaints.

8.3 JICA MONITORING AND REPORTING REQUIREMENTS

966. Permits and approvals, anti-pollution measures, and the natural and social environments of the project are monitored by the proponent in consideration of the sector, nature, and phase of the project. The results of the monitoring are confirmed by JICA to ensure that the appropriate environmental and social conditions for the project are followed (see Section 3.2.3). When necessary, JICA may conduct its own investigations on the matter as follows:

- When third parties report that the environmental and social conditions for the project are not followed, JICA forwards the report to the proponent and encourage the same to take action. JICA may also request the cooperation of the proponent in conducting investigations to confirm that the report is being adequately addressed. Should JICA decide that the response of the proponent is inadequate, JICA may consider taking action, including the suspension of disbursement.
- If a project undergoes significant changes, JICA may conduct an environmental review and recategorize the project. JICA discloses the outline of changes and pertinent environmental and social documents. Currently, the SBT Section is undergoing environmental review. The outline of changes and pertinent documents are likewise pending disclosure from JICA.

967. JICA discloses the results of the monitoring on its website to the extent that they are made public by the proponent. When third parties request for additional information on the results, JICA may disclose this information subject to the approval of the proponent. When JICA conducts a detailed design study independently, JICA conducts an environmental review for the project prior to commencement of the study. JICA likewise publish a copy of the final report on its website.

8.4 EXTERNAL MONITORING AGENCY (EMA)

968. In accordance with JICA Guidelines (2010) requirement for environment category A projects, DOTr will hire an external monitoring agency (EMA) to conduct and prepare reports for submission to JICA independent verification of the project's compliance with its EMP/EMoP, ECC conditions, JICA Guidelines (2010) and WBG EHS Guidelines. The specific functions of the EMA include the following:

- Verify results of internal monitoring and supervision undertaken by DOTr and assess adequacy of the process and suggest any improvement measures as required;
- Conduct site visits and assess works contractors' compliance with the EMP/EMoP and their CEMP. Such assessment shall include compliance to World Bank's environmental and social policies;
- Assess the adequacy of EMP/EMoP implementation and identify necessary corrective actions, as needed;
- Review and assess adequacy of the institutional arrangements and capacities of the the PMO, the General Consultant, and the works contractors for EMP/EMoP implementation;
- Assess the extent to which consultation and information disclosure activities are inclusive, accessible, and effective in conveying key information from the EIA/EMP/EMoP as well as provide conditions for stakeholders to contribute to decision making which affects them such as pre-construction, construction and operational impacts;
- Assess the works contractor's construction safety performance, including safety provisions for workers and communities, construction safety procedures, protocols and record, and emergency preparedness and response procedures;
- Assess the effectiveness of the grievance redress mechanism (GRM) and its accessibility and responsiveness to resolving complaints;
- Conduct key stakeholder interviews, as required, to substantiate observations and identify meaningful corrective actions;
- Recommend corrective actions required to resolve on-site environmental problems including proposed actions for inclusion in the Corrective Action Plan (CAP), if required;
- Prepare and submit to DOTr and JICA for review the periodic EEMR for disclosure to the JICA website.

969. The NSCR PMO is required to submit internal and external environment monitoring reports to the DENR-EMB and JICA during the pre-construction, construction, and operation phases until the project completion report is issued. These reports, along with the results of public consultation, SDP and IEC Framework implementation, and information disclosure are disclosed to the public. As such, throughout the pre-construction and construction phases, each works contractor is required to submit monthly environmental compliance reports highlighting the activities undertaken to implement the measures outlined in the EMP and EMoP. These reports include any community complaints received, their resolution, and all activities relating to social protection, health, and safety. Moreover, all events of accidents involving construction workers and community members must be reported within 24 hours to the GC and NSCR PMO.

970. The GC consolidates and forwards to the NSCR PMO the results of the monthly environmental monitoring in the quarterly self-monitoring report, and semi-annual environmental monitoring report. These reports include a summary of the environmental impacts and safety risks during the construction period, as well as the measures undertaken to address them. Once the environmental monitoring reports

are received by the NSCR PMO, the compliance of the project to the ECC and EMP is reviewed by the HSEC and PMO. These reports are then submitted to the DENR-EMB and JICA.

971. All semi-annual environmental monitoring reports are likewise subject to disclosure on the JICA website. During the operation of the project, the NSCR PMO monitors the EMP and commissions a TPA to prepare the semi-annual reports. The NSCR PMO reviews these reports and submits the same to JICA. Semi-annual compliance monitoring and validation reports (CMVR), otherwise known as the MMT report form, are also submitted by the TPA to the DENR-EMB.

8.5 ENVIRONMENTAL GUARANTEE AND MONITORING FUND COMMITMENTS

8.5.1 Environmental Monitoring Fund

972. The EMF is a fund that a proponent is required to set-up after the issuance of ECC by the DENR EMB. The EMF is used to support the activities of the MMT, as described in an Annual Work and Financial Plan approved by the DENR-EMB. However, since the DENR-EMB approved the use of a TPA (**Section 8.2**) for the NSCR Project, DOTr has included the budget for the TPA in the Provisional Sum of their Contractors.

8.5.2 Environmental Guarantee Fund

973. The EGF is a fund that is set up by the DOTr PMO in accordance with the requirements of DAO 2003-30. The EGF has two components consisting of the EGF Trust Fund and the EGF Cash Fund, which are established and used exclusively for the purposes described below:

974. EGF Trust Fund – The EGF Trust Fund is replenished to its original amount annually or whenever the amount goes below a mutually agreed amount between DOTr and the DENR-EMB; it is also be renewed upon every expiration. The fund is used for:

- Compensating of aggrieved parties for any damages to life or property;
- Undertaking community-based environmental programs;
- Conducting environmental research aimed at strengthening measures to prevent environmental damage; and
- Financing restoration and rehabilitation of the environmental quality of the project-affected area.

975. EGF Cash Fund – The EGF Cash Fund is used for the immediate rehabilitation and compensation of affected communities in case of damage or accidents and for the operational costs of the EGF Committee. The EGF Cash Fund is placed in an interest-bearing account, and replenished to its original amount annually or whenever the amount goes 50% below of the amount.

976. The EGF for the SBT Section is part of the overall EGF for the NSCR Project, which is equivalent to a minimum of PHP 1,205,800.00 (Cash Fund) during the construction phase and PHP 3,000,000.00 (Cash Fund: PHP 1,205,800.00; Trust Fund: 1,794,200.00) during the operation phase. The indicative amounts of the EGF Trust Fund and the EGF Cash Fund for the SBT Section is presented below. An additional PHP 550,000.00 per project phase is added to the overall EGF to cover the SBT Section.

Table 8.5.1 Indicative EGF for the SBT Section

Item	Estimated Amount	
	Construction Phase	Operations Phase
Compensation for aggrieved parties for any damages to life or property	PHP 100,000.00	PHP 100,000.00
Community-based environmental programs	PHP 50,000.00	PHP 50,000.00
Environmental research aimed at strengthening measures to prevent environmental damage	PHP 50,000.00	PHP 50,000.00
Restoration and rehabilitation of the environmental quality of the project-affected area	PHP 100,000.00	PHP 100,000.00

Supplemental Environmental Impact Assessment Report for the
the North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Item	Estimated Amount	
	Construction Phase	Operations Phase
Total	PHP 300,000.00	PHP 300,000.00
EGF Cash Fund	PHP 250,000.00	PHP 250,000.00

9. PUBLIC CONSULTATION DOCUMENTATION

9.1 OBJECTIVES

977. A stakeholder engagement program was undertaken as part of the preparation of the Supplemental Environmental Impact Assessment (EIA) Report for the SBT Section. The stakeholder engagement activities were implemented to satisfy the requirements of the Department of Environment and Natural Resources-Environmental Management Bureau (DENR-EMB) concerning the Philippine Environmental Impact Statement System under the DENR Administrative Order 2003-30 (DAO 2003-30); the Guidelines on Public Participation under the Philippine Environmental Impact Statement System (PEISS) under DAO 2017-15; and, the Japan International Cooperation Agency (JICA) Guidelines for Environmental and Social Considerations. Public participation requirements of the DENR-EMB and JICA are presented in **Chapter 3**.

978. The key objectives of the stakeholder engagement program for the SBT Section were to:

- provide stakeholders with information about the Project and the EIA process;
- gather issues, concerns, feedback, and recommendations of stakeholders as input to the preparation of the Supplemental EIA Study Report and project planning;
- inform stakeholders about potential environmental and social impacts associated with the Project along with their respective proposed mitigation measures; and
- develop and maintain open and transparent relationships with stakeholders.

979. The issues, concerns, and recommendations of the stakeholders concerning their understanding of development needs, and adverse effects to the environment and society are consolidated and incorporated into the decision-making processes; the analysis of viable alternatives for development; and the reaching of a consensus on the foregoing. These processes must likewise ensure the meaningful participation of stakeholders in all stages of the project to guarantee the protection of the environmental and social circumstances of the stakeholders.

9.2 OVERVIEW OF STAKEHOLDER ENGAGEMENT ACTIVITIES

980. Stakeholder engagement activities that were conducted as part of the supplemental study include information, education, and communication (IEC) campaigns, and stakeholder consultation meetings (SCMs). The IEC meetings were led by the Department of Transportation (DOTr) assisted by the JICA Design Team (JDT) and conducted on August 6, 2020 with the Manila Local Government Unit (LGU), and March 19, 2021 with Barangay 217 of Manila. Project coordination meetings were also conducted with the Manila Barangay Bureau (MBB) and the Barangay Officials of Barangay 218 on October 8, 2020 and November 11, 2020, respectively.

981. The SCMs during FS phase with the Project Affected Persons (PAPs) were held on 3 February 3, June 7, and August 20 in 2018, while the SCMs during DD phase were held on October 28-29, 2020, November 3, 2020, December 4, 2020, January 13-15, 2021, March 30, 2021, May 12, 2021, June 2, 2021, June 15-16, 2021 and September 14-15, 2021.

Table 9.2.1 Summary of Stakeholder Engagement Activities

Activity	Participants	Information Delivered	Location	Dates Conducted	Sessions (No.)	Methodology	Number of Participants		
							M	F	Total
IEC Campaign	City and Barangay Officials, National Government Agencies, DOTr, JDT, EcosysCorp Corp Inc. (EcosysCorp)	- Project information and timeline - Introduction of environmental and social studies that will be undertaken for the Project - Open Forum	Manila	- August 6, 2020 - October 8, 2020 - November 11, 2020 - March 19, 2021	4	Online	54	63	117
SCMs	City and Barangay Officials, PAPs, National Government Agencies, DOTr, PNR, JDT, EcosysCorp, PAPs of Project Area	- Project information and timeline - Introduction of environmental and social studies that will be undertaken for the Project - Introduction of social (RAP) Activities - Open Forum	Manila	- February 3, 2018 - June 7, 2018 - August 20, 2018 - October 28-29, 2020 - November 3, 2020 - December 4, 2020 - January 13-15, 2021 - March 30, 2021 - May 12, 2021 - June 2, 2021 - June 15-16, 2021 - September 14-15, 2021	25	Blended of both online and on-site methods	454	644	1,101

9.3 GUIDELINES AND PROTOCOLS ON MASS GATHERINGS

982. Since Presidential Proclamation 922 s. 2020, or the national declaration of a State of Public Health Emergency due to COVID-19 on March 8, 2020, the Philippine Government has been imposing restrictions on mass gatherings in varying degrees throughout the country. Pursuant to the said declaration, RA 11469 (Bayanihan to Heal as One Act), and IATF Resolution No. 11 (Recommendations for the Management of the COVID-19 Situation) that prohibits mass gatherings, the DENR-EMB has set out alternative modes of public participation under EMB MC 2020-30 or the Interim Guidelines on Public Participation in the Implementation of the PEISS (PD 1586) During the State of National Public Health Emergency (July 29, 2020).

983. Based on EMB MC 2020-30, the requirement is to conduct public consultations through one or a combination of the (1) on-site option (small group following minimum IATF health standards) and the (2) online option (video conferencing or other similar digital technology for not less than 2 hours) during Community Quarantine period.

984. **Table 9.3.1** shows the community quarantine classifications and mass gathering restrictions in Metro Manila during the stakeholder engagement activities from August 2020 to September 2021.

Table 9.3.1 Community Quarantine Classifications During Stakeholder Engagement Activities

Community Quarantine			Stakeholder Engagement Activities	
Classification	Period Applied	Mass Gathering Restrictions (Venues for meetings and conferences)	IEC	SCM
Modified Enhanced Community Quarantine (MECQ)	August 4-18, 2020	Not allowed.	August 6, 2020	-
General Community Quarantine (GCQ)	August 19, 2020-March 21, 2021	Up to 50% capacity allowed.	October 8, 2020 November 11, 2020 March 19, 2021	October 28-29, 2020 November 3, 2020 December 4, 2020 January 13-15, 2021
Enhanced Community Quarantine (ECQ) v. 2021)	March 29 - April 11, 2021	Not allowed.	March 30, 2021	-
MECQ v. 2021	April 12 – May 14, 2021	Not allowed.	May 12, 2021	-
GCQ with restrictions / Modified GCQ	June 1-15, 2021	Up to 30% capacity allowed except for social events in which only 10% of venue capacity allowed. Establishments with Safety Seal can add 10%.	-	June 2, 2021
GCQ with some restrictions	June 16-30, 2021		-	June 15-16, 2021
MECQ	September 1-15, 2021	Not allowed except provision of health or government services, or humanitarian activities authorized by government agency or instrumentality.	-	September 14-15, 2021

9.4 STAKEHOLDER IDENTIFICATION

985. Prior to the conduct of the stakeholder engagement activities, stakeholders relevant to the Project were identified to ensure their early involvement in the decision-making process. Stakeholders are defined in DENR Administrative Order 2017-15 (DAO 2017-15) as “persons (natural or juridical) who affect or are affected by the project or undertaking, such as, but not limited to, members of the local community, industry, local government units (LGUs), national government agencies (NGAs), and non-government organizations (NGOs) and people’s organizations (POs). The JICA Guidelines for Environmental and Social Considerations (2010) define stakeholders as “individuals or groups who have views about cooperation projects, including local stakeholders.” Local stakeholders are defined under the same document as “affected individuals or groups (including illegal dwellers) and local NGOs.”

986. **Table 9.4.1** presents the list of identified stakeholders for the Project. Directly impacted LGUs were identified based on the area within the estimated total 1.57 km length of the SBT Section, and the project ROW with an approximate width of 15 to 30 m extending up to 100 m from the edge of the ROW on both sides to take account of noise and dust impacts.

Table 9.4.1 Initial Project Stakeholder List

Category	Stakeholder
City Government	Manila City Government, Registry of Deeds – Manila (MNL), Department of Assessment – MNL, Urban Settlements Office (USO), Public Employment Service Office (PESO), MBB
National Government Agencies	Presidential Commission for the Urban Poor (PCUP), Department of Public Works and Highways (DPWH), Department of Human Settlements and Urban Development

Category	Stakeholder
	(DHSUD), National Housing Authority (NHA), Commission on Human Rights (CHR), Pag-IBIG Fund
Project Affected Barangays (Identified Direct Impact Areas)*	152, 155, 157, 159, 160, 161, 162, 163, 164, 165, 184, 185, 186, 198, 200, 203, 204, 213, 214, 216, 217, 218, 221, 227, 228, 231, 232
Others	Manila Electric Railroad and Light Company (MERALCO)

Note: *Apart from the barangays traversed by the project ROW, the project affected barangays for the supplemental EIA study, also referred to as direct impact areas, also cover barangays within the 100-m buffer distance from the edge of the SBT ROW in consideration of noise and dust impacts.

9.5 STAKEHOLDER ENGAGEMENT ACTIVITIES

9.5.1 IEC CAMPAIGN

987. The IEC campaigns were conducted to provide information about the SBT Section and inform stakeholders about upcoming environmental and social surveys that will be conducted as part of the EIA supplemental study. The IEC meetings were held online to allow participants to join remotely due to the on-going pandemic. Concerns relating to the impacts to the environment were responded to by the DOTr during the sessions. IEC meetings were conducted on August 6, 2020, October 8, 2020, November 11, 2020, and March 19, 2021 (**Table 9.5.1**). Major issues and concerns that were raised during the IEC meetings are summarized in **Table 9.5.2**. The minutes of the IEC meetings are provided in **Annex I-1**.

Table 9.5.1 Summary of the IEC Meetings Conducted for the SBT Section

Venue	Date	Participants		No. of Attendees		
		LGU and NGAs	Proponent side	Male	Female	Total
Online: Zoom Meeting	August 6, 2020	Registry of Deeds – MLA, Dept. of Assessment – MLA, PCUP, USO, PESO, MBB, DPWH, DHSUD, NHA, CHR	DOTr, JDT, AECOM, EcosysCorp	22	27	49
Online: Skype Meeting	October 8, 2020	Brgys. 232, 155, 218, 148, 228, 160, 217, 203, MBB	DOTr, JDT, AECOM, EcosysCorp, NSTren	18	15	33
Online: Skype Meeting	November 11, 2020	Officials of Brgy. 218	DOTr, JDT	6	8	14
Online: Zoom Meeting	March 19, 2021	Officials of Brgy. 217	DOTr, JDT, AECOM, EcosysCorp	8	13	21

Table 9.5.2 Summary of Issues and Concerns Raised during the IEC Meetings

Issues and Concerns Raised	Stakeholder	Response to Issues and Concerns	Respondent*
Project Concerns			
Meaning of “demand” in terms of ridership and its effect to affected ISFs	Mary Gene Lipata – Agoncillo, PCUP	Demand is the volume of passengers who prefer to ride the Solis-Blumentritt (SB) Section. SB Section is prioritized because of less affected ISFs. Solis-Tutuban (ST) will be a future project.	KE, DOTr
Estimated number and type of PAHs covered by Phase 1 and Phase 2	Mary Gene Lipata-Agoncillo, PCUP	Phase 1 covers Partial Operation (PO) while Phase 2 covers the remaining areas in Manila. The number of PAHs covers both landowner (LO) and non-landowner (NLO). The number of PAHs for Phase 1 is only 240 for LO and 507 for NLO while for Phase 2 is estimated at 3,844 for both LO and NLO.	ML, DOTr
NHA and school projects in Dagupan area affected by the Project	Marlou R. Mabini, PCUP	DOTr to review the area to confirm and verify the presence of tagged structures in the area.	ML, DOTr
Funding source for the Project	Pablito Abejero, MUSO	Project has been approved by NEDA.	ML, DOTr

Issues and Concerns Raised	Stakeholder	Response to Issues and Concerns	Respondent*
Approval of clearance to resume survey works by the Office of the Mayor.	Pablito Abejero, MUSO	All requests and documents have been provided to the Office of the Mayor.	ML, DOTr
SHFC participation to the meeting.	Mary Ann Policarpio, DHSUD	The focus of the meeting is the Manila LGU departments. The SHFC will not be required to participate.	SL, DOTr
Difference between yellow and red line on the map and affected structures	Arnold del Rosario, Chairperson, Brgy. 218	The yellow line represents NSCR-Ex and SBT Section ROW along Brgy. 218. The areas outside the lines are not part of the Project.	VN, DOTr
Assistance to be provided by the Project to the affected	Arnold del Rosario, Chairperson, Brgy. 218	The list of affected families could not be provided yet during this stage. RAP survey activities must be conducted first.	EE, JDT
Difference between SC Phase 1 and SBT Section	Arnold del Rosario, Chairperson, Brgy. 218	The SC or Calamba Extension is divided into phases. The one mentioned by Ch.AD is part of Phase 1 or the Manila PO Section.	JS, JDT
Coverage of compensation to be provided for loss of structures.	Brgy. Councilors	PAPs will be paid based on replacement cost of structures if covered by the cut-off date.	EE, JDT; GK, DOTr
Relocation and Resettlement Concerns			
Payment of real property taxes, amount of compensation and relocation sites.	Arnold del Rosario, Chairperson, Brgy. 218	On-going discussion with the LGU Mayor on the possible in-city relocation site. If unavailable, off-city relocation site may be considered.	GK, DOTr
Stakeholder Engagement Activities and Survey Concerns			
Suggestion to invite only the persons who will surely be affected to avoid confusion for other residents.	Arnold del Rosario, Chairperson, Brgy. 218	Only PAPs who will attend the SCMs are provided with the invitation.	GK, DOTr
Conduct of environmental surveys	Arnold del Rosario, Chairperson, Brgy. 218	Barangays will be contacted for the environmental activities. The sub-consultants are EcosysCorp for RAP and AECOM for the Environment.	GK, DOTr
Suggestion to hold the meetings within the barangay since the elderly have difficulty to travel	Arnold del Rosario, Chairperson, Brgy. 218	Venue was determined in terms of compactness of space in compliance with Health and Safety Protocols and online SCMs.	GK, DOTr
COVID-19 Concerns			
Concern on COVID-19 transmission	Pee Jay Chiapoco, Chairperson, Brgy. 217	The Chairperson was assured that the field surveyors will not cause for a new COVID case in Brgy 217.	GK, DOTr
RAP Concerns			
RAP (Report) Timeline	Mary Ann Policarpio, DHSUD	Phase 1 Report forwarded to the USO and Office of the Mayor. Phase 2 Report deadline will be adjusted from October-November to a later date.	ML, DOTr
Provision of project information to newly affected families	Pee Jay Chiapoco, Chairperson, Brgy. 217	Newly affected families are not part of the previously conducted SCMs and not yet informed about the Project.	GK, DOTr
Concern on PAPs participating in the recently conducted survey who initially refused cooperation	Pee Jay Bernardo Chiapoco, Brgy. Chairperson	The DMS is currently pending.	GK, DOTr
Inquiry whether PAPs owning private properties will be compensated	Pee Jay Bernardo Chiapoco, Brgy. Chairperson	PAPs owning private properties will be compensated.	GK, DOTr

Note: *Only the complete names that correspond to the initials of the respondents are as follows: Kristian Rey Evangelista (KE), Mary Jane Largo (ML), Sherlynn Mae Lucas (SL), Vanessa Natividad (VN), Gabriel Kintanar (GK), Ella Eleazar (EE), Jahra Santos (JS)

9.5.2 STAKEHOLDER CONSULTATION MEETINGS

988. SCMs were primarily undertaken as part of the RAP process to meet the requirements of the JICA Guidelines for Environmental and Social Considerations (2010). The SCMs are also in line with the requirements under Philippine laws as Section 3 of EO 1035 series of 1985, Section 2 of DAO 96-37 and Section 3 of DAO 2017-15.

989. The SCMs were conducted through a combination of simultaneous onsite and online meetings due to the current restrictions of the pandemic in compliance to IATF guidelines and EMB MC 2020-30. The numbers of participants for the onsite venues were based on the maximum capacities allowed by the IATF to ensure that social distancing was maintained and appropriate health protocols were observed. A total of 18 SCMs were conducted for the Project.

990. The SCMs aimed to provide technical information to the stakeholders about the SBT Section; the stakeholder engagement and RAP processes; their entitlements for compensation, relocation, and resettlement; and land acquisition requirements and processes. It also aimed to scope the issues, concerns, and recommendations of the stakeholders as input to the RAP process. Details about the SCMs including the attendees for online and onsite SCMs are provided in **Table 9.5.3**.

991. Participants of the SCMs were allowed to express their issues, concerns, and views about the Project through an open forum. The participants (including those in written form and submitted online) including raised issues and concerns on alignment, payment/ compensation, extrajudicial settlements, eligibility, land acquisition, livelihood, maps, affected structures/ structure ownership, RAP surveys, relocation and resettlement. The issues and concerns of the participants and the responses of the proponent are covered in **Annex I-2**.

Table 9.5.3 Summary of RAP SCMs Conducted for the SBT Section

Activity	Mode of SCM	Date and Time	Main Participants	No. of Attendees		
				M	F	Total
FS RAP SCMs for SB Section	Brgy. 224 Covered Court	February 3, 2018,2 PM	PAPs, LGUs, DOTr, JDT	5	2	7
	Brgy. 224 Covered Court	June 7, 2018,8 AM	PAPs, LGUs, DOTr, JDT	5	2	7
	Dapitan Sports Complex, Manila	August 20, 2018,8 AM	ISFs, SHFC, DOTr, JDT	8	7	15
DD RAP SCMs for SB Section	Online via Zoom	October 28, 2020,8 AM	PAPs, MBB, DOTr, PNR, JDT	23	28	51
	Online via Zoom	October 28, 2020,11 AM	PAPs, MBB, DOTr, PNR, JDT	15	24	39
	Online via Zoom	October 28, 2020,2 PM	PAPs, MBB, DOTr, PNR, JDT	14	23	37
	Online via Zoom	October 29, 2020,8 AM	PAPs, MBB, DOTr, PNR, JDT	14	23	24
	Online via Zoom	October 29, 2020,11 AM	PAPs, DOTr, PNR, JDT	13	11	24
	Online via Zoom	October 29, 2020,2 PM	PAPs, DOTr, PNR, JDT	9	19	28
	Brgy. 224 Covered Court	November 3, 2020,9 AM	PAPs, DOTr, PNR, JDT	9	17	26
	Brgy. 224 Covered Court	November 3, 2020,1 PM	PAPs, DOTr, PNR, JDT	10	11	21
	Brgy. 224 Covered Court	December 4, 2020,9 AM	PAPs, DOTr, PNR, JDT	16	15	31
	Online via Zoom	June 15, 2021,8 AM	PAPs, LGU, DOTr, PNR, JDT	40	49	89
	Online via Zoom	June 15, 2021,2 PM	PAPs, LGU, DOTr, PNR, JDT	18	27	45
	Online via Zoom	June 16, 2021,8 AM	PAPs, LGU, DOTr, PNR, JDT	10	18	28
FS RAP SCMs for BT Section	Brgy. 228 Covered Court, Online via Zoom	January 13, 2021,9 AM	PAPs, DOTr, PNR, JDT	20	21	41
	Brgy. 228 Covered Court, Online via Zoom	January 13, 2021,1 PM	PAPs, DOTr, PNR, JDT	7	24	31
	Brgy. 228 Covered Court, Online via Zoom	January 14, 2021,9 AM	PAPs, DOTr, PNR, JDT	11	18	29
	Brgy. 228 Covered Court, Online via Zoom	January 14, 2021,1 PM	PAPs, DOTr, PNR, JDT	7	18	25

Activity	Mode of SCM	Date and Time	Main Participants	No. of Attendees		
				M	F	Total
	Brgy. 228 Covered Court, Online via Zoom	January 15, 2021, 9 AM	PAPs, DOTr, PNR, JDT	12	11	23
	Brgy. 228 Covered Court, Online via Zoom	January 15, 2021, 1 PM	PAPs, DOTr, PNR, JDT	10	15	25
	Online via Zoom	May 12, 2021, 8 AM	PAPs, DOTr, PNR, JDT, MERALCO, NHA, Pag-IBIG	92	145	237
DD RAP 1 st SCM for TSS-1	Online via Zoom	March 30, 2021, 8 AM	PAPs, DOTr, PNR, JDT	7	14	21
DD RAP 2 nd SCM for TSS-1	Online via Zoom	June 15, 2021, 8 AM	Non-landowner PAPs, LGU, DOTr, PNR, JDT	40	49	89
DD RAP 2 nd SCM for TSS-1	Online via Zoom	June 15, 2021, 2 PM	Non-landowner PAPs, LGU, DOTr, PNR, JDT	18	27	45
DD RAP 2 nd SCM for TSS-1	Online via Zoom	June 16, 2021, 8 AM	Landowner PAPs, LGU, DOTr, PNR, JDT	10	18	28
DD RAP SCM with MERALCO	Online via Skype	June 2, 2021, 10 AM	DOTr, NSTren, MERALCO, JDT, AECOM	15	20	35
DD RAP SCM for BT Section	Online	September 14, 2021, 8 AM	PAPs, LGU, DOTr, PNR, JDT	36	52	88
DD RAP SCM for BT Section	Online	September 14, 2021, 2 PM	PAPs, LGU, DOTr, PNR, JDT	32	77	109
DD RAP SCM for BT Section	Online	September 15, 2021, 8 AM	PAPs, LGU, DOTr, PNR, JDT	10	27	37
Total				536	812	1348

Note: The number of participants accounted the facilitators, proponent, national/local government representatives and affected persons.

9.6 FUTURE STAKEHOLDER ENGAGEMENT ACTIVITIES

992. Stakeholder engagement will be a continuing undertaking throughout the life of the Project as stakeholders raise new issues and concerns during subsequent phases of the project development, following the ECC conditions, IEC framework, EMP, and EMoP.

10 CONCLUSIONS AND RECOMMENDATIONS

993. The environmental impacts associated with the construction and operation of the SBT Section has been assessed and described in this Supplemental EIA Report. Potential negative impacts were identified in relation to the construction and operation of the SBT Section. Mitigation measures, following the mitigation hierarchy, has been developed to reduce all negative impacts to acceptable level. Positive impacts, direct and indirect, has been enhanced, as much as possible. As such, only after these impacts have been properly addressed, will the full potential of the Project and its objectives will be realized.

994. Most of the negative environmental impacts of the SBT Section are predicted to occur during construction phase and entail development and enforcement of various mitigation measures and management plans by the DOTr, including the following:

- Due to detections of arsenic concentrations attributed as naturally occurring background concentrations in the study area, there are concerns on the potential impacts to construction workers and local communities. The impacts, however, will depend on the volume of soil with high arsenic concentration within project site and the duration of exposure to any person. Additional investigation is therefore recommended to be carried out prior to construction to verify the extent of soil contamination. Necessary action should be conducted depending on the level of contamination detected during the sampling along with preparation of a soil contamination management plan as well as contact management plan for workers. There will be continuous and close monitoring of arsenic concentration in excavated soils within the project site.
- The clearing of vegetation cover along the Project ROW will entail removal of plants including deliberately planted tree species. To minimize adverse impacts, the clearing of vegetation will be limited to only those that have been identified and permitted to be removed by DENR. Trees that will not be permitted to be cut will be relocated within the Project ROW before considering areas outside the project site. The Project will comply with the stipulations of Revised Forestry Code (Presidential Decree 705) in terms of acquisition of tree cutting permit and compliance to its conditions including seedling replacement for cut trees following the requirements of DENR Memorandum Order No. 2012-02. All sites to be planted within and in the vicinity of the project site will be closely monitored by the DOTr until they are deemed self-sustaining, functional or able to deliver intended ecosystem services, and integrated in the larger ecosystem in which they are located.
- Concern on siltation and sedimentation during construction phase will be managed by the development and enforcement of solid waste management plan and erosion and sediment control plan as well as compliance to the requirements of discharge criteria of the Clean Water Act of the Philippines. To further ensure minimal impact to receiving waterways, an effluent management plan will be developed by the contractor as part of the CEMMP.
- Due to the existing poor quality of water in the waterways, overflow of polluted water and wastes finding its way to nearby residents during heavy rainfall and flooding event is also a concern. Hence, construction activities will cover waste management and drainage system improvement within the construction sites. Also, there will be sufficient drainage taking into account the expected volume of stormwater during operation.
- Fugitive dusts such as wheel entrained dusts, storage and handling of materials, and stockpiles of construction equipment may increase dust concentrations in the area. Fugitive dust emissions can be controlled by managing vehicle speeds and implementing a robust traffic management guidelines and fuel efficiency measures. Regular water sprinkling/spraying will also be conducted to further reduce the impacts to air quality.
- Though baseline noise levels have already exceeded the standards, additional noise may be generated by various construction activities that may impact nearby sensitive receptors. In

consideration of potential impacts to sensitive receptors, prior information and coordination with affected residents will be conducted through stakeholder engagement activities. To address the concern, appropriate noise attenuation measures will be implemented (i.e., noise barriers, enclosures, etc.). Furthermore, reassessment of future construction and operational noise and vibration will be undertaken in consideration of final detailed engineering design and train specifications to validate proposed mitigating measures. During construction and operation phases, noise and vibration levels as well as effectiveness of mitigating measures will be monitored to ensure compliance with the requirements of the National Pollution Control Commission (NPCC) Memorandum Circular 1980-002, World Bank Group – Environmental, Health and Safety (WBG-EHS) Guidelines on Noise Management, Japanese Noise Value Guidelines and US FTA Monitoring criteria.

- Although the existing PNR ROW will be utilized for the SBT Section, additional land acquisition for the Project ROW is necessary to achieve the capacity and design objective of the Project that results in involuntary resettlement. To address physical and economic displacement brought about by involuntary resettlement, a robust and responsive Resettlement Action Plan (RAP) will be developed and implemented in accordance with JICA Guidelines and applicable Philippine laws and regulations. This will include external and internal monitoring to ensure mitigating measures are done in compliance to the EIA and RAP. There will also be a GRM to serve as a platform for DOTr to engage constructively and productively with affected communities and stakeholder groups and to address concerns relating to the project impacts.
- During operation phase, economic opportunities and accessibility brought about by the Project may contribute to increase in in-migration and draw more people to the city including the probability for informal settlers to proliferate. As a result, pollutive anthropogenic activities such as domestic wastewater being discharged to nearby waterways may increase that may cause adverse impacts to quality of life such. Lack of sanitation facilities and treatment will be left uncontrolled. Thus, there is a need for the LGU and relevant water and wastewater concessionaire to take part in regulating and managing pollutive practices of locals including improper disposal of waste and wastewater.
- To address concerns on the health and safety of both the workers and the public during construction and operation, an Occupational and Community Health and Safety Management Plan (OCHSMP) and Emergency Preparedness and Response Plan (EPRP) will be developed and implemented.
- In order to protect cultural/historical assets, particularly the Casas de Tondo, DOTr will closely coordinate with the National Historical Commission of the Philippines (NHCP), National Museum (NM) and National Commission for Culture and the Arts (NCCA) for the proper management of cultural and archaeological assets as well as the development and implementation of Cultural Resources Protection and Preservation Plan and other relevant conservation management plans.
- In compliance with the PEISS and JICA environment and social considerations, the public is provided several venues to air issues and concerns during the entire project life. As such, there will be continuous public consultation and information dissemination about project schedule and specific activities prior to construction on site. During construction and operation phase, any project updates that may directly or indirectly impact the host communities will be communicated.

995. Furthermore, the development of major projects, such as the NLEX-SLEX Connector Road Project and the NSCR Calamba Ex Project coinciding with the construction of the SBT Section that may result in cumulative impacts are also assessed as discussed above.

996. The above listed mitigating measures will be implemented and continuously monitored throughout the project life. This will include updating of management plans as new information and

technology becomes available. Monitoring reports will be regularly submitted to the DENR and JICA, as necessary, and will be made accessible to public.

997. The DOTr, as the project proponent, is responsible for the management of the environmental and social impacts identified in this Supplemental EIA Report. Prior to construction, all management plans in compliance with the ECC conditions, EMP and the EMoP will be implemented by the DOTr. Similarly, the DOTr will monitor compliance to the plans that will cover the project ROW and its immediate vicinity as well as project-associated temporary facilities located off site.

998. The DOTr will manage identified impacts in compliance with the requirements of the local environmental regulatory agency, the DENR, as well as in compliance with relevant international standards as part of its commitment to its lender – in the case of the SBT Section, the JICA. Reports of negative impacts, unresolved grievances, or poor project perception gathered during monitoring and continuous public participation will be addressed immediately.

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Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
GENERAL						
Pre-construction, construction, operation activities	Land, Water, Air and People	-	Comply with relevant national and international environmental laws, guidelines, and standards¹ • JICA Environment and Social Guidelines (2010). • Philippine Environmental Impact Statement System (PEISS). RA 6969: Storage, Transport, Handling, Treatment and Disposal of Hazardous Waste • Secure hazardous waste generator's ID from DENR-EMB. • Provide hazardous materials storage area. • Store hazardous materials/wastes in appropriate containers properly sealed and labelled. • Transport hazardous wastes by an accredited waste transporter • Treat hazardous waste by a registered waste treater (TSD Facility). RA 9003: Management and Disposal of Solid Wastes • Segregate, recycle and provide waste color coded bins, etc. • Provide Material Recovery Facility (MRF). • Regularly haul out solid wastes through the LGU or private contractor. RA 8749: Comprehensive Air Pollution Control Policy • Secure permit to operate all air pollution source installations (i.e genset). • Conduct regular inspection and preventive maintenance of heavy equipment, machineries and service vehicles to meet the DENR Emission Standards. • Conduct regular cleaning and clearing of construction access/site surfaces of spoils and debris from construction equipment and vehicles and wetting of ground soil in the construction site when necessary. • Control vehicle movement maintaining the speed limit within the construction site to <10kph and provide cover to loaded trucks.	Implement: • DOTr PMO • Contractors • Operators Monitor: • DOTr PMO • GC • LGUs • EMA, TPA • DENR-EMB	Contractor and operator's service fee on health, safety and environmental (HSE) management RA 6969: PhP 100,000 p.a. RA 9003: PhP 400,000 p.a. RA 8749: PhP 400,000 p.p.a. RA 9275: PhP 400,000 p.a. PD 442: PhP 6,000 per worker PD 856: PhP 50,000 p.a. Sanitary facility: PhP 200,000 per site Emergency Response Plan (ERP and Occupational and Community Health and Safety Management Plan): PhP 300,000 Health and Safety Desk or Medical Station: PhP 200,000 per site PhP 1,500 per man-hour	EGF/ Bid Documents/ Contract Agreement

¹ Compliance to relevant laws, guidelines and standards but not limited to those presented here and those discussed in Section 2 of this Supplemental EIA Report.

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			RA 9275: Comprehensive Water Quality Management and for Other Purposes - Secure discharge permit. - Provide Wastewater Treatment Facility. PD 442: Labor Code of the Philippines, as amended (including Occupational Safety and Health Standards) - Consider gender equality in the hiring of workers - Include medical certificate in the requirements for hiring of workers to ensure that they are fit to work. Ensure that they are provided with proper training on construction, occupational health and safety, and emergency response procedure. - Provide appropriate personal protective equipment (PPE) to all construction workers, particularly to the personnel working on heights, heavy and electrical equipment. - Establish Health and Safety Desk or Medical Station at the active construction sites to monitor and safeguard the health of the workers and local residents and to provide immediate response during unexpected incidents/emergencies. - Closely coordinate with the nearest hospitals in the active construction site for immediate transfer and/or further evaluation and medical management of the patient. RA 8504: Philippine AIDS Prevention and Control Act of 1998 - Educate employees on standardized basic HIV/AIDS information and instruction. PD 856: Sanitation Code of the Philippines - Provide safe and clean water for drinking. - Provide appropriate sanitary facilities such as portable toilets and waste bins. Implementation of Emergency Response Plan (ERP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include but not limited to: - Distribute guidelines for employees and workers on HSE management. - Conduct orientation and continuous trainings of qualified workers, employees and/or operator/s on Environmental Management, Basic and Construction Occupational Safety			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			and Health, Scaffolding Safety, Fire Safety and Safe Use of Chemicals at Work. • Conduct earthquake and fire drills with the participation of employees and workers. • Provide appropriate PPE for workers. • Provide security personnel. Note: Laws and regulations applicable to the Project are listed here given their relevance to multiple impacts.			
Baseline Environmental Surveys	• Soil quality and contamination • Terrestrial ecology • Surface water quality • Air quality • Noise • Vibration		Pre-Construction • Conduct environmental baseline surveys where necessary such as TSS-1, temporary facilities and other locations indicated specified in the EMoP and design changes.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
Additional surveys	Land Health and safety		Pre-Construction • Conduct additional soil testing to verify the extent of soil contamination (arsenic and if any other concerns arise) in the project site. • Conduct traffic Impact assessment (TIA) for Blumentritt-Tutuban Section, if required. • Conduct building condition survey of Casas de Tondo and other sensitive buildings if any. • Conduct engineering geological and geohazard assessment studies such as geotechnical investigation, three-dimensional groundwater modelling, liquefaction potential analysis and comprehensive study on West Valley Fault, if required. • Conduct rail safety assessment in compliance with NFPA 130 and other relevant national and international standards, including third-party audit.	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
CEMMP (focusing on Contractor's	EMP Implementation		Pre-Construction • Prior to start of site works and within 60 days upon receipt of the notice to proceed, the Contractors are to prepare a site-	Implement: • DOTr PMO • Contractor	Contractor's service fee on HSE management	EGF/ Bid Documents/

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Environmental Management Plan (CEMP)			specific CEMP based on the updated EMP of this Supplemental EIA Report and submit to DOTr for JICA review. The CEMP that includes the following: - scope of works and schedule, construction methodology, facilities and site conditions, including sensitive receptors. - the detailed operational plan for the implementation of the EMP/CEMP with targets/indicators over a specific timeline that would be monitored for milestone highlights. • Include the preparation of the following specific management plans in the CEMP: - Pre-Construction Vegetation Clearing Plan - Vegetation and Ecology Management Plan - Spoil Management Plan (SMP) - Soil Contamination Management Plan (SCMP) - Erosion and Sediment Control Plan (ESCP) - Solid Waste Management Plan (SWMP) - Hazardous Waste Management Plan (HWMP) - Effluent Management Plan - Flood Management Plan (FMP) - Climate Change Adaptation and Mitigation (CCAM) Plan - Dust and Emission Control Plan - Noise and Vibration Management Plan - Labor Influx Management Plan or Worker's Camp Management Plan. - Public Access and Traffic Management-Plan (PATMP) or Traffic Management Plan (TMP) - Occupational and Community Health and Safety Management Plan (OCHSMP) - Emergency Preparedness and Response Plan (EPRP) - Pandemic Response Plan (PRP) - Cultural Resources Protection and Preservation Plan - Social Development Plan (SDP) - Energy Conservation Program - Water Conservation Program - Abandonment Plan	Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB		Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Note: Plans applicable to the Project are listed here given their relevance to multiple impacts. Specific measures under each plan are listed at the first citing of the plan or program.			
LAND						
Clearing of ROW and vegetation removal	Terrestrial vegetation and wildlife	- Narra trees along the alignment from Caloocan to Tutuban and at the Valenzuela depot site may be affected and removed during the clearing operation - Other trees, such as fruit bearing trees, along the alignment will be removed - Habitat loss - Topsoil removal will have no impacts to wildlife as there are no fossorial or burrowing species recorded in the area.	- Coordination with concerned agencies or groups for relocation sites of earth-balled trees and management of reforestation site. - Provision of corresponding number of tree seedlings will be provided by the proponent in replacement of trees to be cut - Monitoring of survival of trees planted - Provision of compensation to owners of non-timber species such as fruit trees that are removed (to be included in the RAP) - Design, plan and implement the project that will minimize vegetation clearing, alteration of landform particularly in areas adjacent to flora of higher conservation significance (i.e., Antipolo, Is-is, Narra) and in the vicinity of ecological significant areas. - Prepare and implement pre-clearing plan will include the following: 100% inventory of plants that may be affected by vegetation removal; - Determination of important species that will require relocation; - Marking of plants allowed to be cut or relocated; - Demarcation on the ground the limits of vegetation removal prior to any clearing activities to eliminate unnecessary cutting or clearing; and - Development of relocation procedure, post relocation care and maintenance, and protection. - Protocols on how to handle and manage potential wildlife that may be encountered during vegetation clearing. - Relocation/balling-out of endemic and/or threatened trees from the ROW. - Handling of debris from vegetation clearance and tree cutting.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	[Tree Cutting] PHP 20,000 / ha Cost will include but not limited to pre-clearing plan, tree inventory, tree baling and transport, purchase of seedlings to replace relocated trees that will not survive, preparation of relocation cum off-set area, and monitoring cost. Seedling cost: using indigenous species with a density of 500 seedlings / ha at P12 seedling, P6,000/ ha. [Tree Relocation] PhP10,000/ha Cost will include but not limited to assessment and preparation of the relocation area per FMB TB #10-A). Detailed costs include: site validation, assessment and planning (PhP450/ ha); site preparation and planting (PhP6,500/ ha); IEC/transportation/mobilization of partners (PhP1,000/ ha); and, maintenance and protection (PhP5,000/ ha/ year).	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Conduct 100% inventory of trees that may be affected by vegetation removal - Secure all statutory requirements following DAO 2020-06 relating to vegetation clearing or relocation (i.e. 100% Tree Inventory and Tree Cutting Permit) and RA 8048 (Coconut Preservation Act of 1995) from the DENR and PCA, respectively, before any vegetation clearing operations - During the inventory, potentially affected wildlife that may be occupying areas marked for vegetation clearing also need to be identified for cataloguing and for turnover to the local DENR for relocation to nearby suitable habitats. - Coordinate with the DENR and the LGU for trees not allowed to be cut and the relocation areas in lieu of the areas affected by vegetation clearing - Replace non-surviving relocated plants as DMO 2012-02 (Uniform replacement ratio at 1:100 replacement ratio) requires. - Demarcate the ground with the limits of vegetation removal prior to any clearing activities to eliminate unnecessary clearings - Prohibit use of hazardous chemicals/herbicides/pesticides for vegetation clearing/removal in any portion of the ROW. - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and management procedures of the cut logs and/or sustainable practices in disposing vegetation waste. - Implementation of RA 9003 and implementing the 5Rs (i.e., Refuse, Reduce, Reuse, Repurpose, and Recycle. all wastes will find a use if possible i.e. leaves from trees can be composted as natural soil improvers and all generated logs will be turned over to the local DENR and converted into furniture for government schools and offices. no burning of any type of solid wastes generated during the vegetation removal and tree cutting. Construction - Plant vegetation on vacant space within the project site as much as possible certain vegetation types (with due consideration of height restrictions) will be allowed to grow on		PHP 20,000 / ha Cost will include but not limited to development and implementation of a pre-clearing plan. Perform detailed inventory/ survey of plants in the SBT ROW (not just trees and saplings). Relocate other plant growth forms that are equally important (threatened and/or endemic). PHP 10,000 / ha Post vegetation clearing activities. Care, maintenance, and protection of out-planted seedlings and relocated trees	

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			selected portions of the project site though Assisted Natural Regeneration (ANR). - The relocation and replanting sites are according to the order of priority: (a) within the project site (e.g., reintroduction within the ROW after construction phase); (b) outside the project site but within affected barangays; and (c) outside affected barangays but within the City of Manila. The relocation site(s) should be designated for long term use, and if possible, legally declared to be protected and enriched. The DOTr will coordinate with LGU and secure their approval. Designate the relocation site(s) for long term use, and if possible, legally declare to be protected and enriched - Planting within the project areas, especially in areas where heavy equipment movement is frequent, will have to commence when construction activities are completed to prevent damaging the replanted trees - Replant outside the project area may commence simultaneously with the construction activities once coordination and agreements with DENR and the LGUs are settled - Monitor the growth of replaced trees and ecosystem recovery/ establishment and disclose the results to the public. In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - replace non-surviving replaced/ relocated trees with corresponding number of tree seedlings following DENR MO 2012-02 (usually 1:100 replacement ratio) that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis before planting and amend as necessary - Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on result of soil nutrient analysis and investigation			
Clearing of ROW and vegetation removal		Threat to abundance, frequency, and	Develop and implement a pre-clearing plan detailing the management of all endemic and/or threatened species found within the Project ROW from inventory, characterization, relocation or propagation, up to management.	Implement: - DOTr PMO - Contractor	Cost will include but not limited to development and implementation of a pre-	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		distribution of important species (Birds and other wildlife, particularly endemics species, will avoid the area due to loss of vegetation.) Threat to existence and/or loss of important local species	- Identify all endemic and/or threatened including selected native species will be identified, characterized, and relocated and if not practicable, seeds/wildlings for propagation will be collected/transferred. - Minimise the cutting of the endemic and/or threatened species as much as possible. - Replacement seedlings will also consider local endemic and/or threatened species recorded during this baseline study. The use of native plants should be considered if green spaces are favored. Native plants especially pioneer species i.e. Alim (Melanolepis multigalIndulosa), Anabiong (Trema orientalis), Hauli (Ficus septica), Is-is (Ficus ulmifolia), Binunga (Macaranga tanarius) etc. - The relocation and replacement planting site being considered that will be located outside the project area is the La Mesa Watershed Reservation in Quezon City. This site is the nearest natural habitat (relative to the ROW) for the recorded endemic and/or threatened trees, and there is land available to receive relocated trees and replacement seedlings. - The effectiveness of ecological mitigation measures will be monitored as described in "Habitat Loss by Vegetation removal. - Restricted access to location of threatened and/or endemic species within said areas will be implemented. Collection of plants and wildlife hunting will be strictly prohibited.	Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	clearing plan: PhP 1,500 per man-hour Perform detailed inventory/survey of plants in the SBT ROW (not just trees and saplings): ranges from PhP 100,000-500,000 for 100% tree inventory Relocate other plant growth forms that are equally important (threatened and/or endemic): PhP 100 per sapling	
Site Preparation and Development	Terrestrial vegetation and wildlife	Dust deposition on vegetation by anthropogenic activities	Construction - Properly cover overfills, topsoil/ soils, spoils, and construction materials onsite as well as construction equipment, trucks and vehicles for the transport of materials to prevent escape of dust. - Strictly implement policies regarding safe driving and enforce the speed limit for vehicles along the access roads. - Execute water sprinkling in access roads and areas with exposed soils or dust-generating materials or equipment at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area.	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Terrestrial wildlife	Vehicular strikes to wildlife and vegetation	Construction - Strictly implement policies regarding safe driving and enforce the speed limit for vehicles along the access roads. - Install proper signages to increase awareness and avoid accidents			
		Intensified noise caused by anthropogenic activities	Construction - Contain and monitor the effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards for all vehicles and heavy equipment to reduce effects of noise pollution - Intense producing noise activities will be minimized when birds are most active (i.e., 6:00-8:00 am and 3:30-5:30pm). - Both sides of the ROW will be fenced.			
		Increase in the intensity of artificial light by anthropogenic activities	Construction - Contain and monitor the effects from source of artificial light at night during operation hours - Improve vegetation that creates barrier to limit the glare coming from the artificial light - Concentrate the light on operations using directional light - Install anti-glare to the source of artificial light to regulate glare - In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the project site and bring back into its natural habitat			
Development of Depot Site	Wetland habitat	Loss of small swampy area used for a few migratory and resident birds	- To offset the lost wetland, the proponent will seek assistance from the Society for the Conservation of Philippine Wetlands (SCPW) to identify an adjacent wetland area that the proponent will manage/conserves and enhance so that this area will attract the birds and stay here instead. - Conduct seasonal bird count to monitor the bird population in the surrogate wetland area established.		To be included in the project cost to be finalized during DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/untoward incidents
Site Preparation and Development	Geologic hazard	Liquefaction in the event of an earthquake or due to heavy load construction	Pre-Construction Design the earthquake loading capacity of structures to resist earthquake ground motion based on projected PGA values from the West Valley Fault as well as relevant national and international standards		Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		activities may result to bearing failures, floatation of embedded structures, damage to overlying structures Continuous operation of heavy machinery produces vibration that may induce liquefaction	- Adhere to seismic and structure design standards including but not limited to the DPWH Guide Specifications Load and Resistance Factor Design (LRFD) - Bridge Seismic Design (2013), DPWH Design Guidelines, Criteria and Standards Volume 5 – Bridge Design (2015) and AASHTO LRFD (2015). - Conduct IEC campaign on railway structure and geologic hazards for the workers, employees, and surrounding communities Construction - Implement the Emergency Preparedness and Response Plan (EPRP) to include emergency protocols, such as temporary suspension of construction activities - Ensure pile foundations are deep enough to reach the load bearing strata based on the geotechnical study conducted - Conduct preventive maintenance/inspection on the integrity of structures; reinforce if necessary			
Earthworks (excavations for foundation, cut and fill, land grading, etc.)	Topography	Alteration of topography	Construction Depot area must be re-graded to match the original topography	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management Soil erosion control: PhP30,000 per m ² Drainage system: PhP15,000 per meter	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
		Soil erosion	Construction - Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected, benching of cuts, use of sediment basins - Provision of surface water runoff drainage systems - Limit stockpile height up to 2 m high only - Minimize removal of vegetation cover as much as possible - Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season)	Implement: - DOTr PMO - Contractor	Included in the contractor's service fee	

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Soil	Soil contamination due to oil or lubricant spills	Construction • Provide proper construction machines and heavy vehicles and maintain them properly • Oil and grease traps in the drainage system • Establish and implement health and safety management plan and emergency and contingency plan in case of spills		Contractor's service fee on HSE management	
	People (Health and Safety of Workers and nearby communities)	Worker and community exposure to health and safety hazards due to working in areas with contaminated soils and/or excavation of such soils (Meycauayan soil contaminated site)	Pre-Construction • Establish and implement specifications for worker safety, and proper disposal of excavated materials • Confirmation by DENR EMB of Site Management Plan for Contaminated Land • Fencing of the contaminated soil area prior to confirmation Construction • Proper management and disposal of excavated contaminated soil to an EMB registered facility for hazardous wastes	Implement: • DOTr PMO • Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
Construction/ Civil works Liquefaction Ground subsidence Ground shaking/ Ground rupture	• Solid Waste • People (Health and Safety)	• Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	• Submission and implementation of Solid Waste Management Plan • as part of contractors' engagement • Provision of waste bins to avoid dispersal of litter and regular site maintenance duties • Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests	Implement: • DOTr PMO • Contractor	To be included in the contractor's service fee on health, safety and environmental management	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Liquefaction – geological environment of entire alignment is highly susceptible to liquefaction	Loss of soil strength, settlement of soil, lateral spreading, bearing failures, floatation of embedded structures, damage to overlying	• Undertake more detailed geotechnical investigation and liquefaction potential analysis during the DED stage	• DOTr PMO • DED Consultant	To be included in the DED Cost	EGF

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		structures, in the event of an earthquake				
	Ground settlement	Settlement due to placement of new embankments, bridges, viaducts, and platforms	Conduct more detailed geotechnical investigation and settlement analysis during DED	- DOTr PMO - DED Consultant	To be included in the DED Cost	EGF
	Ground shaking/ Ground rupture	Embankments and structures will be subjected to strong seismic loading in case of a major earthquake along the West Valley Fault	- Undertake site-specific, project specific seismic hazard assessment will be conducted during DED; Results of the JICA MMEIRS report will be considered in the assessment. - Design structures that will address seismic hazards identified above	- DOTr PMO - DED Consultant	To be included in the DED Cost	EGF
Earthworks (excavations for foundation, cut and fill, land grading, etc.)	Soil quality and contamination	Soil erosion and contamination due to generated excess soil or spoils	Pre-Construction - Design slope protection/ soil erosion control to prevent or minimize slope failure during construction based on the results of the geohazard assessment and geotechnical investigation - Limit the removal of vegetation cover and topsoil to what is necessary for the works by marking up the vegetation removal area on site - Designate the spoil disposal area (SDA) where no future slides are to take place and be washed off in watercourses - Avoid locating the SDA on (1) irrigated rice fields, (2) slopes of more than 25 degrees, (3) where geological structure is unfavorable to stability, (4) on slopes that are subjected to stream erosions, (5) on areas identified to be protected or are special status habitats, (6) within 100 m from waterbodies or drainage line, whether permanent or seasonal, (7) on areas where adequate health and safety procedures are not in place, (8) areas of groundwater discharge, sources of drinking or irrigation water and (9) areas where permanent stabilization of disposal spoils will be difficult Construction	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management Soil erosion control: PhP30,000 per m² Drainage system: PhP15,000 per meter	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Implement the Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and sedimentation and Spoil Management Plan (SMP) to properly handle, transport and dispose spoils (including identification of haul routes, truck queuing and parking procedures for dust control and mud-tracking prevention) • Minimize ground subsidence, maintain stable cut and fill slopes at all times and install engineering interventions such as slope protection and drainage systems with sedimentation/erosion pond and temporary ditches around work areas to collect sediments from erosion or use bunds and silt fences to protect watercourses from soil run-off during the wet season • Schedule clearing and excavation activities in a speedy manner during dry season and minimize excavation during wet season • Place construction materials and excavated materials including excess soil/ spoils on appropriate staging site or spoils area with adequate containment away from waterways • For stockpiles of excavated soil, cover and limit at height up to 2 m and install silt traps, deviation channels, mounting, barriers or trenches around the stockpiles. For spoils, immediately haul out and remove from the construction site and transport to the disposal site especially prior to expected rains. Ensure wet/damp soils are sufficiently dry prior to transport • For stockpiles of sand and gravel for construction, install fences around and reduce storage time in the work areas to minimize sediment transport during heavy rains • For excavation works, adequately brace the sides of the excavation, drive double steel sheet piles in the construction area near soil surface water sources, and use bentonite or polymer slurry for bored piles to prevent soil erosion or soft soil displacement and to stabilize uncased borings in loose soils • Regularly clean and clear the construction areas and road surfaces of scattered construction materials and scraps to avoid obstruction of natural flow especially during the wet season			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- For construction works during wet season that may require long-term storage, grade soil storage heaps to flat tops and cover or vegetate with soil stabilizing grasses for long-term storage - Monitor visible signs of erosion and implement the Erosion and Sediment Control Plan (ESCP) for the disposal and management of soil			
Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Soil quality and contamination	Soil contamination due to generation of solid wastes (including wastes from vegetation clearing and demolition)	Construction - Submission and Implementation the Solid Waste Management Plan (SWMP) as part of contractors' engagement - Minimize the production of wastes that must be treated or eliminated - Reuse leftover concrete and metals for suitable alternative projects - Repurpose cut logs and other usable wastes (e.g. convert into school chairs) - Recycle wastes including soil - Sort wastes for disposal, designate an appropriate temporary storage area and provide MRF - Manage all debris and other waste generated during vegetation removal based on DAO 2001-34 especially on handling and management procedures of the cut logs and/or sustainable practices in disposing vegetation waste - Engage only DENR and LGU-accredited companies in the tree cutting and vegetation removal procedures. Contractors to follow RA 9175 and chainsaws to be used for the tree cutting activities will have a Certificate of Registration from the local DENR - Ensure that collectors undergo the minimum standards and requirements for the collection, transport and handling of solid waste per DAO 2001-34 Rule 10, Section 1 - Provide 75-liter waste bins with covers and label at strategic locations in work areas for segregated storage of different types of solid wastes, including hazardous wastes - Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Dispose non-recyclable wastes (trash bags, non-recyclable plastic, glass, non-recyclable paper) to a sanitary landfill by a licensed contractor - Prohibit burning of any type of solid wastes generated during the vegetation removal and tree cutting - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal - Conduct soil quality monitoring and disclose the results to the public			
	Soil quality and contamination	Due to arsenic concentration, there are potential human health impacts if workers and community are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	Pre-Construction - Conduct additional testing prior to construction to verify extent of contamination and to properly manage contaminated soil - Prepare a Soil Contamination Management Plan (SCMP) based on the level of impacts detected during the additional sampling Construction - Implement the Soil Contamination Management Plan (SCMP) / Occupational and Community Health and Safety Management Plan (OCHSMP) which includes a Contact Management Plan with details on proper handling procedures - In case of contamination, clearly mark contaminated area and control the access - Inform workers and communities on potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil - Provide decontamination area where personnel can clean/sanitize themselves and encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves - Implement the Dust and Emission Control Plan to minimize dust generation, including water spraying to avoid dust clouds during dry season - Conduct continuous monitoring of arsenic level and disclose result to the public - Assess effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			action to reduce health hazard and continue intensive monitoring			
	Soil quality and contamination	Soil contamination due to accidental spills of oil, lubricants, or other chemicals and other hazardous wastes	Construction - Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) - Conduct safety induction training for the workers including personnel training on spills removal and emergency response procedures - Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes and ensure that hazardous wastes are the transporter and TSD facility are accredited by the DENR-EMB - Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) - Conduct regular maintenance of all vehicles and machinery - Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials - Establish and maintain an inventory of chemicals and hazardous wastes for documentation and monitoring - Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate spillage protection. If necessary, provide proper roofing and concrete-paved floor with proper chemical-proofing. Immediately use and remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. - During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks - Properly handle and dispose potential contaminants coming from construction sites through DENR-accredited hazardous waste haulers. For residual wastes, put inside sacks and other bags that don't leak and bring to residuals containment areas of the LGU - Regularly monitor and inspect handling of chemicals and hazardous substances including storage conditions to check	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			for damages so that needed repairs can be done immediately to prevent leaks, spills and other related emergencies from occurring In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and Hazardous Waste Management Plan (HWMP) or contact the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities			
WATER						
Earthworks (excavation for foundation, cut and fill, land grading, etc.) Demolition, excavation, and bore piling activities	Surface water quality	Siltation and sedimentation of waterways during construction of SBT Section, including TSS-1 Increase in suspended sediments in the receiving water	Pre-Construction - Minimize vegetation removal as much as practicable - Plan earthwork activities in consideration of weather conditions especially during wet season Construction - Implement applicable erosion prevention and sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in construction site entrances and exits) based on Erosion and Sediment Control Plan (ESCP) - Construct the new drainage channel prior to re-training to avoid siltation and impeded flows and construct temporary facilities above flood levels and place machineries in a dry storage area at all times - Install and maintain drainage channels to prevent drainage capacity overflow due to excess water during construction - Limit stockpile height of loose earth up to 2 m only, cover stockpiles and immediately remove loose earth materials from the site especially before expected heavy rains - Periodically remove sediments from the sediment traps and properly dispose off-site. If sediments have entered the surrounding waterways from surface runoff and streambank erosions, conduct dredging and clean up the waterways - Monitor visible signs of siltation and sedimentation and disposal activities - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Site Preparation (Demolition and removal of existing structures along the ROW including TSS-1) and Development	Surface water quality	Contamination of waterways with solid waste and domestic wastewater from construction sites and construction camps	Construction • Implement the Effluent Management Plan • Install, maintain and monitor a temporary septic tank system and/or the sanitation facilities (e.g. portalets) • Dispose wastewater through DENR-accredited waste haulers • Prohibit the local community, construction workers, and personnel from disposing wastes in South Antipolo Canal and Antipolo Creek • Secure temporary discharge permits as necessary for the disposal of construction wastewater • Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal to the waterways • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
Use of oil, lubricants, and other chemicals during construction activities	Surface water quality	Contamination of waterways through accidental spills of oil, lubricants, and other chemicals	Construction • Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) • Prepare a procedural manual for workers to prevent oil and chemical spills and conduct safety induction training for all workers and personnel on proper handling potential contaminants and prevent accidental spills to the waterways • Secure appropriate permits such as Permit to Transport and Hazardous Waste Manifest from DENR • Use properly rated machines and equipment (i.e., used within the capacity, no overloading), with certification appropriate for the task (e.g. heavy equipment operator certification) • Conduct regular maintenance of all vehicles and machinery • Seek appropriate approvals on the use of chemicals and prohibit the use of unapproved toxic materials • Provide storage tanks or containers for bulk waste oils, lubricants, and chemicals with proper labelling and adequate spillage protection • Provide signages, fire extinguishers, barricades, and control access	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- During fuel refilling and repairs, provide oil and grease traps or spill containment kits (containers/drip trays) in the wash bay to collect leaks - Dispose used oil, lubricant and other chemicals by engaging DENR-accredited hazardous waste haulers - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
Land development, earthworks, and civil works for SBT Section (including TSS-1) Realignment of South Antipolo Canal as part of road diversion requirements	Surface water quality	Contamination of waterways due to concrete and drilling wastewater spills	Construction - Recondition and reuse bentonite slurries to lessen the amount of slurry to be disposed - Store concrete wastewater in large PTFE containers to avoid spillage on-site - Dispose wastes through a DENR-accredited wastewater hauler - Install settling tanks/drying ponds for concrete and drilling wastewater in the absence of wastewater haulers - Dispose dried waste in line with the project's Solid Waste Management Plan (SWMP) - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
	Flooding (including climate change induced flooding)	Flooding may be aggravated by excavation activities and siltation from earthworks	Pre-Construction - More detailed hydrological studies will be undertaken during Detailed Engineering Design stage to be used as basis for designing bridges and drainage structures; Such studies will take into consideration recent flood events such as Ondoy and Habagat - Sufficient and effective drainage systems, including retention basins, shall be incorporated in the designs. The proponent shall coordinate with DPWH and LGUs how to integrate the drainage systems into the existing canals/culverts - Design all structures and supporting facilities in consideration of flood levels based on 100-year flooding hazard map to have a clearance of above established flood level	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Design the channel for retraining larger than the existing canal to avoid flooding and overflow of drainage capacity - Design railway structures on elevated viaducts and supporting facilities to have a clearance of above established flood level Construction - Implement the Emergency Preparedness and Response Plan (EPRP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones in consideration of flooding induced by climate change such as extreme weather events - Implement the Flood Management Plan (FMP) to include details on the installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures for the construction project - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal into the waterways to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities - Install and maintain sufficient and effective drainage and/or dewatering system with drain channels and sumps to facilitate proper drainage of excess water and to regularly remove water that accumulate in pits, excavations, and other depressions. For a new drainage channel, construct prior to retraining to avoid siltation and impeded flows - Construct temporary facilities above flood levels, place machineries and equipment in dry storage area at all times and insulate electrical wirings and sources away from wet working areas and flood-prone zones - Conduct cleaning or de-clogging of waterways as necessary to avoid blockage of existing drains during construction or provide alternative drains should there be unavoidable blockage of existing drains - Provide erosion and sediment controls such as slope protection, silt screens, sediment traps, sumps, and/or settling			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			ponds to minimize siltation of waterways especially during masonry and earthmoving activities Properly handle waste bentonite slurry in accordance with RA 9003 and temporarily store in bentonite tanks to prevent siltation			
AIR						
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Climate change	Injury, property damage and disruption of activities due to flooding, strong wind, tropical cyclones, including events induced by climate change Systems failure/ Overheating of construction equipment due to projected increase in temperature due to climate change	Pre-Construction - Climate change adaptation - conduct climate risk and vulnerability assessment (CRVA) to provide information useful to relevant stakeholders in understanding the vulnerability of the Project to climate change and to identify appropriate adaptation options for consideration in the Climate Change Adaptation and Mitigation (CCAM) Plan development - Climate change mitigation - Conduct greenhouse gas (GHG) inventory to determine the GHG emissions of the existing PNR in operation and projected GHG emissions during construction and operation and identify appropriate mitigation options for consideration in CCAM Plan development - Design a resilient railway infrastructure based on robust engineering design and construction standards in consideration of the national building code and other relevant standards as well as predicted climate changes Construction - Implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology - Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety (EHS)-related plans such as OCHSMP and EPRP (appropriate protocols for each PAGASA warning signal for tropical cyclones) especially during extreme weather events - Conduct regular inspection and proper maintenance of all construction equipment, machineries, and drainage systems - Track GHG emissions throughout project construction and regularly update GHG emission reduction targets - Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Earthmoving, demolition, and earth-balling Mobilization of equipment, machineries, and service vehicles Storage or stockpiling of construction materials (sand, aggregates, cement, bentonite, etc.) and solid wastes/debris from construction sites (excess soil/cement, bentonite slurry, spoils from excavation/drilling activities, etc.)	Air quality	Emissions of particulate and gaseous pollutants	Pre-Construction - Require construction vehicles and equipment to undergo the mandatory government vehicle emission tests prior to the start of construction - Select and use low-emitting and fuel-efficient vehicles, machineries and equipment - Secure Permit to Operate (PTO) from DENR-EMB for stationary equipment (Air Pollution Source Installations (APSI)s), monitor the APSIs based on the requirements stipulated in the PTO and place in strategic locations to ensure they are far from windows of houses and offices - Incorporate traffic management guidelines in the induction seminar for workers and EPC contractors Construction - Maximize fuel efficiency through scheduling of vehicle and equipment movements to minimize idle time and distances travelled - Conduct regular maintenance and annual emission testing of the vehicles to ensure that emissions are within acceptable limits - Closely monitor equipment dispatch to eliminate unnecessary use and to increase use efficiency - Regularly monitor ambient air quality (emissions of particulate and gaseous pollutants) and disclose all monitoring results to the public	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
		Fugitive dust emissions	Pre-Construction - Install controls at the construction site exits to prevent build-up of mud and/or soil in vehicle wheels and public roads such as wheel and truck wash facilities and/or mud mats Construction - Implement a Dust and Emission Control Plan - Manage vehicle speeds and impose speed limits of 10 km/hr in construction areas, 20 km/hr in barangay roads, and 30 km/hr in provincial/ municipal roads in accordance to JMC 2018-001 (Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136,	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			and Collection of Road Crash Data) to trucks that carry materials - Cover overfills, topsoil/ soils, spoils, and construction materials onsite as well as construction equipment, trucks and vehicles for the transport of materials to prevent escape of dusts - Execute water sprinkling of access roads, stockpiles and areas with exposed soils or dust-generating materials or equipment whenever visible dust is observed or at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area - Provide workers with appropriate PPEs and implement safety protocols pursuant to RA 11058 and its IRR (DO 2018-198), and DOLE-BWC DO 1998-13 to protect them from disease associated with dusts - Regularly monitor fugitive dust emissions/ generation and disclose all monitoring results to the public			
		Generation of dusts and particulate matter, and gas emissions	- Regular wetting of ground soil in the construction site - Regular preventive maintenance of heavy equipment and service vehicle - Construction sites must be fenced for safety and security reasons	- DOTr PMO - Contractor	To be included in the project cost to be finalized during DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/untoward incidents
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Ambient noise	Noise levels produced from general construction works affecting the amenity at nearby sensitive receptors. Out of hours night work produces noise that affects amenity and causes sleep disturbance at	Pre-Construction - Select sites (i.e. ROW, construction yard, temporary facilities, access route) in consideration to sensitive receptors including ecologically significant areas (if any) likely to be affected. - Place noisy construction equipment such as generators, refuelling and laydown sites etc. as far away from sensitive receptors as possible. - Minimize activities like alteration of topography and removal of vegetation which generate noise. - Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works. Also establish Grievance Redress Mechanism to handle complaints on noise during	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		sensitive receptors	construction if any and monitor the actions taken to resolve the complaints • Schedule noise-generating construction activities during the day where feasible. • Reassess the future construction noise level based on final design and location of temporary facilities and validate noise mitigation measures. • Conduct baseline surveys for areas outside the ROW where noise-generating temporary construction facilities and sources will be located and reassess future construction noise level based on final design and once location of temporary facilities and access roads are identified. Construction • Prepare and Implement the Construction Noise and Vibration Management Plan (CNVMP) covering noise and vibration abatement / control, monitoring, public information and complaint response including but not limited to the following: • Maintain 10-m working distance from construction activities. • Conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes). • Locate heavy vehicles and activities as far from sensitive buildings as possible through design coordination and project layout • Implement construction activities in consideration of time, duration, and scale to optimize the use construction equipment, machineries, and vehicles in accordance to noise emission standards; For instance, operation of vibration hammer and other noisy equipment will be scheduled at limited time. Undertake noisy construction activities at the same time or within a restricted area to reduce the number of sensitive receptors exposed to noisy works. In case out-of-hours works are necessary, secure permits for specific work activities and seek permission from the PMO and concerned LGU. • Construct walled enclosures around especially noisy activities or clusters of noisy equipment 50 m from sensitive receptors.			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Locate site buildings or barriers/ enclosures around especially noisy activities or clusters of fixed noisy construction equipment • Select quieter construction equipment where practicable; fit construction equipment with silencers, acoustic enclosures or other noise attenuation measures, where possible. Properly maintain machinery to minimize noise. • Where practicable, limit heavy construction vehicle movements to normal working hours and design traffic routes to limit the amount of accelerating and braking and avoid local roads, where practicable. Also minimise blowing of horn and limit speed when passing through residential areas • Install 3 m noise barrier with additional noise barrier walls, or panels instead of noise barrier sheets to further reduce construction noise. Install additional sound barrier curtain or sound barrier window at sensitive receptor (e.g., Melchora Aquino Elementary School) in the immediate vicinity of the construction area. • Install noise control devices such as mufflers and noise suppressors for all construction equipment and machineries. Use of electric instead of diesel-powered equipment, hydraulic tools instead of pneumatic tools. • Regular maintenance of heavy equipment, construction machinery • Construction workers must be provided with PPE • Scheduling of high noise generating activities during daytime • Construction sites must be fenced for safety and security reasons • Disclose construction activities and schedule to public and issue advance notices to the public at least 24 hours before the start of construction activities especially if the noise is expected to exceed acceptable level. In case of complaints, follow the GRM/ complaint response procedure to urgently respond to the complaints and resolve the problem. • Encourage nearby communities to use acoustic insulation or sound proofing installation at most noise sensitive indoor areas, and installation of sound barrier curtains at the windows of nearby schools and places of worship specially during daytime when construction noise generated is higher.			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Monitor noise levels at identified nearby sensitive receptors (residential, school and hospital areas) including ecologically and culturally significant area/s (if any) likely to be affected and compliance with WBG EHS criteria and Japanese Guidelines and disclose the result to public. Evaluate effectiveness of the noise reduction measures provided and revised as necessary.			
Site Preparation (Demolition and removal of existing structures along the ROW) and Development	Ambient vibration	Vibration from construction works causes human disturbance and structural damage to buildings sensitive to vibration	Pre-Construction - Identify nearby sensitive receptors likely to be affected and monitor vibration levels including old PNR stations - Conduct building condition survey of those with culturally significant and buildings adjacent to the alignment to provide proper protection measures and to conduct continuous monitoring of vibration impacts. Prepare and submit work plan for building and structures of historic concerns and obtain approval from cultural agencies - Inform local communities on potential vibration impacts and proposed work schedule Construction - Implement the Construction Noise and Vibration Management Plan (CNVMP) to avoid cosmetic damage to sensitive structures - Locate heavy vehicles and activities as far from sensitive buildings as possible through design coordination and project layout - Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance - Plan the demolition and construction schedule such that high levels of vibration only occur during the day where feasible and consider time, duration, and scale of construction to optimize the use construction equipment, machineries, and vehicles with minimal vibration generation - Select construction equipment and machineries matching the scale of the construction and with minimal vibration generation if possible - Maintain 10-m working distance from construction activities; In areas where safe working distances cannot be maintained, demonstrate compliance or trigger further mitigation measures	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			to reduce vibration where levels exceed acceptable FTA thresholds - For works closer than 10 m from a sensitive receptor (e.g. school, church, residential, historical structures), conduct precondition assessments prior to commencement of sheet/bored piling, vibratory rolling or other high impact works (greater distances may need to be considered if the construction plan changes) - Substitute construction methods to emit lower vibration levels where feasible - Strictly control construction activities close to historical/archaeological sites - If construction activities will cause continuous vibration, especially foundation excavation, it is necessary to reduce energy at each excavation - Require vehicles transporting construction materials and equipment to follow traffic rules strictly and limit speed not to exceed 30 kph and the load shall not exceed 25 tonnes if passing communities, commercial or sensitive areas (e.g. health premises, schools, educational institutions or religious institutions such as temples, mosques and churches) - Monitor vibration levels at the sites of sensitive receptors (i.e. affected ecologically and culturally significant areas), temporary facilities and construction especially during initial piling and vibratory roller activities at the closest sensitive receptors to verify predicted vibration levels, evaluate effectiveness of/ refine mitigation measures. Document and clearly state the methodology and results in required monitoring reports accessible to the public			
Site Preparation (Demolition and removal of existing structures along the ROW including TSS-1) and Development	Ambient noise and vibration	Noise and Vibration generated by construction works impact on workers	Construction - Provide training on noise and vibration mitigation and require workers to wear appropriate PPE including ear plugs or ear muffs - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole body vibration (e.g. operating excavators) and reduce exposure duration for high vibration tasks; If loud work is unavoidable, assign restricted areas to limit noise exposure; Rotate workers and organize	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			work schedules so worker exposure to hazardous noise is limited - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload - Substitute high vibration tools for vibration-reduced tools where possible - Regularly maintain vehicles, machineries and other equipment as well as surface conditions of access roads - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers and Contractors	DENR-EMB		
PEOPLE						
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs Construction activities	Public Participation and Information Disclosure	Social acceptability and conflict of interest	Pre-Construction - Inform project stakeholders who are likely to be affected by the project on the construction schedule and activities, potential environmental impacts, mitigation measures and grievance redress procedure through public meetings - Establish the approved grievance redress mechanism in coordination with the contractors prior to commencement of site works Construction - Continue public involvement activities on the framework for public involvement and disclosure - Conduct regular consultations with affected people and relevant offices/agencies by the contractor during construction phase - Install notice boards outside the construction sites that indicate the contact details of the DOTr helpdesk - Act on complaints reported by the affected person(s) based on the following RAP and HSE GRM Procedure levels - RAP: (1) Local Help Desk/Central Help Desk (Local/Central GRM Team), (2) TWC/ROW Site Acquisition Committee or DOTr Legal Department, (3) Court of Law - HSE: (1) Local Help Desk/ Central Help Desk, (2) PMO HSE, HSEC or TPA, (3) EGF Committee / DENR Pollution Adjudication Board, (4) Court	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- If not resolved, elevated to DENR-EMB Regional Office for environment-related grievances and DOTr management for health and safety-related grievances - If still not resolved to DENR for environment related and Court of Justice for health and safety grievances - Monitor the activities and effectiveness of GRM and disclose the monitoring results to the public • Monitor if public involvement and information dissemination are conducted in terms of target stakeholders, information provided, means of dissemination/involvement, and timing involved/disseminated			
Land Acquisition for the Project ROW	Land use and classification	• Incompatibility with existing land use and development plan	Pre-Construction/ Construction • Maximize the use of existing PNR ROW and minimize land acquisition • Coordinate with the affected LGU to align and ensure that SBT Section is integrated in the updating of land use plan and zoning ordinance • Coordinate with the lot owners, LGUs, relevant agencies and concerned stakeholders in acquiring and/or securing the ROW in accordance with RAP • Coordinate with PNR, affected LGU and other concerned parties in relation to the Casita de Tondo (refer to Cultural Heritage)	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU DENR-EMB	Contractor's service fee on Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management	EGF/ Bid Documents/ Contract Agreement
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs	Land acquisition and utilization and involuntary resettlement	• Displacement of PAPs (informal settler families (ISFs) and other non-landowners; and), • Removal/ relocation of project affected structures	Pre-Construction • Maximize the use of existing PNR ROW and minimize additional land acquisition • Update and implement a Resettlement Action Plan (RAP) with Livelihood Restoration and Improvement Program (LRIP) to compensate for loss of assets at replacement cost and to assist displaced persons restore or improve their pre-project living standards, income-earning capacity and production levels • Coordinate with the LGU for the updating of land use classification and local zoning • Coordinate with other stakeholders such as MERALCO for the existing substation and DPWH for other infrastructure projects • Implement Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Conflict in land ownership, change in land use and relocation of landowners	concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder groups - Conduct monitoring to track whether the planned compensation are provided, resettlement activities for the PAPs and LRIP are delivered and whether the planned activities in the RAP achieved the desired outcomes, and disclose the result to public - Conduct meaningful public consultations and information disclosure Construction - Continue the implementation of RAP, LRIP, SDP and GRM - Continue conduct of meaningful public consultations and information disclosure			
	Land use and classification	Potential conflict among PAFs and other government infrastructure projects	Pre-Construction - Prepare and implement RAP with close coordination on financial assistance arrangements with DPWH, and other agencies with ongoing infrastructure projects that share impact areas with the SBT Section in terms of PAFs and ROW. Ensure PAFs/PAPs are compensated the same entitlements for SBT Section. Where required, DOTr is to top up the gap to meet the entitlement of the SBT Section. - Monitor compliance of land acquisition and displacement activities to the RAP Construction - If PAFs raise an issue, ensure prompt response and resolution per established GRM - Monitor compliance of land acquisition and displacement activities to the RAP	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs (DPWH)/ LGU - DENR-EMB	RAP Cost/ Construction cost/ DOTr IEC Cost PhP 1,500 per man-hour	EGF/ Bid Documents/ Contract Agreement
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs Construction activities	Local economy, employment and livelihood	Disruption of livelihood, local business and economy Generation of livelihood, employment and	Pre-Construction - Prepare and implement the LRIP in coordination with the LGU and other government agencies - Identify relocation sites for those to be displaced within the same LGU or as close as possible to their current residence where if feasible so that PAPs can maintain their current livelihood Construction	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		business opportunities	- Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs - Provide alternative livelihood program in coordination with the LGU and relevant government agencies - Monitor until the LRIP is complete so that the PAPs achieve the same livelihood status or better than prior to the project - For business establishments for permanent removal, provide fair compensation measures to ensure continued economic activity and/or the restoration and/or improvement of livelihood - Provide alternative access for affected businesses and directional signboards to ensure continuous business operations. In case of disturbances on income earnings and capacity, consult with the affected and make necessary arrangements to ensure livelihoods are maintained or improved - Undertake construction activities at the shortest possible time to restore normal business operations immediately - Monitor compliance to manpower requirements in terms of local hiring, gender and vulnerable groups	- NGAs (DSWD, DOLE, DTI, TESDA)/ LGU - DENR-EMB		
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	In-migration	Encroachment/proliferation of ISFs, influx of construction labor force	Pre-Construction - Minimize encroachment of informal settlers taking advantage of the relocation package for ISFs through setting of cut-off dates under RAP - Train local workers within a reasonable timeframe to meet project requirements on manpower and skill level and prioritize employing skilled and unskilled local residents. In the inadequacy of local workers, accommodate incoming non-local workers in dedicated construction camps or other affordable accommodation options with appropriate trainings, supervision, and security to maintain public order and minimize unlawful conduct - Closely coordinate with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx - Shorten the time between the pre-construction and construction	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Construction - Adequately fence the SBT ROW and assign security personnel to limit access or entry of unauthorized persons - Implement the Labor Influx Management Plan or Workers' Camp Management Plan - Employ skilled and unskilled local residents and accommodate non-local workers in case of inadequate local workers. Monitor compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public - Continue close coordination with national government agencies together with the sending and receiving LGUs to prevent encroachment of ISFs in the ROW and manage labor force influx			
	Cultural / lifestyle change	Cultural and lifestyle change of community members of the localities where the Project will be situated and where the PAPs will be resettled	Pre-Construction - Undertake comprehensive development planning with integration of concerns on cultural and lifestyle change and integrate in the Social Development Plan (SDP) for SBT Section in line with the NSCR Project SDP and LGU SDP - Coordinate with the receiving LGU to discuss and agree on the financial assistance for the relocates to cover any of the following: - Health services, facilities and/or infrastructure - Educational services, facilities and/or infrastructure - Services, logistics or equipment for the maintenance of peace and order - Provision of transport services or improvement thereof - Solid waste management - Implementation of the LRIP (alternative livelihood programs vocational trainings, employment in local communities, soft loans to establish business) - Identify and provide relocation sites for those displaced within same LGU if feasible so that social and cultural environments can be maintained Construction - Provide financial assistance to the receiving LGU for off-city socialized housing site to prevent adverse impacts of sudden	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			increase in population in receiving LGUs specifically to compensate for the strain on social infrastructure			
Land Acquisition for the Project ROW and Involuntary resettlement of PAPs Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Vulnerable groups, gender issues and children's rights	Greater challenges in re-establishing living standards, Additional hardship due to vulnerability	Pre-Construction - Conduct meaningful, gender-responsive and response public consultations tailored to the needs of disadvantaged and vulnerable groups - Update and implement RAP in consideration of gender equality and vulnerable groups including livelihood and skills training program with support from the LGU, DSWD and TESDA - Prepare and implement the Social Development Plan (SDP) aligned with LGU SDP integrated with gender-responsive and socially inclusive programs, projects and activities to deal with risks, issues and concerns raised during public participation activities - Consider the rights and welfare of children in the preparation of the SDP and coordinate with the City Council for the Protection of Children and conduct awareness campaign programs geared towards protecting children's rights - Design and install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. work environment and facilities for women and PWD like toilet, changing room, access ramp) - Integrate GAD-related information in existing railway transport management information system to ensure that relevant gender statistics and sex-disaggregated data are regularly collected, analyzed and used as inputs for planning, budgeting, programming and policy formulation Construction - Continue the implementation of the LRIP ensuring the provision of gender equal job opportunities in line with national laws and regulations - Maintain access to government welfare programs and provide support to help family members needing special assistance and/or medical care before and during resettlement activities and/or and nurses or social workers - Immediately replace the social/barangay facilities (clinic, chapel, barangay hall, grotto, basketball court) affected by	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			project ROW (if any) and strategically locate in in safe areas within the affected community • Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities • Monitor provision of entitlements for PAPs classified under RAP as vulnerable groups and compliance to manpower requirements in terms of local hiring and disclose all monitoring results to the public • Immediately report to appropriate authorities' incidents involving children-in-conflict-with-law (CICL) and street children around the project premises while respecting their rights			
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Cultural heritage	Damage/ destruction risk to physical cultural/ archaeological resources Loss off PNR Stations	Pre-Construction • Prior to the relocation of the Casitas de Tondo in Tutuban Station, undertake the actions agreed with NHCP and PNR - Incorporate the structure into the design of the Tutuban Station - Prepare necessary detailed design/ relocation documents and plans including but not limited to architectural and structural plans, specifications, and dismantling and reconstruction methodologies, terms of reference (TOR) for conservation works, conservation management plan, protection plan, etc. - Submit all relevant documentation and seek the approval of the cultural agencies (CAs) • During the relocation of the Casitas de Tondo, undertake the following agreed with NHCP and PNR: - Implement the approved plans for the Casitas de Tondo and closely coordinate the relocation activities with the CAs - Implement historical heritage protection plan including noise and vibration measures as applicable • Follow the procedure for the preservation of historic structures/ buildings during construction developed for NSCR Ex: - Determine temporary facilities and access routes to be affected by vibration impacts due to pile driving,	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs (NM, NCCA, NHCP)/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			concrete/rock breaking activities and movement of heavy equipment, machineries and trucks - Identify historical structures or buildings within the vibration impact standard distance of 0.10 km from temporary construction yards, facilities and access routes - Inform the CAs about identified historical structures or buildings adjacent or close to the temporary construction facilities with significant vibration source and conduct baseline condition surveys or other any other additional surveys as the CAs require in consultation with the building owner - Implement the approved historical heritage protection plan in case of any new assets found to be adjacent or close to the Project ROW and temporary construction facilities and access routes with vibration source • Prepare and implement the Construction Noise and Vibration Management Plan (CNVMP) to consider measures to address damage risks to historical structures due to construction noise and vibration • Coordinate with relevant CAs and NGO/CSO to monitor and protect the structures outside the SBT ROW in close proximity to the temporary construction facilities and access routes Construction • Implement recommendations of NHCP in the detailed design to preserve and integrate the old PNR stations • Implement the concept design of Tutuban Station to preserve the historical structures and integrate it into the development design • Implement CNVMP to address damage risks to historical structures • Carry out mitigation and traffic management in the area of the buildings to not exceed allowable vibration level at the building • Regularly monitor and measure vibration level at concerned buildings identified prior to construction and ensure public disclosure of results • Conduct archaeological watch in close coordination with NM for accidental finds			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			In the event that an archaeological site or chance finds, immediately cease all earthmoving activities until the CA decides the project to continue			
Site Preparation (Demolition and removal of existing structures along the ROW) Site Development (including relocation or realignment of affected electric poles and wires as well as water supply systems)	Public infrastructure and utilities	Relocation or realignment of affected public utilities and disruption of utility services	Pre-Construction - Prepare and implement a Utility Conflict and Relocation Plan with close coordination with affected LGU and utility companies. Negotiate the appropriate relocation compensation and replacement for the affected community facilities and/or public utilities - Consider affected structures including community facilities and public utilities in the RAP - Divert or relocate utilities overhead high voltage cables, telephone and communication cables, underground water pipes and other utilities prior to construction to minimize service interruption - Issue public notices or announcements in advance regarding temporary disruption of services	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
		Increase in demand for resources	Pre-Construction - Closely coordinate with utility companies for the relocation of existing utilities within Project ROW as well as power, water and other utility requirements Construction - Timely coordinate with public utility companies to prevent service interruption in nearby communities and to arrange utility requirements for construction - Issue public notices or announcements in advance regarding temporary disruption of services if any - Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section - Use back-up generator sets during power interruption - Implement Energy/Water Conservation Program. Monitor power and water consumption and install energy-efficient equipment and water saving fixtures. - Monitor fuel consumption and solid waste generation and disposal	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Land Acquisition of the Project ROW Site Preparation (Demolition and removal of existing structures along the ROW) and Site Development	Public infrastructure and utilities (social services)	Disruption of social services due to removal or relocation of social infrastructure (schools, hospitals, barangay halls, religious institution, etc.)	Pre-Construction - Issue public notices or announcements in advance regarding temporary disruption of social services - Negotiate with the local government for the compensation and replacement intervention for the affected social infrastructure and facilities - Consider employees of affected social infrastructure and facilities in livelihood restoration measures (alternative livelihood programs) to mitigate economic impacts of displacement - Coordinate with utility companies for power, water and other utility requirements for the facilities Construction - Provide listing of alternative social infrastructure or facilities available and accessible to the affected communities - Build the social infrastructure and facilities near the original location	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
		Increase in demand for social infrastructure in the relocation site	Pre-Construction - Issue public notices or announcements in advance regarding temporary disruption of services - Provide financial assistance to LGUs offering the off-city socialized housing sites to cover social services required for the increased population caused by the project such as health, educational, religious and institutional services, facilities and/or infrastructure - Closely coordinate with national government agencies together with the sending and receiving LGUs Construction - Provide listing of social infrastructure or facilities available and accessible to the affected communities - Closely coordinate with the LGU and national government agencies (DSWD, DOH, DepEd, and CHED, etc.) to ensure the delivery of social services	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
Site Preparation Site Development	Occupational and community health and safety	Risk of construction-related accidents	Pre-Construction Integrate health, safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP	Implement: - DOTr PMO - Contractor	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Increased risk of accidents due to improper work ethics, which may threaten health and safety of workers and local residents	• Inform the public on work schedule, planned activities and potential impacts • Conduct safety and security training for the workers Construction • Implement an Occupational and Community Safety and Health Management Plan (OCSHMP) in compliance to OSH and the WB-IFC EHS Guidelines • Implement an Emergency Preparedness and Response Plan (EPRP) to include emergency protocols and post-event monitoring for safety and well-being of workers • Provide appropriate PPE and enforce strict use by construction workers • Assign security guards and safety officers in strategic posts and coordinate with the Philippine National Police (PNP) or LGU for police visibility • Install fencing of the construction site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public. Install and utilize security cameras at strategic places within the ROW • Provide sufficient lighting system and safety measures such as ventilation, monitoring, and emergency rescue procedures • Provide safety signages and warnings throughout all construction-affected areas especially those that are accessible to the general public • Prohibit unauthorized personnel to access the work area unless coordinated with security personnel at least one day before the visit • Conduct regular inspection and maintenance of work areas. • Place a first aid centre and provide first aid kits in strategic areas at the construction site • Hire safety officers to monitor the health and safety of the local community. If any complaints arise, immediately identify the causes and evaluate built-in measures • Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan	Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB		

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			will be prepared and compliant with the applicable legal guidelines (e.g. DOH) - Limit exposure to elements, suspend construction activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin - Implement the GRM (complaints management system) including setting up of help desk - Regularly monitor and report construction-related accidents and make information available to the public			
		Exposure to contaminated soil via incidental ingestion and/or dermal contact	Pre-Construction - Inform nearby communities and construction workers on the potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil Construction - Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and/or Soil Contamination Management Plan (SCMP) in consideration of arsenic exposure and incorporated with Contact Management Plan (CMP) for proper handling procedures - Provide decontamination area and implement proper decontamination after work and regular hand washing to minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin - Implement a Dust Emission Control Plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement
		Transmission of communicable diseases	Pre-Construction/ Construction Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and the Pandemic Response Plan (PRP) based on international and national guidelines (i.e. IATF guidelines) to effectively respond to COVID-19 and other communicable diseases including protocols on personal hygiene	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC	Contractor's service fee on HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Implement proper solid waste management practices (e.g. regular cleaning of waterways) and awareness campaigns not only among workers but also the among the nearby communities in close coordination with the LGU - Implement daily health check (temperature, health condition, symptoms) of workers, use of PPEs, disinfection (hands, venue, equipment, etc.), social distancing - Integrate health and safety and security considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP and conduct trainings for the workers and the community - Require workers to submit medical clearances and to certify their fitness to work - Construct sanitary facilities at all construction sites - Regularly maintain and sanitize work areas to help reduce bacteria, viruses, and their carriers - Lessen interaction with nearby community unless needed - Coordinate with the DOH to obtain the status and potential health risks of communicable diseases within the vicinity of the project area - Coordinate with the LGU and barangays for the preventive actions against the transmission of communicable diseases - Comply with working condition requirements in RA 11058, DOLE DO 198-2018 and DO No. 13 - Prohibit the nearby community and workers to wade or swim in floodwaters or standing water to avoid diseases	- TPA, EMA - NGAs/ LGU - DENR-EMB		
		Nuisance of receptors including nearby communities and construction workers due to dust, noise and vibration	Construction - If loud work is unavoidable, assign restricted areas to limit noise exposure - Ensure equipment is properly maintained - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers - Provide PPEs and regular safety trainings and supervise the proper use of PPEs - Organize work schedules and shifts to limit workers exposure to dust, noise and vibration	Construction Implement: - Contractors - DOTr PMO Monitor: - DOTr PMO - GC - MMT/TPA, EMA	To be included in the overall project construction cost	Bid documents/ Contract agreements, EGF

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible - Maintain the surface condition of access roads to reduce vibrations being transferred to plant operators - Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload	DENR-EMB		
Land Acquisition of the Project ROW	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads	Pre-Construction - Maintain access or acquire the remaining land in case the residual community loses access due to the project - Compensate for additional land acquisition (including all affected structures, improvements and crops) as a result of landlock, access provision or required setback as similarly provided in the RAP entitlement matrix; Likewise, apply all relevant entitlements to eligible families and businesses to be displaced as provided for in the RAP - Conduct consultation meetings on public access arrangements and construction schedule with affected barangays and residents Construction - Provide and maintain access to the public and maintain the existing public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of construction activities, in case of any temporary closure during construction - Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs - Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts, Assign traffic guides to provide assistance to road users when necessary - Install boundary fence and restrict public use and access of the ROW. Only allow authorized personnel to access the construction sites and temporary construction yards and facility areas as well as "off-limits"/ danger zones areas	Implement: - DOTr PMO - Contractor Monitor: - DOTr PMO - GC - TPA, EMA - NGAs/ LGU - DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Apply RAP in case of permanent loss of public access. • Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures			
Mobilization of heavy machineries and equipment and transportation of construction Workers and materials	Public access and traffic management	• Traffic congestion • Traffic accidents	Pre-Construction • If required, update Traffic Impact Assessment (TIA), prepare and implement a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to construction activities (movement of construction vehicles, haulage trucks, and equipment) is minimized • Publicize the access arrangements and construction schedule to community as well as wider public for potential user of roads in the area • Coordinate with the LGU, DPWH and MMDA to ensure alternative public access for pedestrians and vehicles • Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas • Coordinate with the traffic police or employ flag persons for traffic management Construction • Disseminate information to the general public, host barangays, and LGUs on the potential impact of the project to the existing access and provide mitigating measures • Implement the Public Access and Traffic Management Plan (PATMP) to reduce traffic congestion due to construction activities and movement of construction vehicles, haulage trucks, and equipment • Provide traffic advisory signs stating that construction is in progress and that road narrows in some sections • Provide sufficient lighting at night within and in the vicinity of the construction sites • Prohibit prolonged side street parking of construction trucks. • Schedule delivery and transport of construction materials and spoils during non-peak hours	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Landscape value, quality	• Temporary visual blight or visual pollution due to construction facilities that may cause nuisance to people • Degradation of landscape quality due to improper handling of excavated soils	Pre-Construction • Secure the necessary approvals and permits prior to establishment and operation of construction-related facilities • Coordinate with LGUs to identify minimization options, including identification of available public land where possible for access roads, material storage areas, construction yards, etc. • Select construction camps and other construction facilities at least 300m from sensitive receptors such as residential housing areas, hospitals, schools, religious and cultural sites • Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures • Record the condition of the urban landscape, roads, and other infrastructure prior to transporting materials to the project site and construction activities Construction • Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) by contractor strictly in accordance with RA 9003 • Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the construction site/yard tidy and clean and rehabilitate after construction • Use cover-ups (e.g., vertical sheets of plywood or metal fencing) and hoarding around the boundary/vicinity of the construction area. For project structures, use combination of embankment, fencing, seeding of bare soils where sites are in proximity to aesthetically sensitive sites • Implement Social Development Plan (SDP) including waste management	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement
OPERATION PHASE						
LAND						
Use of railway transportation	Land Use	More efficient and safer transportation facility due to reduced travel	• Identification of future land use of surrounding areas that will result to a significant increase in commercial activities especially near train stations, to guide urban planners of the LGUs to adapt future development plans accordingly.	LGUs	N/A	N/A

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		time, reduced traffic congestion, improved traveler safety and reduced energy consumption. Increase in land development along or near the corridor				
Train operation and maintenance	Soil quality and contamination	Soil contamination due to generation of solid wastes	• Implement the Solid Waste Management Plan (SWMP) • Establish and enforce daily site clean-up procedures • Minimize the production of wastes that must be treated or eliminated • Properly sort wastes for disposal and designate an appropriate temporary storage area • Provide a Materials Recovery Facility • Provide 75-liter waste bins with covers and label at strategic locations in work areas (i.e. one every 80 square meters) for segregated storage of different types of solid wastes including hazardous wastes • Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed • Recycle wastes including soil, as much as possible • Reuse leftover concrete and metals for suitable alternative projects • Dispose non-recyclable wastes (trash bags, non-recyclable plastic, glass, non-recyclable paper) to a sanitary landfill by a licensed contractor • Conduct soil quality monitoring and disclose results to the public	Implement: • Railway Operator Monitor: • DOTr • LGUs	To be included in the regular operation and maintenance budget (PHP 50,000/ year)	EGF / Operational Budget
	Soil quality and contamination	Soil contamination due to accidental spills of oils,	• Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) for handling accidental spills and	Implement: • Railway Operator Monitor:	To be included in the regular operation and maintenance budget (PHP 50,000/ year)	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		lubricants or other chemicals, handling of generated hazardous wastes	- training personnel to ensure safety in the workplace and surrounding environment • Provide procedural manual for workers at the depot to prevent oil and chemical spills and also provide regular training to workers to keep working and surrounding environment in good • Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes • Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities • Remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. Use temporary waste storage to avoid spills • Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills • Prohibit the use of unapproved toxic materials and use properly-rated machines and equipment with certification appropriate for the task and regularly maintain all vehicles and machinery • Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 'Guidelines governing occupational safety and health in the construction industry' • Collect leakage during fuel refilling and repairs using containers/drip trays/drums • Regularly monitor and inspect the handling of chemicals and hazardous substances to prevent spills and other related emergencies from occurring • In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and Hazardous Waste Management Plan (HWMP) or contact the local authority for appropriate response	• DOTr • LGUs TPA		
	Soil quality and contamination	Due to arsenic concentration, there are potential human health impacts if	• Prepare and implement the Soil Contamination Management Plan (SCMP) / Occupational and Community Health and Safety Management Plan (OCHSMP) which includes a	Implement: • Railway Operator Monitor:	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		humans are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	- Contact Management Plan with details on proper handling procedures - Inform workers on potential hazards associated with soil ingestion and dermal contact - Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil - Provide decontamination area where personnel can clean/sanitize themselves - Encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves - Implement the Dust and Emission Control Plan to minimize dust generation - Conduct water spraying to avoid dust clouds during dry season - Conduct regular monitoring of soil contamination or visual inspection to assess the effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring	- DOTr - LGUs		
Passengers Movement	Solid wastes from staff and patrons	Land and water contamination; aesthetic impacts; spread of diseases	- Proper segregation of wastes - Provision of waste bins that will allow proper waste segregation - Use of sealable waste bins to avoid attraction of vermin, insects and pests, - Regular collection and transportation of wastes for recycling or disposal at licensed facilities - Formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff	DOTr PMO	Php 100,000.00/ year. Part of Maintenance Cost of the Facilities	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
Revegetation of selected areas of the SBT Section ROW Train operation and maintenance	Terrestrial wildlife and vegetation	Increase biodiversity due to retention/ provision of urban green spaces along the Project alignment ROW	- Implement vegetation regeneration on portions that have been completed to allow vegetation growth on some portions until the whole area (where vegetation is allowed) is re-vegetated and rehabilitated. - Plant in portions of the alignment where vegetation could thrive following safe operation procedures to allow plant growth and propagation naturally and/or through Assisted	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Natural Regeneration (ANR) for aesthetics, vegetation connectivity and wildlife passage. • Restrict access and conserve remaining vegetation within the ROW to protect remaining threatened and/or endemic species • Maintain remaining vegetation and/or vegetation that may regenerate (with due consideration of safe operations) within the ROW to provide green spaces and wildlife habitat for local biodiversity. • Conduct continuous monitoring for the following and disclose the results to the public: - project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability - the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species • In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis - Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on the result of soil nutrient analysis and investigation			
		Increase in the intensity of artificial light	• Contain and monitor the effects from source of artificial light at night during operation hours • Improve vegetation that creates barrier to limit the glare coming from the artificial light • Concentrate the light on operations using directional light • Install anti-glare to the source of artificial light to regulate glare • In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the project site and bring back into its natural habitat			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Dust deposition on vegetation	- During dry season, execute water sprinkling to access roads and other exposed soils at least twice in the morning and twice in the afternoon or as needed - Cover properly (with tarp) overfills and/or topsoil for transport to prevent escape of dust			
		Vehicular strikes to existing wildlife and vegetation	- Strictly enforce the speed limit for vehicles along the access roads - Strictly implement policies regarding safe driving - Install proper signages to increase awareness and avoid accident			
		Intensified noise caused by anthropogenic activities	- Contain effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards of all vehicles and equipment to reduce effects of noise pollution			
Train operation Movement of trains	Geohazard susceptibility to ground shaking and liquefaction (entire alignment is highly susceptible to liquefaction) including volcanic hazards	Liquefaction in the event of an earthquake may result to loss of soil strength, lateral spreading, bearing failures, flotation of embedded structures, damage to overlying structures, which can lead to casualties, property damage, and disruption of operations	- Consider liquefaction hazards in the final design of the structures - Conduct preventive maintenance/inspection on the integrity of structures; reinforce if necessary - Implement an Emergency Preparedness and Response Plan (EPRP) to include emergency and evacuation protocols and post-event monitoring of major ground shaking events - Conduct IEC campaign on railway structure and geologic hazards for the workers/employees, railway passengers and surrounding communities	Implement: - DOTr PMO - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
Train operation	Ground subsidence	Subsidence due to soft soil at depot area	Regular monitoring and measurement of level of ground subsidence	Implement: Railway Operator Monitor:	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
				- DOTr - LGUs		
WATER						
Train operation and maintenance Maintenance activities in the railway stations and depot	Surface water quality	Contamination of waterways with solid waste and wastewater	- Wastewater with oil shall be separately collected and disposed for treatment. - A wastewater treatment facility (WTF) with oil removal will be constructed at the Depot. - Draw up a procedural manual for workers at the Depot to prevent oil spills in EMP - Implement the Effluent Management Plan - Maintain and monitor wastewater management system and the sanitation facilities - Dispose wastewater through DENR-accredited waste haulers - Prohibit the local community and employees from disposing wastes in South Antipolo Canal and Antipolo Creek - Secure necessary discharge and/or wastewater permits from DENR - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal to the waterways - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Surface water quality (especially Antipolo Creek during TSS-1 maintenance)	Contamination of waterways due to accidental spills of oils, lubricants or other chemicals, and generation of hazardous wastes	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) - Prepare a procedure manual for workers to prevent oil and chemical spills and also provide regular training to workers on proper handling and disposal to keep working and surrounding environment in good condition - Properly handle and dispose potential contaminants through DENR-accredited hazardous waste haulers - Secure DENR permits such as Discharge Permit (DP), Hazardous Waste Generator ID HWID), Permit to Transport (PTT) and Hazardous Waste Manifest from DENR prior to disposal - Prohibit the use of unapproved toxic materials	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget (PHP 50,000/ year)	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Use properly-rated machines and equipment appropriate for the task and regular proper maintenance of all vehicles and machinery • Collect leakage during fuel refilling and repairs using containers/drip trays • Provide oil and water separator or spill containment to address possible impact of oil spill and leaks from oil-filled substation (TSS-1) components (e.g., transformer, reactors, regulators) • Store bulk waste oils and lubricants (i.e., 110% of waste volume capacity) in properly labelled containers • Conduct IEC campaign and community awareness initiatives in partnership with the LGU to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities (residential areas and commercial establishments) along waterways • Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP • Provide signages, fire extinguishers, barricades and controlled access • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
	Flood hazard susceptibility	Potential flooding affecting TSS-1 operations	• Conduct regular inspection and clearing of drainage to avoid blockage of existing drains • Implement the Flood Management Plan (FMP) to include details on the installation of drainage and dewatering systems, proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures • Enhance the capacity of the drainage system or provide alternative drains to prevent drainage overflow and prevent floodwaters from encroaching TSS-1 • Conduct IEC campaign and community awareness initiatives in partnership with the LGU to prevent water pollution, flooding and drainage overflow brought about by anthropogenic activities (residential areas and commercial establishments) along waterways	Implement: • Railway Operator Monitor: • DOTr • LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Integrate flooding considerations in the Social Development Plan (SDP) for the SBT Section aligned with the NSCR Project SDP and LGU SDP			
AIR						
Train operation	Climate change	Overheating, thermal expansion, signalling problems and heat stress due to temperature increase Drainage overflow, slower drainage, ground subsidence, flooding and train operation disruption and restrictions due to precipitation increase Infrastructure damage, drainage overflow and train operation disruption and restrictions due to more frequent and intensified extreme weather events	- Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology - Integrate climate change considerations in the preparation and implementation of relevant environmental, health and safety plans such as EPRP and OCHSMP - Establish and maintain a GHG inventory database to track GHG emissions during operation and to keep GHG emission reduction targets and mitigation options updated throughout the project duration - Conduct regular inspection and proper maintenance of all operation equipment, machineries, facilities (e.g. drainage system) and other railway assets (e.g. tracks, substation, viaduct piers) to ensure optimum working condition - Plant vegetation in open spaces along the SBT Section - Install improvements to the railway system to be more resilient to climate change impacts in case of significant damages during operation - Monitor the implementation of the CCAM Plan and periodically update and report to JICA as necessary including but not limited to comprehensive management systems to address climate adaptation, risk-identification processes and climate-related risks and mitigating measures integrated into the project's decisions throughout the project life - Design in making infrastructure robust or resilient to the effects of climate change should be taken into consideration - Improvement of current drainages along the alignment to be resilient to climate change	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		GHG emissions reductions due to modal shift	Prepare and implement a Climate Change Adaptation and Mitigation (CCAM) Plan to specifically address climate change concerns and timely update the CCAM Plan based on latest climate projections, predictions and technology	Implement: Railway Operator Monitor:	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Provide incentives and/or IEC activities on the benefits of the Project in reducing GHG emissions to encourage commuters to use rail transit • Establish and maintain a GHG inventory database to track GHG emissions during operation and to keep GHG emission reduction targets and mitigation options updated throughout the project duration • Develop strategies to further reduce GHG emissions that include addressing the anticipated traffic congestion expected to occur in areas adjacent to the SBT Section that links Solis, Blumentritt and Tutuban stations due to pick-up and drop off of passengers by transport vehicles • Monitor and ensure continual improvement of railway services including increasing trips to increase train ridership and conduct regular inspection and proper maintenance of the railway system and facilities to ensure the efficient transport of goods and services, to encourage the use of environmentally sustainable transport and to reduce public dependence on motor vehicles • Conduct energy/ water conservation program such as use energy efficient products (i.e. LED lights) and monitor carbon footprint • GHG emission in 2020 will be reduced by 97,000 t-CO₂ / year by starting the operation of NSCR	• DOTr • LGUs		
	Air quality	Degradation of air quality in the vicinity of the SBT Section and increase in vehicle exhaust emissions and entrained dust due to increased movement of people Emissions of fugitive dusts, particulate and	• Use fuel-efficient and properly-rated stationary equipment or facilities • Conduct regular maintenance and check up of equipment, machineries, service vehicles and facilities such as generator sets to meet the DENR Emission Standard • Reduction of pollutants from vehicles • Conduct regular cleaning and clearing of internal roads from dirt and spoils and frequent wetting of ground in TSS-1 area or where vehicles frequent within the project vicinity • Comply with environmental permitting requirements and provide appropriate PPE for the concerned personnel • Control service vehicle movement by maintaining the speed limit	Implement: • Railway Operator Monitor: • DOTr • LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		gaseous pollutants	Monitor air quality at the identified sampling stations and disclose the result to the public. Evaluate effectiveness of the mitigation measures provided and apply further mitigation measures and/ or revise current measures			
Train operation (including TSS-1)	Ambient noise	The operation of the rail corridor causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	- Optimize the number of train operation and train speed at night time to reduce generated noise. - Use ballastless track with elastic and absorbent sleeper supports to minimize noise generation from train operation - Provide noise control device such as muffler to all stationary sources (i.e. generator set) - Install traffic signs in the areas before and after passing SBT Section, e.g. directional signs, speed limit signs, no blowing of horn signs, etc. - Install a 1.5-meter-high sound-absorbing noise barrier extending the length of the SBT project alignment. Locate barriers on both sides of each rail viaduct to achieve compliance with project criteria at nearby residential receptors. Ensure that the inward facing wall of the barrier are acoustically absorptive to reduce reflections. 2m noise barrier will be considered for class AA area especially sensitive facilities such as school, hospital, etc. are located within 30 meter distance - Detailed survey in measuring the distance from sensitive area should be carried out at detail design stage. - Proper maintenance of structures and tracks, such as regular rail grinding, must be conducted - Conduct regular inspection, proper maintenance and reconditioning of trains and tracks. - Monitor noise levels at identified sampling points including nearby sensitive receptors likely to be affected by the operation and evaluate effectiveness of the noise reduction measures provided and modify as needed. Disclose results to the public. - Monitor the complaints and resolutions taken based on the established GRM.	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		The operation of the TSS-1 causes an	Design to ensure that fixed mechanical plant and equipment associated with the substation can achieve the WBG EHS, whichever is more stringent			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria	- Enclose significant noise generating equipment within sealed concrete enclosure - Duct supply air fans (i.e. not mounted on the facade or roof) - Seal well the doors that open to the environment - Conduct regular monitoring and compliance to WBG for rail operation and disclose results to the public - Evaluate effectiveness of the noise reduction measures provided and apply further mitigation measures and/ or revised current measures			
	Ambient vibration	Vibration at sensitive receptors generated by the operation of Project causes human disturbance.	- Regularly check and maintain vibration-reducing elastic sleeper track - Design of rail tracks must incorporate measures to reduce level of vibration generated by the railway during train operations, such as use of long rail, sleeper with the antivibration mat - Conduct regular inspection, proper maintenance and reconditioning of trains and tracks such as rail grinding, slip-slide detectors and maintenance or replacement of suspension system, brakes and wheels - Regular reconditioning of train and its components, such as suspension system, brakes, wheels and slip-slide detectors - Monitor vibration levels including identified nearby sensitive receptors, historical heritages including ecologically significant area/s (if any) likely to be affected by the operation and evaluate the compliance with the FTA criteria and disclose the results to public - Evaluate effectiveness of the vibration reduction measures provided and apply further mitigation measures as recommended in the FTA Manual (i.e., standard and non-standard methods) if current measures are ineffective	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		The operation of the TSS-1 causes an increase in vibration affecting amenity at nearby sensitive	Install equipment inside TSS-1 in accordance with the manufacturer's recommended mounting systems to reduce possible vibration/resonance			

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		receptors and/or an exceedance of criteria				
PEOPLE						
Train operation	Public Participation and Information Disclosure	Conflict of interest and low social acceptability	Conduct regular consultations with affected people and relevant offices/agencies during operation phase to ensure adequate and timely mitigation of adverse project impacts	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget Php 1,500 per work hour	EGF / Operational Budget
	Land acquisition and utilization and involuntary resettlement	Displacement of PAPs (informal settler families (ISFs) and other non-landowners Removal/relocation of project affected structures Conflict in land ownership, change in land use and relocation of landowners	- Maximize the use of existing PNR ROW and minimize additional land acquisition - Continue to implement and monitor the Resettlement Action Plan (RAP) with Livelihood Restoration and Improvement Program (LRIP) to ensure assistance to displaced persons through restoration or improvement of their pre-project living standards, income-earning capacity and production levels. Disclose result to the public. - Coordinate with the LGU for the updating of land use classification and local zoning - Coordinate with other stakeholders such as MERALCO for the existing substation and DPWH for other infrastructure projects - Implement Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve RAP-related complaints of the communities and stakeholder groups - Conduct meaningful public consultations and information disclosure	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Land acquisition and utilization and involuntary resettlement	Potential conflict among PAFs and other government infrastructure projects	- Continue implementation of RAP with close coordination on financial assistance arrangements with DPWH, and other agencies with ongoing infrastructure projects that share impact areas with the SBT Section in terms of PAFs and ROW. Ensure PAFs/PAPs are compensated the same entitlements for SBT Section. Where required, DOTr is to top up the gap to meet the entitlement of the SBT Section. - If PAFs raise issues, ensure prompt response and resolution per established GRM	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			Conduct monitoring to ensure that land acquisition and displacement activities are conducted in compliance to the RAP			
	Visual aesthetics	Impairment of visual aesthetics	Planting of trees to minimize the visual impact by the Project and harmonize with the surrounding environments in open areas within the ROW to create a green corridor	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	In-migration	Encroachment/ Proliferation of ISFs	- Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW - Only allow authorized personnel to access the ROW - Timely inspect the condition of the boundary fence	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Cultural/ lifestyle change	Cultural and lifestyle change of community members of the localities where the Project will be situated and where the PAPs will be resettled	- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Continue to monitor and coordinate with the sending LGU and receiving LGU for assistance arrangements to ensure the restoration and/or improvement of the livelihood and living conditions of the PAPs	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
		Paradigm shift to a low-carbon and eco-efficient lifestyle due to a more environment-friendly and efficient transport	- Implement the Social Development Plan (SDP) for SBT Section integrated with concerns on cultural and lifestyle change in line with the NSCR Project SDP and LGU SDP - Pursue policy interventions and new market mechanisms to motivate citizens and companies to shift from a business-as-usual economic setting to a sustainable and climate-resilient economy	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Local economy, employment and livelihood, in-migration	Generation of local employment and business opportunities	- Prioritize hiring qualified locals as employees of the TSS-1 in coordination with the host LGU - Ensure equal participation of women and men in all employment/ business opportunities arising from the Project	Implement: Railway Operator Monitor:	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Increased economy along NSCR route	• Ensure efficiency of NSCR system in order to attract passengers and increase ridership • Encourage commercial development at Stations • Monitor the implementation and effectiveness of the LRIP and project impact to the local economy as applicable: - Eligible PAPs assisted in finding new location for business and in availing soft loans - Businesses for relocation and PAPs with movable business asset provided with transportation allowance and/or assistance - Vulnerable households assisted in re-establishing their livelihood in the relocation site - Eligible PAPs/businesses losing income during transition period (not exceeding 6 months) provided with income loss compensation	• DOTr • LGUs		
	Vulnerable groups, gender and children's rights	Threat to train safety and accessibility and convenience to all users	• Provide train system (station and trains) to account for the needs of women, allocation of trains for women (especially those pregnant), senior citizens, children, and persons with disability including allocation of visible security officers • Provide adequate security personnel and sufficient lighting to ensure safety and security • Install gender-responsive and inclusive railway features friendly to and safe for elderly people, women, children, and people with disabilities. (e.g. CCTV system and sufficient lighting for security purposes) • Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation • Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the project activities • Monitor the train user environments, LRIP, work environment / employment status. If measures is not effective, revise and provide supplement measures	Implement: • Railway Operator Monitor: • DOTr • LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
	Cultural heritage	Damage / destruction risk to physical cultural resources	- If cultural resources are discovered during operation that are within the standard distance of 0.10 km from the ROW, prepare an outline protection plan including methodology and drawings showing discovered cultural resource/ historical structure and proposed protection to prevent damage risk due to railway vibration and seek the approval of CAs and PNR - Conduct baseline vibration survey or any additional survey upon the request of CAs to determine appropriate mitigating measure and implement periodic monitoring of impacts to cultural resources - Continue conservation activities of old PNR structures in coordination with PNR and LGUs	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Public utilities	Disruption in public utility services, Increased demand for local resources, resource depletion (solid waste generation)	- Timely coordinate with affected utility companies to avoid service interruption in nearby communities during operation as the railway system will heavily rely on electricity supply - Issue public notices or announcements in advance regarding temporary disruption of services - Install energy-efficient equipment and water saving fixtures - Regularly maintain TSS-1 facilities to ensure suitable power supply for the SBT Section - Use back-up generators during power interruption - Implement Energy/Water Conservation Program - Monitor power, fuel and water consumption and solid waste generation and disposal	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
	Occupational and community health and safety	Risk of railway accidents Exposure to contaminated soil	- Prepare and implement train safety operations plan - Train workers and staff on implementation of the operations particularly in TSS-1 operations - Conduct drills on emergency situations at least once a year through professional experts - Conduct internal safety audits at least every six months. - Conduct full audit of the fire protection system every month and conduct daily random checks - Implement the GRM (complaints management system) with complaint desks at all stations - Implement the Occupational and Community Health and Safety Management Plan (OCHSMP) and/or Soil	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		via incidental ingestion and/or dermal contact	Contamination Management Plan (SCMP) in consideration of exposure to contaminated soil and incorporated with Contact Management Plan (CMP) for proper handling procedures Implement a Dust Control Plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures			
		Transmission of communicable diseases	- Sanitary facilities or utilities to maintain sanitary and healthy conditions at all stations and depot. - Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers - Prepare and implement Occupational and Community Health and Safety Management Plan (OCHSMP) and Pandemic Response Plan (PRP) compliant with national and international guidelines - Ensure working conditions comply with RA 11058, DOLE DO 198-2018 and DO No. 13			
		Nuisance to receptors due to dust, noise and vibration	- Provide protection walls and/or noise barriers - Install a 1.5-meter-high sound-absorbing noise barrier extending the length of the SBT project alignment. - Develop and prepare Operational Noise and Vibration Management Plan and secure out-of-hours permit as necessary - Conduct public consultation and information disclosure and prepare/implement GRM procedures			
Railway Operation	Traffic Management	Traffic congestion near railway stations	- Designate / Provide for loading and unloading areas - Fielding of traffic enforcers near the stations - Provision for tricycle / jeepney/bus terminals	DOTr PMO LGUs	N/A	N/A
Train operation (Operation of the access road to MERALCO substation and realigned Old Antipolo Street)	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads	- Ensure accessibility and avoid blocking existing access roads traversing the SBT Section ROW (Hermosa Street, Solis Street and Raxabago/Yuseco Street) as well as the surrounding public access roads including access roads which were temporarily closed during construction - Restrict public use and access of SBT Section ROW except road crossings	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		improved public accessibility due to opening of access roads affected during construction	- Update the Public Access and Traffic Management Plan (PATMP) for the SBT Section / NSCR Project and coordinate with the LGU for the incorporation of public access and traffic management concerns into the LGU TMP - Maintain the relocated Old Antipolo Street and the new access road for MERALCO substation and Triangle Area in coordination with DPWH and other concerned agencies. - Conduct public consultation and information disclosure and prepare/implement GRM procedure			
		Traffic congestion due to road crossings surrounding the SBT Section that links Solis, Blumentritt and Tutuban stations	- Participate in interagency cooperation and coordination between and among LGU, DOTr, DPWH, and other NGAs in the updating the overall LGU TMP covering identification of alternative traffic routes and traffic flow schemes and closely coordinate with barangay LGUs (BLGUs) on concerns that may affect the traffic flow - Prepare and implement a Public Access and Traffic Management Plan (PATMP) in consideration of the TIA for the project and in consultation with concerned traffic agencies, local officials and the general public - Coordinate with the PNP and LGU for traffic management especially during peak hours			
	Landscape value, quality	Improved interoperability and connectivity Temporary visual blight or visual pollution due to construction facilities that may cause nuisance to people Change in landscape quality and value	- Identify planting area within the ROW that will act as buffer zone/ green corridor to lessen visual impacts of construction activities and railway structures - Ensure that the railway structures aesthetically blend with the general landscape of the area in scale, color, and shape - Ensure cleanliness of facilities and substation area through the implementation of Solid Waste Management Plan (SWMP) - Consider the rail corridor in Transit-Oriented Development (TOD) of nearest stations to increase land use efficiency, discourage urban sprawl leading to informal settlements along the ROW and promote sense of uniqueness of the place	Implement: - Railway Operator Monitor: - DOTr - LGUs	To be included in the regular operation and maintenance budget	EGF / Operational Budget
ABANDONMENT PHASE						
LAND						
Demolition of railway structures	Soil quality and contamination	Soil erosion and contamination due to generated	Implement the Erosion and Sediment Control Plan (ESCP) to prevent and manage soil erosion and sedimentation and Spoil Management Plan (SMP) to properly handle, transport and	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
and abandonment		excess soil or spoils	dispose spoils (including identification of haul routes, truck queuing and parking procedures for dust control and mud-tracking prevention) - Minimize ground subsidence, maintain excavated/demolished materials at all times and install engineering interventions such as slope protection and drainage systems with sedimentation/erosion pond and temporary ditches around work areas to collect sediments from erosion or use bunds and silt fences to protect watercourses from soil run-off during the wet season - Schedule clearing, excavation and/or demolition activities in a speedy manner during dry season and minimize demolition during wet season - Place excavated/demolition materials including excess soil/spoils on appropriate in spoils area with adequate containment away from waterways - For stockpiles of excavated soil and materials, cover and limit at height up to 2 m and install silt traps, deviation channels, mounting, barriers or trenches around the stockpiles. For spoils, immediately haul out and remove from the demolition site and transport to the disposal site especially prior to expected rains. Ensure wet/damp soils are sufficiently dry prior to transport - Regularly clean and clear the demolition areas and road surfaces with dust/excavated/demolished materials and scraps to avoid obstruction of natural flow especially during the wet season - In case long-term storage is required during wet season, grade soil storage heaps to flat tops and cover or vegetate with soil stabilizing grasses - Monitor visible signs of erosion for the disposal and management of spoils			
		Generation of solid wastes	- Prepare and implement a Solid Waste Management Plan (SWMP) as part of Abandonment Plan - Establish and enforce daily site clean-up procedures - Minimize the production of wastes that must be treated or eliminated - Properly sort wastes for disposal and designate an appropriate temporary storage area	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Provide a Materials Recovery Facility • Provide 75-liter waste bins with covers and label at strategic locations in work areas (i.e., one every 80 square meters) for segregated storage of different types of solid wastes, including hazardous wastes • Identify and demarcate temporary disposal areas and provide clear instructions on specific materials that can be disposed in these • Recycle wastes including soil, as much as possible • Reuse leftover concrete and metals for suitable alternative projects • Dispose non-recyclable wastes through a licensed contractor. • Conduct soil quality and contamination monitoring and disclose all monitoring results to the public			
	Soil quality and contamination	Due to arsenic concentrations, there are potential human health impacts if humans are chronically exposed via incidental ingestion, i.e., incidental ingestion of dust particles if soils are disturbed, and dermal contact	• Inform workers and community on potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize handling/direct contact with soil • Provide decontamination area (i.e. area where personnel can clean/sanitize themselves) • Encourage regular hand washing and avoid touching the face or eating using bare hands or with work gloves • Implement a Dust and Emission Control Plan to minimize dust generation and assess effectivity of dust control measures to prevent exposure to contaminated soil. Undertake immediate action to reduce health hazard. • Conduct water spraying to avoid dust clouds during dry season. Conduct regular monitoring or visual inspection to assess effectivity of dust control measures • Prepare and implement Soil Contamination Management Plan (SCMP), Contact Management Plan (CMP) and Occupational and Community Health and Safety Management Plan (OCHSMP) as part of the Abandonment Plan • Conduct regular monitoring of soil contamination and visual inspection to assess the effectivity of dust control measures to prevent exposure to contaminated soil and undertake immediate action to reduce health hazard and continue intensive monitoring	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Use of oil, lubricants, and other chemicals during abandonment activities	Soil quality and contamination	Soil contamination due to accidental spills of oil, lubricants, or other chemicals Generation of hazardous wastes	- Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) as part of the Abandonment Plan - Properly handle and dispose potential contaminants coming from demolition sites through DENR-accredited hazardous waste haulers - Secure appropriate DENR permits such as Hazardous Waste Generator ID, Permit to Transport and Hazardous Waste Manifest prior to disposal of hazardous wastes - Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Prohibit the use of unapproved toxic materials - Use properly-rated machines and equipment with applicable certification appropriate for the task and regularly maintain all vehicles and machinery - Deploy heavy equipment operators with certification and conduct safety induction and training for the workers - Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 - Use oil and grease traps, and drip containers or trays to prevent leaks during fuel refilling, repair or demolition activities - In case of spill, isolate the area and stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance with local regulations and WMP or contact the local authority for appropriate response	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Terrestrial wildlife and vegetation	Dust deposition on vegetation	- Properly cover overfills, topsoil/ soils, spoils, and demolition materials onsite as well as equipment, trucks and vehicles for the transport of materials to prevent escape of dust - Execute water sprinkling in access roads and areas with exposed soils or dust-generating materials or equipment at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
Demolition of railway structures and abandonment	Terrestrial wildlife and vegetation	Vehicular strikes to wildlife and vegetation	- Strictly enforce the speed limit for vehicles along the access roads - Strictly implement policies on safe driving - Install proper signages to increase awareness and avoid accidents	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Terrestrial wildlife	Intensified noise caused by anthropogenic activities	- Contain effects from noise pollution coming from vehicles, equipment and nearby facilities - Follow the minimum maintenance standards of all vehicles and heavy equipment to reduce effects of noise pollution	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Demolition of railway structures and abandonment	Terrestrial wildlife	Increase in the intensity of artificial light	- Contain and monitor the effects from source of artificial light at night during demolition work hours - Improve vegetation that creates barrier to limit the glare coming from the artificial light - Concentrate the light on operations using directional light - Install anti-glare to the source of artificial light to regulate glare - In coordination with DENR, ensure the safe removal of wildlife attracted to the artificial light from the demolition site and bring back to its natural habitat	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Clearing of ROW and re-vegetation of selected areas of the SBT Section ROW	Terrestrial wildlife and vegetation	Increase biodiversity due to retention/provision of urban green spaces along the Project alignment ROW	- Restrict access and conserve remaining vegetation within the ROW to provide protection for the remaining threatened and/or endemic species - Monitor the following and disclose the results to the public: - project site and replanted areas (i.e., planted seedlings and/or relocated plants' survival rate) to ensure that there is no degradation of existing biodiversity/ecosystem but will lead to ecosystem stability - the overall improvement of the planted sites in terms of habitat complexity, species richness and diversity, and the presence of more native and endemic species - In case the mortality rate of seedlings and plants are at 10% - 30%, undertake the following: - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. - Conduct a detailed soil nutrient analysis	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality - Make necessary adjustment based on result of soil nutrient analysis and investigation			
WATER						
Demolition of railway structures	Surface water quality	Siltation and sedimentation of waterways due to debris and demolition works	• Implement applicable erosion prevention and sediment control measures (e.g. silt fences, sediment traps, sandbags, fiber rolls in disturbed areas and stockpiles for perimeter control, vehicle tracking pads or shaker racks in demolition site entrances and exits) based on Erosion and Sediment Control Plan (ESCP) • Construct temporary facilities above flood levels and place machineries in a dry storage area at all times • Maintain and protect drainage channels to prevent drainage capacity overflow due to excess water during demolition • Limit stockpile height of dust/ excavated/ demolished materials to 2 m only, cover stockpiles and immediately remove loose earth materials from the site especially before expected heavy rains • Periodically remove sediments from the sediment traps and properly dispose off-site. If sediments have entered the surrounding waterways from surface runoff and streambank erosions, conduct dredging and clean up the waterways • Monitor visible signs of siltation and sedimentation and disposal activities • Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Use of oil, lubricants, and other chemicals during demolition activities	Surface water quality	Contamination of waterways due to accidental spills of oil, lubricants, or other chemicals and generation of hazardous wastes	• Implement the Hazardous Waste Management Plan (HWMP) to include spill prevention and management and emergency response plan (SPMERP) as part of the Abandonment Plan • Properly handle and dispose potential contaminants coming from demolition sites through DENR-accredited hazardous waste haulers • Secure appropriate DENR permits such as Discharge Permit (DP), Hazardous Waste Generator ID (HWID), Permit to Transport (PTT) and Hazardous Waste Manifest prior to disposal of hazardous wastes	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Store waste oils, lubricants, and chemicals in designated storage tanks with adequate spillage protection and dispose in appropriate off-site facilities - Provide proper roofing and concrete-paved floor with proper chemical-proofing to avoid permeation of chemicals. Remove petroleum products and other hazardous chemicals and transfer to a localized area as much as possible. Use temporary waste storage to avoid spills - Regularly inspect storage conditions to check for damages so that needed repairs can be done immediately to prevent leaks and spills - Prohibit the use of unapproved toxic materials - Use properly-rated machines and equipment with applicable certification appropriate for the task and regularly maintain all vehicles and machinery - Deploy heavy equipment operators with certification and conduct safety induction and training for the workers - Comply with required working conditions under RA 11058, DOLE DO 198 - 2018 and DO 13 - Provide oil and grease traps - Collect leakage during fuel refilling and repairs using containers/drip trays - Regularly monitor water quality of Antipolo Creek and South Antipolo Canal and disclose all monitoring results to the public			
Demolition of railway structures	Flood hazard susceptibility	Flooding during demolition works	- Implement the Emergency Preparedness and Response Plan (EPRP) and Occupational and Community Health and Safety Management Plan (OCHSMP) to include protocols for rainy weather conditions and for each PAGASA warning signal for tropical cyclones in consideration of flooding induced by climate change such as extreme weather events - Implement the Flood Management Plan (FMP) to include details on proper handling and storage of electrical wirings, material stockpiles, and heavy equipment, identification of evacuation sites, and post-flood recovery procedures - Conduct IEC campaign and community awareness initiatives on waste management in partnership with the LGU and install signages prohibiting waste disposal into the waterways to prevent water pollution, flooding and drainage overflow	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Install and maintain sufficient and effective drainage and/or dewatering system with drain channels and sumps to facilitate proper drainage of excess water and to regularly remove water that accumulate in pits, excavations, and other depressions • Construct temporary demolition facilities above flood levels, place machineries and equipment in dry storage area at all times and insulate electrical wirings and sources away from wet working areas and flood-prone zones • Conduct cleaning or declogging of waterways as necessary to avoid blockage of existing drains or provide alternative drains should there be unavoidable blockage of existing drains • Provide erosion and sediment controls such as slope protection, silt screens, sediment traps, sumps, and/or settling ponds to minimize siltation of waterways • Properly handle waste bentonite slurry in accordance with RA 9003 and temporarily store in bentonite tanks to prevent siltation			
AIR						
Demolition of railway structures and abandonment	Climate change	Injury, property damage, or disruption of activities due to susceptibility to flooding, tropical cyclone or strong wind	• Prepare and implement a CCAM Plan and/or an Emergency Preparedness and Response Plan (EPRP) as part of the Abandonment Plan in consideration of climate change impacts and including appropriate operation protocols for each PAGASA warning signal for tropical cyclones • Conduct CRVA to provide information useful to relevant stakeholders to understand vulnerability of climate change and adaptation options • Monitor implementation of CCAM Plan as necessary	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
Use of equipment and other dust-generating demolition activities	Air quality	Emissions of fugitive dusts, particulate, and gaseous pollutants	• Implement Dust and Emission Control Plan (DECP) • Incorporate traffic management guidelines in worker's and EPC contractor's induction seminar • Provide workers with appropriate PPEs and implement safety protocols pursuant to RA 11058 and its IRR (DO 2018-198), and DOLE-BWC DO 1998-13 to protect them from disease associated with dusts • Manage vehicle speeds and impose speed limits of 10 km/hr in demolition areas, 20 km/hr in barangay roads, and 30 km/hr	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			in provincial/ municipal roads in accordance to JMC 2018-001 (Guidelines and Standards for the Classification of Roads, Setting of Speed Limits under Republic Act No. 4136, and Collection of Road Crash Data) to trucks that carry materials • Maximize fuel efficiency through scheduling of vehicle and equipment movements in order to minimize both idle time and distances travelled • Prohibit trucks and vehicles to idle on site or roads while waiting • Closely monitor equipment dispatch in order to eliminate unnecessary use and to increase efficiency of use • Undergo the mandatory government vehicle emission tests for contractors' vehicles and demolition equipment • Properly maintain the vehicles to ensure that emissions are within air pollution targets • Execute water sprinkling of access roads, stockpiles and areas with exposed soils or dust-generating materials or equipment whenever visible dust is observed or at least twice in the morning and twice in the afternoon or as needed during dry season; In case stockpile of soils or other dust-generating materials erode, clean up immediately the affected area • Provide adequate buffer zones and install perimeter fence and screens • Put covers on excavated soil and hauling trucks • Regularly monitor emissions of fugitive dusts, particulate and gaseous pollutants) and disclose all monitoring results to the public			
Demolition activities and mobilization of heavy machineries and equipment	Ambient noise	General demolition works produces noise levels that affect the amenity at nearby sensitive receptors	• Prepare and implement a Noise and Vibration Management Plan as part of the Abandonment Plan, including good practice noise and vibration management techniques • Locate site buildings or walled enclosures around especially noisy activities or clusters of fixed noisy demolition equipment • Where practicable, limit heavy demolition vehicle movements to normal working hours and design traffic routes to limit the amount of accelerating and braking and avoid local roads, where practicable	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Prior to particularly noisy activities, contact likely affected residents to inform them of the possible impact and proposed timing/duration of the specific works - Monitor noise levels and evaluate compliance with WBG EHS and Japanese Guidelines and disclose all monitoring results to the public			
	Ambient vibration	Vibration from demolition works causes human disturbance, and structural damage to buildings	- Implement a Noise and Vibration Management Plan (to be included as part of the Abandonment Plan), including good practice noise and vibration management techniques - Plan the demolition schedule such that high levels of vibration only occur during the day where feasible - Substitute demolition methods to emit lower vibration levels where feasible, e.g. smaller vibratory rollers - Design coordination and project layout so that heavy vehicles and activities are located as far from sensitive buildings as possible - Conduct pre-condition assessments of residential and other sensitive assets prior to demolition works where these works are located within 10 meters of buildings sensitive to vibration (greater distances may need to be considered if the abandonment plan changes) - Conduct compliance monitoring where safe working distances cannot be maintained to demonstrate compliance or trigger further mitigation measures to reduce vibration where levels exceed acceptable thresholds - Regularly monitor vibration levels, evaluate compliance with WBG EHS and FTA guidelines and disclose all monitoring results to the public	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Ambient noise and vibration	Noise and vibration generated by demolition works and impact on workers	- Provide training on noise and vibration mitigation and require workers to wear appropriate PPE including ear plugs or ear muffs - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole body vibration (e.g. operating excavators) and reduce exposure duration for high vibration tasks; If loud work is unavoidable, assign restricted areas to limit noise exposure; Rotate workers and organize work schedules so worker exposure to hazardous noise is limited	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload - Substitute high vibration tools for vibration-reduced tools where possible - Regularly maintain vehicles, machineries and other equipment as well as surface conditions of access roads - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers and Contractors			
PEOPLE						
Demolition of railway structures and abandonment	Land use and classification	Incompatibility with existing land use, Change in land use	- Conduct public consultations for the appropriate use and management of the ROW after the demolition - Reinstate the land to agreed conditions in coordination with the lot owners, LGUs, other relevant agencies and concerned stakeholders in acquiring and/or securing the ROW	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Public participation and information disclosure	Conflict of interest or low social acceptability	- Prepare a detailed Abandonment Plan for DENR/EMB approval - Conduct regular consultations with the affected LGU, community and relevant government agencies to ensure adequate and timely mitigation of adverse project impacts - Conduct public consultation and information disclosure activities on demolition schedule and potential impacts using all media - Implement the Social Development Plan (SDP), Helpdesk and GRM to engage with stakeholders and address project concerns and impacts and/or to resolve complaints of the communities and stakeholder groups - Install notice boards at the demolition site that indicate the contact details of the responsible party tasked to receive and document complaints	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Local economy, employment and livelihood	Disruption of livelihood, local business and economy	- Prioritize hiring qualified PAPs and local workers for the manpower requirement and provide equal opportunities for all qualified applicants including women and PWDs - Establish a referral system prior to retrenchment and closure.	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
		Generation of livelihood, employment and business opportunities	- Provide alternative livelihood or employment program in coordination with the LGU and relevant government agencies for affected railway employees - Provide alternative access for affected businesses and directional signboards to ensure continuous business operations - Undertake demolition activities at the shortest possible time to restore normal business operations within the project vicinity			
	In-migration	Encroachment/proliferation of ISFs	- Install boundary fence and sign boards, and deploy security guards to restrict public use and access of the ROW even after the completion of demolition works - Implement proper land use planning (designation to new land use, as needed), and turnover of ROW to LGU or relevant NGA for management - Closely coordinate with the host LGUs specifically at the barangay level regarding the hiring of regular workers to ensure that the workers are considered as legitimate residents in the area	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Vulnerable groups, gender and children's rights	Greater challenges in re-establishing living standards, Additional hardship due to vulnerability	- Provide job opportunities and work environments in consideration to gender equality and vulnerable groups in line with national and international laws and regulation - Ensure compliance with RA 7658 or Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act and child labour will not be tolerated with respect to the demolition activities - Monitor compliance to manpower requirements in terms of work environment / employment status and disclose all monitoring results to the public	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
	Occupational and community health and safety	Risk of demolition-related accidents	- Prepare and implement Occupational and Community Health and Safety Management Plan (OCHSMP) and Emergency Preparedness and Response Plan (EPRP) to include safety and security policies and procedures - Install fencing of the demolition site, provision of signage and posters, and guarding of the access point to ensure that the area is not accessible to the public - Use proper PPEs and install signages within the demolition area	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Maintain good sanitary conditions to help reduce bacteria, viruses, and their carriers. Prior to start of work, workers will submit medical clearance to certify their fitness to work. Workers who are ill will also be advised not to come to work until they are well. If applicable, a Pandemic Response Plan will be prepared and compliant with the applicable legal guidelines (e.g. DOH) • Provide sufficient lighting system and safety measures such as venting, monitoring, and emergency rescue procedures • Limit exposure to elements, suspend demolition activities upon announcement of inclement weather from PAGASA, keep updated with the latest weather bulletin • Appoint an environment, health, and safety officer to supervise the implementation of environmental mitigation measures and to ensure that health and safety measures are strictly implemented at the demolition site and immediate vicinity • Establish Health and Safety Desk or Medical Station at strategic sites to monitor and safeguard the health of the workers and local residents (if applicable) and provide immediate response as per Emergency Preparedness and Response Plan (EPRP) during emergencies • Implement the GRM (complaints management system) including setting up of help desk • Monitor demolition-related accidents among the workers and the community and disclose results for appropriate action • Immediately inspect areas where accidents happen, determine/ investigate the cause and apply corrective actions to prevent similar events in the future			
		Exposure to contaminated soil via incidental ingestion and/or dermal contact	• Prepare and implement a Soil Contamination Management Plan (SCMP) and Occupational and Community Health and Safety Management Plan (OCHSMP) incorporated with Contact Management Plan (CMP) as part of Abandonment Plan • Inform nearby communities and workers on the potential hazards associated with soil ingestion and dermal contact • Provide appropriate PPE such as face mask, goggles, gloves, etc. to minimize direct contact with soil • Provide decontamination area and implement proper decontamination after work and regular hand washing to	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			minimize the risk of incidental ingestion of soil particles that adhered to clothing and exposed skin Implement a dust control plan to minimize generation of dust, conduct water spraying to avoid dust clouds during dry season and regularly monitor or conduct visual inspection to assess the effectivity of dust control measures			
		Transmission of communicable diseases	- Prepare and implement OCSHMP and Pandemic Response Plan (PRP) compliant with national and international guidelines. - Conduct regular maintenance and sanitation to help reduce bacteria, viruses, and their carriers. - Comply with working condition requirements or guidelines governing occupational safety and health - Interact less with nearby community unless needed and following appropriate protocols - Require workers to undertake/ submit fitness-to-work certification prior to demolition works and medical clearances will be required after a sick leave - Conduct health and safety trainings for workers - Ensure adequate health and safety considerations in the Social Development Plan (SDP) for the community	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
		Nuisance to receptors due to dust, noise and vibration	- Implement Noise and Vibration Management Plan and Dust Emission Control Plan - If loud work is unavoidable, assign restricted areas to limit noise exposure - Ensure equipment is properly maintained - Hold daily safety 'toolbox meetings' to provide and obtain feedback on the effectiveness of noise control measures from workers - Provide PPEs and regular safety trainings for workers and supervise the proper use of PPEs - Organize work schedules and shifts to limit workers exposure to dust, noise and vibration hazards - Identify tasks where workers may be exposed to hand-arm vibration (e.g., jackhammering) or whole-body vibration (e.g. operating excavators) and substitute high vibration tools for vibration-reduced tools where possible	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			• Maintain the surface condition of access roads to reduce vibrations being transferred • Schedule regular breaks to avoid awkward postures, frequent twisting, long periods in the same position (standing, sitting, kneeling) and physical workload			
Demolition of railway structures and abandonment	Public access and traffic management	Restrictions to public access that locals are accustomed to due to diverted and realigned public access roads	• Provide and maintain public access as much as possible to minimize the impact to the daily life of affected communities such as designating safe access to schools in coordination with the DepEd and host LGUs for the schedule of demolition activities in case of any temporary road closure • Provide diversion route with appropriate health and safety measures. In case of any changes, prompt update on the diverted routes to the concerned communities and LGUs • Implement the Public Access and Traffic Management Plan (PATMP) with due consideration of LGU and community recommendations on public access impacts • Restrict public use and access of the ROW by installing boundary fence and "off-limits"/ danger zones areas • Only allow authorized personnel to access the demolition site • Assign traffic guides to provide assistance to road users when necessary • Disseminate information to the public and LGUs on the potential impact to the existing public access and present mitigation measures	• DOTr • Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement
		Traffic congestion And accidents	• Implement a Public Access and Traffic Management Plan (PATMP) to ensure that traffic congestion due to demolition activities (movement of construction vehicles, haulage trucks, and equipment) is minimized • Disseminate information on potential impacts, mitigation, access arrangements and construction schedule to community as well as wider public for potential user of roads in the area • Coordinate with the LGU, DPWH and MMDA to ensure alternative public access for pedestrians and vehicles • Identify traffic diversion and management, traffic schedules, traffic arrangements showing all detours, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists in the affected areas	Implement: • DOTr PMO • Contractor Monitor: • DOTr PMO • GC • TPA, EMA • NGAs/ LGU • DENR-EMB	To be included in the Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost), HSE management	EGF/ Bid Documents/ Contract Agreement

Project Phase / Environmental Aspect	Environmental Component	Potential Impact	Actions for Prevention, Mitigation, or Enhancement	Responsible Entity	Cost	Financial Arrangement
			- Coordinate with the traffic police or employ flag persons for traffic management - Provide traffic advisory signs stating that demolition is in progress and that road narrows in some sections - Provide sufficient lighting at night within and in the vicinity of the construction sites - Prohibit prolonged side street parking of demolition trucks. - Schedule delivery and transport of demolition materials and spoils during non-peak hours			
Demolition of railway structures and abandonment	Landscape value, quality	Temporary visual blight or visual pollution due to demolition activities Degradation of landscape quality and value due to improper handling of excavated soils	- Strictly implement Solid Waste Management Plan (SWMP) and Spoil Management Plan (SMP) in accordance with RA 9003 - Install project structure exteriors (e.g., fence, wall, roofs) harmonize with the surrounding environment and keep the demolition area clean and rehabilitate after demolition/ before abandonment - Use cover-ups (e.g., vertical sheets of plywood or metal fencing) around the demolition area, as necessary, that will aesthetically blend with the general landscape of the area or use seeding of bare soils where sites are in proximity to aesthetically sensitive sites - Implement Social Development Plan (SDP) including waste management	- DOTr - Contractor	To be included in the Contractor's service fee as part of the Abandonment Cost	Contract Agreement

Note:

A+/- : significant positive / negative impact is expected

B+/- : moderate positive / negative impact is expected

C+/- : minor (negligible) positive / negative impact is expected

D : extent of impact is unknown

Annex H-1

Environmental Monitoring Plan (EMoP) for the North-South Commuter Railway Project (Malolos-Tutuban)

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SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
PRE-CONSTRUCTION PHASE								
Land								
Soil Quality and Contamination (Baseline, Additional Testing)	Exposure to contaminated soil (arsenic)	Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb Other parameters may be measured as needed	Method • Visual and odor observation • Composite sampling for surface layer and subsurface layer (0.5 m) Frequency • Once prior to construction	Sampling sites (SS01, SS02) from where soil samples detected with arsenic level exceeding US EPA RSL Other sampling stations within/adjacent to the SBT Section ROW if necessary to verify extent of soil contamination	DOTr PMO and Contractor	Contractor's Service Cost	Alert • Visible staining in soil Action • Soil laboratory results exceed USEPA RSL (> 3.0 mg/kg) – to be agreed with DENR-EMB Limit • At least 25 m3 of soil exceeded DIV (> 76 mg/kg) – to be agreed with DENR-EMB	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis Action • Soil exposure management • Implement Contact Management Plan Limit • Conduct Site Assessment and Remediation • A risk-based approach in the management of potentially contaminated site is recommended • If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
	Soil contamination (baseline)	Soil fertility • pH, OM, total Kieldahl N, available P, extractable K Soil contamination • As, Ba, Cu, Z, Cd, Cr+6, Cr, Fe, Pb, Mg, Mn, Hg, Se, Ni, CN-, F, PCBs, O&G, mineral oils	Method • Composite sampling Frequency • Once prior to construction	In case of any potential contaminated sites within/adjacent to SBT Section ROW as well including temporary facilities.	DOTr PMO and Contractor	Contractor's Service Cost	• Exceeded BSWM standard for soil fertility • Exceeded DIV and/or US EPA standards for soil contamination	• Follow EIA process and secure the ECC
Terrestrial Vegetation and Wildlife (Baseline)	• Vegetation removal and habitat loss • Threat to existence and/or loss of	Issuance of DENR-issued tree cutting permit (TCP) and implementation of Pre-Vegetation Clearing Plan	Method • Visual inspections of all areas approved for tree cutting.	in all areas that were approved by the DENR for tree cutting	DOTr Contractor	PHP 300,000.00	The Tree Cutting Permit is specific and provides in detail the exact location of individual trees, their common and scientific names, and the number of individuals allowed to be cut. Actual trees on the ground	Investigate conditions on the ground and personnel that lead to and/or involved with unauthorized tree cutting. Determine cause of unauthorized tree cutting. Always improve and make sure that all markings on the ground showing limits of

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	important local species • Threat to abundance, frequency, and distribution of important species	Map showing designated areas for clearing. Areas on the ground marked and scheduled for clearing. Trees on-site marked for cutting in conjunction with geo-tagged trees indicated on the TCP. List of approved trees for cutting including their identification, location, and number of individuals to be cut.	• Manual count of cut trees versus the number of trees approved for cutting. Frequency • During all tree cutting activities				approved for cutting are also clearly marked and geo-tagged. Hence, cutting or removal (either accidental or intentional) of even just one tree not included in the Tree Cutting Permit should not occur.	areas for clearing are visible and understood. Make sure that all tree individuals approved for cutting are clearly marked and understood by the contractor. Perform daily orientation of contractors to discuss areas to be cleared and individual trees to be cut.
Terrestrial Vegetation and Wildlife	• Vegetation removal and habitat loss • Threat to existence and/or loss of important local species • Threat to abundance, frequency, and distribution of important species • Further reduction of green spaces in urban areas	For relocated earth-balled trees: survival rate and growth rate. For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate. For the Relocation-cum-Offset area (to monitor overall improvement in ecology as affected by earth-balled trees and/or out-planted seedlings): vegetation species list; vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	Method • Periodic (Measurement) • Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) • Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency • Semi-annual (two seasons)	Planted area within the SBT Section ROW Relocation-cum-Offset area (preferably near the affected area) in lieu of the vegetation loss along the SBT Section ROW	DOTr PMO and Contractor	PHP 300,000	Alert • 10% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW • Mortality of at least 3 individuals of endemic plants balled-out and relocated in the planting site Action • 20% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW • Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out and relocated in the planting site Limit • 30% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW	Alert • Replace seedlings and relocated plants that did not survive. • Conduct visual observations and interviews of locals to determine potential cause of mortalities for both out-planted seedlings and relocated plants. • Test other plant species (by allowing them to grow) that are more adaptable to the site. Action • Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							100% mortality of endemics and threatened plant species balled-out and relocated in the planting site	workers on other potential causes of mortality. - Make necessary adjustment based on result of soil nutrient analysis and investigation. Limit - Replace seedlings and relocated plants that did not survive using species more adaptable to the site. - Review and revise relocation and revegetation plan to improve plant survival. - Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality.
Water								
Surface Water Quality (Baseline)	Contamination of waterways	Color, temperature, pH, DO, conductivity, BOD, TSS, surfactants (MBAS), As, Cd, Cr ⁺⁶ , CN ⁻ , Pb, Hg, O&G (petroleum ether extracts), nitrate as NO ₃ -N, phosphate as P (total, reactive), phenolic substances and phenols, TC, FC, Cl ⁻ , Cu (dissolved, total), Organophosphate as Malathion	Method - Grab sampling Frequency - Once prior to construction for two seasons	Waterways within/adjacent to the SBT Section ROW and temporary facilities not covered by the WQ1, WQ2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded water quality standards (DAO 2016-18, DAO 2021-19)	Follow EIA process and secure the ECC
Air								
Air Quality (Baseline)	Air pollution due to emissions of particulate and gaseous pollutants	TSP, PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO, O ₃ , Pb	Method 24-hour and 1-hour sampling Frequency	selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section ROW and temporary	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded air quality standards (DAO 2000-81, DAO 2020-14)	Follow EIA process and secure the ECC

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Once prior to construction for two seasons	facilities not covered by the ANV1, ANV2				
Noise (Baseline)	Increase in noise level	Noise level	Method 24-hour and 1-hour sampling Frequency - Once prior to construction	selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section ROW and temporary facilities not covered by the ANV1, ANV2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded NPCC, WBG-EHS standard, and Japanese Standard	Follow EIA process and secure the ECC
Vibration (Baseline)	Increase in vibration level	Vibration level	Method 24-hour sampling Frequency - Once prior to construction	selected socially and ecologically sensitive receptors adjacent and close proximity to the SBT Section ROW and temporary facilities not covered by the ANV1, ANV2	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard	Follow EIA process and secure the ECC
People								
Public Participation and Information Disclosure	Conflict of interest and social acceptability	Status, issues and concerns or complaints on: - Information, Education and Communication (IEC) activities - IEC meetings - Project awareness campaign materials - Information disclosure (online, mass media) - Public Participation activities - Public and stakeholder consultations - Focus group discussions (FGDs) - Key informant interviews (KIs)	Method - Documentation, recording and report monitoring - Perception/ Social acceptability survey Frequency - Quarterly or immediately upon receipt of complaints	Barangays impacted by the Project, and relocation sites	DOTr PMO and Contractor in coordination with LGU	Contractor's Service Cost	Alert/Action - Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities Limit - Issues, concerns and complaints raised by the public and stakeholders thru the DOTr Helpdesk - Low social acceptability based on perception survey	Alert/Action - Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM - Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit - Resolve issues, concerns and complaints thru the Helpdesk or GRM - Evaluate the reasons for the low social acceptability based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		-Perception Survey • Social Development Plan (SDP) Implementation						• Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary
Land Acquisition and utilization and Involuntary Resettlement	Displacement of legal PAPs/ landowners	Status of land acquisition and resettlement: • Land area (m ²) acquired • Compensation amount paid for affected land, structures and improvements, households, crops and trees of legal PAFs (amount paid in php) • Legitimate landowners or legal PAPs displaced and assisted for resettlement (no.) • Issue and concern raised	Method • Area measurement, counting and progress reporting • Consultation meeting • Survey with PAPs Frequency • Monthly until ROW is fully compensated and acquired (in case of court case, until the case closed)	Within and adjacent to SBT Section ROW	DOTr PMO (RIC, LIAC)	RAP Cost	Alert • Grievance to be resolved at the GR Officer Level Action • Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit • RAP-related grievance (appeal to second level decision) to be resolved by the PIAC, as necessary	Alert • Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) • Implement corrective actions as necessary Action • Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) • Implement corrective actions as necessary Limit • Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) • Ensure resolution of complaints/conflicts as soon as possible
	Improvement of living conditions	Resettlement of Informal Settlers Families (ISFs) to the relocation sites	Method • Consultation Meeting and/or Survey with the PAPs Frequency • Semi-annually until the end of livelihood restoration program	Affected barangays	DOTC PMO, NHA			
	Displacement of eligible ISFs and other non-landowners	Status of acquisition and resettlement/ relocation: • Compensation paid for affected structures and improvements, households, crops and	Method • Counting, area measurement, counting and progress reporting Frequency	Within and adjacent to SBT Section ROW, Resettlement site (receiving LGU)	DOTr PMO (LIAC)			

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		trees if applicable (amount paid in php) • Resettlement area completed (unit) • Housing units allocated and reserved for PAFs (no.) • ISFs and non-landowner PAPs displaced and/or relocated (no.) • Other relocation assistance provided	• Monthly until ISFs are all relocated					
Local Economy, Employment and Business	Disruption of livelihood, local business and economy	Status of LRIP: • Number of affected persons/households including vulnerable groups local communities by type of livelihood/income (land based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) • affected household members and business compensated for livelihood (amount in peso and no.) • LRIP training type provided and record of training (no.) • Number of affected persons and local communities employed by the project (no by gender and vulnerability)	Method • Survey, recording, and progress reporting Frequency • Quarterly until the end of livelihood restoration program	Impacted barangays and LGU and resettlement sites	DOTr PMO (RIC and LIAC)			

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Status of local economy: • Employment rate • Poverty incidence • Business renewal/registration • Capital investment • Tax revenue	Method • Data gathering in coordination with affected Barangay and LGU Frequency • Quarterly					
Cultural Heritage	Damage/ destruction risk to physical cultural/ archaeological resources	affected historic structures and buildings within SBT Section ROW: Status of relocation of Casitas de Tondo based on agreements with CAs and PNR	Method • Progress reporting and meetings with CAs and PNR Frequency • monthly	The existing site of Casita de Tondo and its relocation site (NSCR Project Tutuban Station)	DOTr PMO and Contractor	Contractor's Service Cost	Any significant change in the relocation of the Casitas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures to be incorporated to the CMP
		Other affected historic structures and buildings based on SBT Section ROW and identified locations of temporary facilities and access routes	Method • Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency • Once prior to construction	Historical structures and buildings adjacent or close to the location of SBT Section ROW and temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard for vibration	Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
		Accidental finds encountered prior to construction	Method • Documentation and reporting to Cas • Interviews with local residents Frequency • Monthly and immediate in case of any found or informed	Within the SBT Section ROW and temporary facilities	DOTr PMO and Contractor	Contractor's Service Cost	Any accidental finds encountered	• Follow the procedure for archaeological watch or artifacts and archaeological remains chance finds to be agreed with and approved by CAs including but not limited to the following: • Secure the area of concern and report to the concerned CA (e.g. NM) any accidental finds upon the advice of the archaeologist • Immediately cease all earthmoving activities subject to the assessment of CA

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- Closely coordinate with CAs on the appropriate course of action in protecting the archaeological find - Continue construction activities if no cease and desist order is issued
Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Number of accidents involving local communities - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - monthly - Immediately in case of accidents Immediately upon receipt of complaint	Affected barangays and properties	DOTr PMO and Contractor	Contractor's Service Cost	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3-4 Procedure (EGF Committee or DENR PAB)
CONSTRUCTION PHASE								
The Land								
Soil Erosion	Soil erosion due to generated excess soil or spoils	Occurrence of soil erosion	Method - Ocular inspection - reporting, - meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and meeting or as needed	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Alert - noticeable soil erosion in active construction sites Action - Increased occurrence of soil erosion in active construction sites Limit	Alert - Investigate and report the areas with occurrence of soil erosion. Action - Investigate and report the areas with increased occurrence of soil erosion. Identify the cause of soil erosion and improve control measures.

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Status of soil/ spoil management: • Volume of excess soil/ spoils • Stockpile height limit • Disposal method and management of soil/ spoils against the approved Spoil Management Plan (SMP)	Method • Ocular inspection, reporting, meeting with Contractor/s Frequency • Daily visual inspection • Monthly reporting and meeting or as needed • Immediately in case of spill				• Excessive soil erosion in active construction sites and immediate vicinity	Limit • Investigate and report the areas with excessive soil erosion. Identify the cause of soil erosion and fortify control measures and barriers.
Soil Quality and Contamination	Soil contamination due to accidental spills of oil, lubricants or other chemicals	Visible soil staining	Method • Visual and odor observation/ immediate reporting of accidental spills and inspection of work site Frequency • Twice a week to daily • Immediately in case of spill	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Hydrocarbon staining or nauseating odor, reported spills/ leaks from the workers and community	• Isolate the work site, stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance HWMP, SPMERP, SCMP and Contact Management Plan • Report to the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities
		• Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb • Other parameters may be measured as needed	Method • Composite sampling Frequency • Quarterly • Immediately in case of accidental spill	SS01, SS02 and the construction sites and the location of temporary facilities especially areas that exceeded soil contamination standards during baseline sampling	DOTr PMO and Contractor	Construction Cost	Alert • Visible soil staining/ reported accidental spill Action • Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit • Soil laboratory results exceed DIV – to be agreed with DENR-EMB	Alert • Conduct soil sampling and verify heavy metal concentration through laboratory analysis Action • Conduct soil exposure management • Implement Contact Management Plan Limit • Conduct Site Assessment and Remediation • A risk-based approach in the management of potentially contaminated site is recommended

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
Soil Quality and Contamination	Soil contamination due to generation of solid wastes	Management of solid wastes against the approved Solid Waste Management Plan (SWMP) - Status of solid waste generation and collection: - Solid wastes generated (cu.m.) - Solid wastes collected (cu.m.) - Solid waste storage and collection - Solid waste disposal method (transport and disposal)	Method - Ocular inspection - Regular reporting, and meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and - Quarterly or semi-annually Regular audits	Construction site, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Construction Cost	Alert - At least two non-compliances that have not been closed out after one succeeding audits Action - At least two non-compliances that have not been closed out after two succeeding audits Limit - At least two non-compliances that have not been closed out after three succeeding audits	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit - Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Soil contamination due to generation of hazardous wastes	- Management of chemicals and hazardous substances/ wastes against the approved Hazardous Waste Management Plan (HWMP) and Spills Prevention and Management and Emergency Response Plan (SPMERP) - Stock inventory - Waste chemicals/ hazardous wastes generated - Handling of hazardous wastes (storage, treatment)	Method - Visual and odor observation, reporting, and meeting with Contractors; Inspection of fuel storage sites, hazardous materials storage, generator set area for visible signs of leakage along with general inspection of work sites, inspection of spill clean-up logs and audit of actions taken - Composite sampling Frequency	Construction areas (including sites of temporary facilities)	DOTr PMO and Contractor	Construction Cost	Alert - At least two non-compliances that have not been closed out after one succeeding audit Action - At least two non-compliances that have not been closed out after two succeeding audits Limit - At least two non-compliances that have not been closed out after three succeeding audits	Alert - Engage lead person and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of non-compliances and sanction the involved parties as necessary; Implement corrective actions and way forward Limit - Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		–Hazardous waste disposal method •Physical soil condition (e.g., presence of hydrocarbon staining) •Fuel condition of construction heavy equipment and other machineries	•Daily to Twice a week visual observation, • Monthly reporting and meeting; Regular inspections (e.g., quarterly or semi-annually) •Immediately in case of accidental spill until regular sampling until fully detoxified					
Soil Contamination	Health impacts to workers / communities due to exposure to arsenic and other heavy metals	• Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb • Other parameters may be measured as needed	Method • Visual and odor observation • Toxicity Characteristic Leaching Procedure (TCLP) Frequency • Daily • Monthly until fully detoxified.	• SS01, SS02 (especially areas that exceeded soil contamination standards during baseline sampling (e.g. SS02 for As) • Construction site and disposal site (including sites of temporary facilities)	DOTr PMO and Contractor	Construction Cost	Alert • Visible staining in soil • Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action • Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit • Cd, Pb, Cr (VI), As: 5 mg/L; • Hg: 0.2 mg/L; Se: 1 mg/L; • F and B – no standard– to be agreed with DENR-EMB	Alert • Soil sampling • Take soil samples and verify arsenic concentration through laboratory analysis • Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action • Soil exposure management • Implement Contact Management Plan Limit • Conduct Site Assessment and Remediation • A risk-based approach in the management of potentially contaminated site is recommended
Soil Contamination	Worker and community exposure to health and safety hazards due to working in areas with excavation of such soils (Meycauayan	• Proper removal and disposal of excavated soil (from Meycaucyan dump site and RAMCAR battery site)	Method • Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances Frequency	• Meycauayan dumpsite and RAMCAR battery site	PCO of the Contractor and DOTC PMO	PhP 200,000	Alert POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30 Action; Limit	POST-ECC Agreement between DOTC, Contractor and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	dumpsite and RAMCAR battery site)		• N.A. Monthly until fully detoxified.				N.A.	
Terrestrial Vegetation and Wildlife	• Vegetation removal and habitat loss • Threat to existence and/or loss of important local species • Threat to abundance, frequency, and distribution of important species	For relocated earth-balled trees: survival rate and growth rate, mortality rate, Provision of corresponding number of tree seedlings For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate, mortality rate, provision of corresponding number of tree seedlings For monitoring of improvement in ecology : vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	Method • Periodic (Measurement) • Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) • Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency • Semi-annual	• Planted area within the SBT Section ROW • Relocation-cum-Offset area (preferably near the affected area) in lieu of the vegetation loss along the SBT Section ROW • Near the affected areas along the SBT Section ROW	• DOTr PMO and Contractor	PHP 300,000	Alert • 10% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW • Mortality of at least 3 individuals of endemic plants balled-out and relocated in the planting site Action • 20% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW • Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out and relocated in the planting site Limit • 30% mortality on out-planted seedlings to replace cut trees in the SBT Section ROW • 100% mortality of endemics and threatened plant species balled-out and relocated in the planting site	Alert • Replace seedlings and relocated plants that did not survive. • Conduct visual observations and interviews of locals to determine potential cause of mortalities for both out-planted seedlings and relocated plants. • Test other plant species (by allowing them to grow) that are more adaptable to the site. Action • Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis of the planting site and perform interviews of locals and workers on other potential causes of mortality. • Make necessary adjustment based on result of soil nutrient analysis and investigation. Limit • Replace seedlings and relocated plants that did not survive using species more adaptable to the site. • Review and revise relocation and revegetation plan to improve plant survival. • Conduct a detailed soil nutrient analysis of the planting site and

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								perform interviews of locals and workers on other potential causes of mortality.
Development of Depot site	• Loss of small swampy area used for a few migratory and resident birds	Seasonal bird count	Method • Ocular survey Frequency • Quarterly	Adjacent offset wetland of the Valenzuela depot	• DOTC PMO, The Society for the Conservation of Philippine Wetlands (SCPW)	To be detained in preparation of Restoration Plan. (Note: monitoring cost is P20,000.00)	Alert; Action • POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30 Limit • N.A.	Alert; Action; Limit POST-ECC Agreement between DOTC and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30
Geologic Hazards	Ground subsidence	Level of ground subsidence/ change in ground level	Method • Visual observation • Level survey Frequency • Daily visual observation • Weekly level survey or as needed	In and around the excavation and temporary facilities	DOTr PMO Contractor	Construction Cost	Alert • Complaints within impact area Action • Visually observed subsidence or minor damage to above ground structures Limit • Verified occurrence of subsidence and damage associated with project activities	Alert • Investigate complaints if attributable to project activities Action • Implement corrective actions as necessary if the observed subsidence poses threat to the workers and community Limit • Temporarily stop work to recalibrate works and legitimate complainants agreed on resolution
			Method • Visual observation • Level survey Frequency • Monthly level survey	Valenzuela Depot	PCO of the Contractor and DOTC PMO	To be included in engineering cost	N.A.	N.A.
The Water								
Surface Water Quality	Siltation and sedimentation	• Visual indication of siltation, sedimentation and clogging of drainage	Method • Ocular inspection	WQ1, WQ2, and other established surface water quality	DOTr PMO and Contractor	PHP 10,000 estimated laboratory fees	Alert	Alert

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		canals (e.g. turbidity, accidental spills)	Frequency • Daily during rainy season	sampling stations (effluent discharge point) near active construction sites, temporary facilities (e.g. construction drainage canals)		per monitoring event for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, and PHP 25,000 sampling fee and expenses	- Observed presence of concentrated flows from construction sites to drainage canals which causes siltation - Compare observed in-situ parameters from the baseline data.	- Check and monitor the performance of the sediment control equipment/ facilities installed. - Check equipment, construction activities, or facilities considered as source of leakage, and halt operations for inspection and maintenance.
	Contamination of waterways with solid wastes and domestic wastewater	Status of Surface water quality: - Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, Ammonia, Chloride, Oil and grease, Cyanide, Phenols, Surfactants (MBAS), Trace metals (As, Cu, Cd, Cr⁶⁺, Pb, Hg) - Other parameters may be measured as needed such as at the event of accidental spill	Method - For temperature, pH and DO – <i>in-situ</i> measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be sampled as needed			Around PHP 140,000 for four quarterly monitoring events	Action - Observed presence of concentrated flows from construction sites to drainage canals which causes siltation - For ambient surface water quality: DAO 2016-08 / DAO 2021-19 Water Quality Guidelines (WQG) for Class C waters Limit - Visually evident changes in surface water quality, such as increased siltation, concentration flows of wastewater, and oil/grease sheet forming above the water. - Complaints from the community due to water pollution attributable to the Project. - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	Action - Investigate if changes in water quality is attributable to the construction activities. - Once identified and verified to be part of the project activities, temporarily halt the specified activity. Apply mitigating measures to stop/attenuate the water quality changes observed. Limit - Investigate if changes in water quality is attributable to the construction activities. - Once identified and verified to be part of the project activities, temporarily halt construction activities to identify main sources of pollution, leaks, or any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed. - Respond to complaint through the Project's Grievance Redress Mechanism
		pH, DO, Oil & Grease, BOD, Fecal Coliform/ Total Coliform, and TSS	Method Water Sampling in accordance with the prescribed procedures described in DAO 34-1990 and EMB-DENR	At sampling locations in Guiguinto River, Santol (Balagtas) River, Bocaue River, Marilao River, Meycauayan River, Valenzuela Depot,		Total sampling cost shall be determined during implementation of the	Alert; Action POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Manual for Ambient Water Quality Monitoring Volume I Frequency • Quarterly	Tullahan River, and Estero de Maypajo.(8 points)		project (Note: sampling cost per monitoring station P50,000.00)	Limit For Class "C" freshwater pH – 6.5 to 8.5 DO – 5.0 mg/L Oil & Grease – 2.0 mg/L BOD – 7.0 mg/L TSS – not more than 30 g/L increase	
Surface Water Quality	Contamination of waterways by accidental spills of oil, lubricants, and other chemicals and concrete / drilling wastewater spills	• Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform • Other parameters may be measured as needed by type of spill	Method • In-situ measurements and grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency • Immediately in case of accidental spill	South Antipolo Canal and drainage within project area	DOTr PMO and Contractor	PHP 10,000 estimated laboratory fees per monitoring event for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, and PHP 25,000 sampling fee and expenses Around PHP 140,000 for four quarterly monitoring events	Alert • Observed presence of concentrated flows from construction sites to drainage canals which causes siltation • Compare observed in-situ parameters from the baseline data. Action • Observed presence of concentrated flows from construction sites to drainage canals which causes siltation • For ambient surface water quality: DAO 2016-08 / DAO 2021-19 Water Quality Guidelines (WQG) for Class C waters Limit • Visually evident changes in surface water quality, such as increased siltation, concentration flows of wastewater, and oil/grease sheet forming above the water.	Alert • Check and monitor the performance of the sediment control equipment/ facilities installed. • Check equipment, construction activities, or facilities considered as source of leakage, and halt operations for inspection and maintenance. Action • Investigate if changes in water quality is attributable to the construction activities. • Once identified and verified to be part of the project activities, temporarily halt the specified activity. Apply mitigating measures to stop/attenuate the water quality changes observed. Limit • Investigate if changes in water quality is attributable to the construction activities. • Once identified and verified to be part of the project activities, temporarily halt construction activities to identify main sources of pollution, leaks, or

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							- Complaints from the community due to water pollution attributable to the Project. - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed. Respond to complaint through the Project's Grievance Redress Mechanism
Hydrology	Flooding	- Daily record of stream flow and water level - Visible signs of clogged cross drainage structure) - Reports of complaints related to flooding from nearby communities	Method - Ocular inspection and in-situ measurement - Check PAGASA weather bulletin Frequency - Daily - Immediate in case of weather warning.	South Antipolo Canal and drainage within project area	DOTr PMO Contractor in coordination with LGU/ PAGASA	Construction Cost	Alert - Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action - Occurrence of 10cm to 30 cm flooding not subsiding after rainfall event Limit - Occurrence of more than 30cm flooding not subsiding after rainfall event	Alert - Investigate and check drainage clearance Action - Investigate and clear drainage system Limit - Temporary stop work until flooding has subside (clearing/creating new drainage system or pump out water)
The Air								
Air Quality	Air pollution due to emissions of particulate and gaseous pollutants as well as fugitive dust	- Particulate Pollutants: TSP, PM₁₀, PM_{2.5}, Pb - Gaseous Pollutants: SO₂, NO₂, CO, O₃	Method 24-hour monitoring for: - TSP: High volume, Gravimetric - PM₁₀: high volume with PM₁₀ inlet, Gravimetric - PM_{2.5}: High volume with PM_{2.5} inlet, Gravimetric - SO₂: Gas bubbler, Colorimetric Pararosaniline - NO₂: Gas bubbler, Griess Saltzman Reaction Frequency	ANV1, ANV2 other established sampling stations dust-generating temporary facilities/ construction yards outside the ROW	DOTr and Contractor	PHP 50,000 per monitoring event: 24-hour monitoring of TSP, PM ₁₀ , PM _{2.5} , SO ₂ , and NO ₂ : PHP 30,000 Mobilization/ Demobilization Cost: PHP 20,000	Alert 75% of DENR Limit Action 85% of DENR Limit Limit - Complaint lodged by comm - TSP: 230 ug/NCM; - PM10: 150 ug/NCM; - PM2.5: 50 ug/NCM; - SO2: 180 ug/NCM; - NO2: 150 ug/NCM uni	Alert - Continue monitoring and investigate possible causes of increase of particulates and gaseous pollutants, determine, and address the root cause Action - Check efficiency and conduct routine preventive maintenance of dust suppression systems - Investigate cause of complaint and determine and address the root cause. - Increase frequency of dust suppression Limit

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			- Quarterly or as required by EMB - Immediate if complaints received			Total sampling cost shall be determined during implementation of the project (Note: Cost P5,000.00 per monitoring station)		- Consider modifications to dust suppression system (i.e., changes to spray nozzle type, upgrade to air-and-water dust suppression system, etc) - Conduct smoke emission tests of vehicles and construction equipment, as necessary - Review traffic management guidelines
				At sampling locations at Malolos, Bocaue, Guiguinto, Valenzuela, Caloocan and Manila, Solis and Tutuban using the same sampling stations of the baseline air quality surveys			Alert; Action POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in	POST-ECC Agreement between DOTC, Contractor, and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30
							Limit SP 24 hr – 230 µ/Ncm PM _{2.5} 24 hr – 75 µ/Ncm PM ₁₀ 24 hr – 150 µ/Ncm SO ₂ 24 hr – 180 µ/Ncm NO ₂ 24 hr – 150 µ/Ncm	
		Dust generation	Method - Visual inspections - Interview with residents of affected barangays and pedestrians Frequency - Daily	- Construction area and storage and/or stockpiles - Access road, dust-generating facilities/ construction yards outside the ROW			Alert - Visually evident dryness Action - Noticeable dust suspension/deposition, and/or presence of haze Limit - Complaint lodged by community	Alert - Continue monitoring and investigate possible causes of increase of particulates and gaseous pollutants, determine, and address the root cause Action - Check efficiency and conduct routine preventive maintenance of dust suppression systems

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Monthly interview and Immediate if complaints received	Sensitive receptors nearby project area				- Investigate cause of complaint and determine and address the root cause. - Increase frequency of dust suppression Limit - Consider modifications to dust suppression system (i.e., changes to spray nozzle type, upgrade to air-and-water dust suppression system, etc) - Conduct smoke emission tests of vehicles and construction equipment, as necessary Review traffic management guidelines
Noise	General construction works produces noise levels that affect the amenity at nearby sensitive receptors Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	Noise level ($L_{Aeq,T}$, dB)	Method - Ocular observation - In-situ measurement using sound meter - Interview with residents of affected barangays Frequency - Daily and Monthly - Immediate In response to complaints or a significant change of construction work methodology: Method 24 hours 1-5 minutes of monitoring for a source producing steady continuous noise levels 5-15 minutes of monitoring for a source producing variable or impulsive noise levels	ANV1, ANV2 and, In and around construction sites, temporary facilities, affected barangays and nearby sensitive receptors including socially ecologically significant area/s (if any) likely to be affected • ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors (e.g. schools, daycare centers) along the ROW impacted by	DOTr PMO and Contractor	Monthly monitoring 200,000 Attended measurements in response to a public complaint (2 hours per month) PHP 55,000	Alert - Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are within 5 dBA of noise criteria outlined in the WBG (EHS) Guidelines: Residential or institutional receptor: Daytime (07:00 - 22:00) 50 dBA/ Night time (22:00 - 07:00) 40 dBA Or background level Whichever is higher. Action - Complaint lodged by community or Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are occasionally above the noise criteria outlined in the WBG (EHS) Guidelines: Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA/ Nighttime (22:00 - 07:00) 45 dBA Or background level +3 dB Whichever is higher.	Alert - Continue monitoring and investigate possible causes of increased noise emissions Action - Investigate and identify cause of complaint and determine suitable noise control in accordance with the approved CNVMP. Limit - Determine suitable noise control in accordance with the approved CNVMP.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency • 24-hour monitoring to occur monthly at most impacted receptors • Monthly at most impacted receptors or immediately in response to complaints or a significant change of construction work methodology is conducted for each event	- the works being undertaken at the time of monitoring • Other sensitive receptors along noise-generating temporary facilities, construction yards and access roads outside the ROW			Limit • Noise monitoring identifies levels (LAeq (1hr), dB) that are continuously above the noise criteria outlined in the WBG (EHS) Guidelines: Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA/ Nighttime (22:00 - 07:00) 45 dBA or background level +3 dB Whichever is higher.	
Vibration	Vibration from construction works causes human disturbance and structural damage to buildings sensitive to vibration	Vibration level VdB (vibration)	Method • Vibration level monitoring using a vibration level meter Frequency • Quarterly • Immediately based on complaints	Residential area including sensitive receptors in the vicinity the construction site	DOTr and Contractor	Total sampling cost shall be determined during implementation of the project (Note: Monitoring cost P10,000.00 per sampling station)	Alert; Action • POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30 Limit • Vibration level VL - 55dB	POST-ECC Agreement between DOTC, Contractor and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30
			Method • Site observation • Interview with residents of affected barangays Frequency • Daily monitoring for continuous works that generate vibration • Monthly interview • Immediate In response to complaints or a significant change of construction work methodology	• In and around construction sites, temporary facilities, • affected barangays including socially ecologically significant area/s (if any)		Quarterly monitoring PHP 70,000 Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.	Alert • Vibration monitoring identifies levels that are higher than 75% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage: 75 VdB (re 10-6 mm/s) Action • Complaint lodged by community or Vibration monitoring identifies levels that are higher than 90% of the vibration criteria outlined	Alert • Continue monitoring and investigate possible causes of increased vibration emissions Action • Investigate and identify cause of complaint and determine suitable vibration control in accordance with the approved CNVMP. Limit - Investigate and identify cause of complaint and determine suitable

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Method • 24-hour monitoring • 1 – 5 minutes of monitoring for a source producing steady continuous vibration levels • 5 – 15 minutes of monitoring for a source producing variable or impulsive vibration levels Frequency • 24 hours to occur quarterly at most impacted receptors • immediately in response to complaints or a significant change of construction work methodology is conducted for each event.	• ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors (e.g. Casitas de Tondo until relocated) along the ROW impacted by the works being undertaken at the time of monitoring • Other sensitive receptors along vibration-generating temporary facilities, construction yards and access roads outside the ROW			in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:90 VdB(re 10-6 mm/s) Limit Vibration monitoring identifies levels that are higher than 95% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:100 VdB(re 10-6 mm/s)	vibration control in accordance with the approved CNVMP.
The People								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on Project: • SDP Implementation • IEC Meetings • Stakeholder Consultations – Public consultations – FGDs – KIIs • Project awareness campaign materials • Information disclosure	Method • Documentation, • recording • report monitoring Frequency • Quarterly, • immediate received complaints	• Impact barangays and relocation sites	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management)	Alert/ Action • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities and through helpdesk Limit • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities	Alert/Action • R Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		-Online -Mass media • GRM					• Negative feedback from participants/ recipients	• Resolve issues, concerns and complaints thru the Helpdesk or GRM • Evaluate the reasons for the low social acceptability rate based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary
Land Acquisition and Utilization and Involuntary Resettlement	Displacement of legal PAPs/ landowners	Status of land acquisition and resettlement: • Land area (m²) acquired • Compensation amount paid for affected land, structures and improvements, households, crops and trees of legal PAFs (amount paid in php) • Legitimate landowners or legal PAPs displaced and assisted for resettlement (no.) • Issue and concern raised	Method • Area measurement, counting and progress reporting Frequency • Monthly until ROW is fully compensated and acquired (in case of court case, until the case closed)	Within and adjacent to SBT Section ROW	DOTr PMO (RIC, LIAC)	RAP Cost	Alert • Grievance to be resolved at the GR Officer Level Action • Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit • RAP-related grievance (appeal to second level decision) to be resolved by the PIAC, as necessary	Alert • Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) • Implement corrective actions as necessary Action • Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) • Implement corrective actions as necessary Limit • Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) • Ensure resolution of complaints/conflicts as soon as possible
	Displacement of eligible ISFs and other non-landowners	Status of acquisition and resettlement/ relocation: • Compensation paid for affected structures and improvements, households, crops and trees if applicable (amount paid in php)	Method • Counting, area measurement, counting and progress reporting Frequency • Monthly until ISFs are all relocated	Within and adjacent to SBT Section ROW, Resettlement site (receiving LGU)				

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Resettlement area completed (unit) - Housing units allocated and reserved for PAFs (no.) - ISFs and non-landowner PAPs displaced and/or relocated (no.) - Other relocation assistance provided						
Local Economy, Employment and Business	Disruption of livelihood, local business and economy	Status of LRIP: - Number of affected persons/persons/households including vulnerable local communities by type of livelihood/income (land based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) - affected household members and business compensated for livelihood (amount in peso and no.) - LRIP training type provided and record of training (no.)	Method - Survey, recording, and progress reporting Frequency - Quarterly until the end of livelihood restoration program	Impacted barangays and LGU and resettlement sites	DOTr PMO (RIC and LIAC)			
		Status of local economy: - Employment rate - Poverty incidence - Business renewal/registration - Capital investment	Method Data gathering in coordination with affected Barangay and LGU Frequency					

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Tax revenue	Quarterly until the end of livelihood restoration program					
Local Employment and Business	Generation of local employment Influx of construction labor (increase of migrants)	Status of employment of PAPs and local communities: - Construction manpower required by job position (no.) - PAPs, Local and non-local manpower hired and their position (no. & percentage) and salary paid - Employees hired by gender and vulnerability (no. & percentage) - Construction camps provided for non-local manpower (no.) - Working environment provided in consideration of gender equality and needs of vulnerable group	Method - Recording and progress reporting Frequency - monthly until the end of construction	SBT Section ROW	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on social (e.g. RAP Budget, Stakeholder Engagement Cost) and HSE management)	Alert 70% of the employees are local residents (based on the skills and capacity) Action 60% of the employees are local residents (based on the skills and capacity) Limit 50 % of the employees are local residents (based on the skills and capacity)	Alert - Increase employability of local residents by undertaking skills training prior to job hiring Action - Investigate the reasons for not meeting the % local resident employment - undertaking skills training prior to job hiring Limit - Investigate the reasons for not meeting the % local resident employment - skills training prior to job hiring
Public Utilities	Disruption in public utility services by relocation	- Affected public utility lines, poles or structures relocated (no.) - Affected households per barangay affected by the relocation of public utilities (no.) - Status of relocation of public utility lines, poles or structures - Extent of disturbance and actions taken	Method - Coordination with the LGU - Interviews with affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity	SBT Section ROW	DOTr PMO and Contractor	Construction Cost / RAP Cost	Alert - Planned power outage or water service interruption due to relocation of facilities Action - Complaints on failure to restore power and water on the given ETR Limit - Complaints on uninformed / unplanned power outage or water service interruption	Alert - Provide advisory to the affected barangays at least 72 hours before the actual time of service interruption and provide estimated time of restoration (ETR) Action - Coordinate with public utility companies to implement contingency measures such as deployment of generator sets and water tankers to affected areas and conduct rationing

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Complaints received during relocation activities					caused by factors that are beyond the control of the public utility companies	- Provide regular updates to the public on electricity and water supply conditions Limit - Coordinate with public utility companies to investigate the cause, assess the damage and necessary repair - Implement contingency measures if the repair or service restoration may take a while
	Increased demand for local resources, resource depletion	- Electricity, fuel and water consumption - Complaint received	Method - Meter readings, utility bills, leaks monitoring - Reporting meetings Frequency - Daily, monthly, annually	Construction sites, yards, camps and offices barangays	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert 1% increase in consumption/ utility expenditures Action 5% increase in consumption/ utility expenditures Limit 10% in consumption/ utility expenditures	Alert - Implement conservation measures and monitor for possible leaks Action - Implement conservation measures and monitor for possible leaks Limit - Conduct calibration testing of utility meters and submeters - If found defective, replace the meters/submeters - Continue implementation of conservation measures
Social Infrastructure	Disruption of social services	- Affected public social/ community facilities relocated (no. and location) - Status of relocations - Extent of disturbance and action taken - Complaint received	Method - Coordination with the LGU - Interviews to affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity Frequency	SBT Section ROW	DOTr PMO and Contractor	RAP Cost	Alert - Grievance to be resolved at the GR Officer Level - Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department Limit - RAP-related grievance (appeal to second level decision) to be	Alert - Follow RAP GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) - Implement corrective actions as necessary Action - Follow RAP GRM Level 2 Procedure (DOTr TWC or Legal Department) - Implement corrective actions as necessary Limit

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							resolved by the PIAC, as necessary	- Follow RAP GRM Level 2 Procedure (Item#7-b: PIAC) - Ensure resolution of complaints/conflicts as soon as possible
Cultural Heritage	Damage / destruction of physical cultural and archaeological resources	Status of relocation of Casas de Tondo based on agreements with CAs and PNR	Method - Progress reporting and meetings with CAs and PNR Frequency - Quarterly	The existing site of Casita de Tondo and its relocation site (NSCR Project Tutuban Station)	DOTr PMO and Contractor	Contractor's Service Cost	Any significant change in the relocation of the Casas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures to be incorporated to the CMP
		Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method - Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency - Monthly	Historical structures and buildings adjacent or close to the location of project temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Exceeded FTA standard for vibration	Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
		Accidental finds encountered during construction	Method - Documentation and reporting to CAs Frequency - During excavation activities especially at pile cap sites	Within the SBT Section ROW and temporary facilities (excavation/ pile cap sites)	DOTr PMO and Contractor	Contractor's Service Cost	Any accidental finds encountered	- Follow the procedure for archaeological watch or artifacts and archaeological remains chance finds to be agreed with and approved by CAs including but not limited to the following: - Secure the area of concern and report to the concerned CA (e.g. NM) any accidental finds upon the advice of the archaeologist - Immediately cease all earthmoving activities subject to the assessment of CA - Closely coordinate with CAs on the appropriate course of action in protecting the archaeological find

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								Continue construction activities if no cease and desist order is issued
Occupational and Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - monthly - Immediately in case of accidents Immediately upon receipt of complain	Affected barangays	DOTr PMO and Contractor in coordination with LGU	Construction Cost (Contractor's service fee on HSE management)	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Working Environment Measurement (WEM) Compliance with DOLE OSH Standards	Method - BWC-OSHC/ NIOSH method Frequency - Quarterly throughout construction phase	SBT Section ROW including sites of temporary facilities and construction yards	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Parameters for good working conditions are near DOLE OSH limits Action - Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit - Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive audits	Alert - Implement corrective actions - Review maintenance and housekeeping activities and revise as needed Action - Implement corrective actions - Conduct internal audit and monitoring after implementation Limit - Conduct third-party (external) audit of working environments - Update/Improve working environment
	Construction-related accidents	Status of accident involving communities	Method Survey occurrence of accidents with local communities	Affected barangays	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on	Alert HSE-related grievance to be resolved by N1 Frontliners	Alert Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk)

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Construction-related accident/s involving communities (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	- monitoring - Coordination with LGU officials and police - Interview with affected communities Frequency - Daily or Immediately in case of accidents			HSE management)	(PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		- Status of accident involving workers - Construction-related accidents among the workers (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Occurrence of accidents related construction work - Monitoring - Documentation Frequency - Daily or immediately in case of accidents	SBT ROW / construction site and sites of temporary facilities, construction yards and access roads	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert/Action - External HSE Audit findings Limit - Unresolved External HSE Audit findings	Alert - Conduct safety re-training for workers involved in accident Action - Conduct departmental re-training of the workers on health safety rules and regulation Limit - Inspect the area where most accidents happen - Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations
	Transmission of communicable diseases	Status of affected communities - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contacts of confirmed	Method - Survey trend of epidemic disease - Barangay health records - Interviews Frequency - Daily - Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on HSE management)	Alert - case counts are low but increasing Action - case counts are high and/or increasing Limit - case counts are high and/or increasing and area declared as critical zone	Alert/Action - Require workers and employees to conduct self-health check prior to going onsite - Require workers and employees with symptoms of a communicable disease to consult a doctor and stay home/ work from home - Strictly implement minimum public health standards (PPE use, social distancing)

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		case among the workforce (no.)						- Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP Limit - Temporarily suspend construction activities and require workers and employees for testing - Require workers and employees who tested positive and their close contacts as well as those with symptoms of a communicable disease to consult a doctor, isolate and take quarantine - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
		Status among the workers: - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Interview and health records of workers - Health check of workers Frequency - Daily or Immediately in case of confirmed cases	SBT Section ROW	DOTr PMO and Contractor in coordination with the LGU	Construction Cost (Contractor's service fee on HSE management) Construction Cost (Contractor's service fee on HSE management)	Alert 5% of workers experience symptoms of disease Action 10% workers are infected with disease Limit 15% of workers are infected with disease	Alert - Assess if illness is work-related; - conduct interview of sick employees and assess health condition by medical health doctor Action - Implement site-wide investigation of cause - Conduct IEC campaign for illness prevention - Monitor health conditions by medical doctor Limit - Implement site-wide investigation of cause,

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- isolate cases and prevent spread of illness; - Conduct IEC campaign for illness prevention - Continue monitoring by health doctor
	Nuisance to onsite construction workers and communities to construction noise and vibration and dust generation	- implementation and effectivity of PPE during workhours - health condition of workers	Method - inspection, strict reinforcement and maintenance of PPE - Noise and vibration, air quality sampling/ measurement - Regular health check Frequency - Daily, monthly, immediately upon receipt of complaint or in case of any symptom	Within construction areas Sensitive receptors	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Health problems reported by employees and workers on-site, or reported damaged PPE Action - Verbal or non-verbal complaints filed by employees and/or workers Limit - Multiple complaints filed by employees and workers on-site, and if the permissible noise levels, as suggested by DOLE, exceeded the limits.	Alert - Determine equipment, machines, or activities that caused the complaints Action - Coordinate with construction employees to address the root cause, or; coordinate with a health institution for necessary medical check-up Limit - Conduct maintenance of construction equipment or machineries or use equipment that produce lesser noise. - Schedule strategically shifts to integrate the permissible noise level exposure in the safety of the workers. - Conduct inspection and maintenance of PPE, and repair of damages (if repairable). - Implement strict wearing of PPE on-site. - Record equipment that produce harmful noise levels, and keeping its nearby area off-limits to workers
Public Access and Traffic Management	Restrictions to public access	- Public access closed (no.) - Public access for temporary closure and permanent closure (no. and location)	Method - Record of complaints Frequency - Immediately	SBT Section ROW Public access (roads and pedestrian access) temporarily and permanently closed	DOTr PMO and Contractor	Construction Cost (Contractor's service fee on HSE management)	Alert - Temporary closure of public access for 3 months or more Action - Temporary closure of public access throughout construction Limit	Alert/Action - Inform/ Coordinate with affected barangays and residents - Provide alternate public access - Update Public Access and Traffic Management Plan (PATMP) Limit

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Barangays affected by public access restriction (no.) - Public access and traffic-related complaints from the community (no.)		Existing and temporary access roads utilized for the Project			Permanent closure of public access	- Update Public Access and Traffic Management Plan (PATMP) in consultation/coordination with the LGU, affected barangays and residents - Compensate displaced families and businesses due to landlock or provision of access road or required setback
	Traffic congestion	Observed road traffic condition in public access roads within 200 m from the SBT ROW during incoming or outgoing trips: - Travel distance from origin to destination - Travel time from origin to destination - Roads with heavy traffic within 200 m from SBT Section - Number of hours, days that road is restricted/ closed. - Public access and traffic-related complaints from the community (no.)	Method - Survey traffic volume - Actual traffic observation and documentation Frequency - Weekly monitoring of traffic condition	Main intersection near construction area and temporary facilities Existing and temporary access roads utilized for the Project	DOTr PMO and Contractor	c Cost (Contractor's service fee on HSE management)	Alert - Grievance to be resolved at the GR Officer Level - Five (5) valid complaints per month Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department - Ten (10) valid complaints per month Limit - Grievance to be resolved by the DOTr PMO, as necessary - Fifteen (15) valid complaints per month	Alert - Resolve complaints based on GRM Action - Resolve complaints based on GRM - Review effectivity of PATMP and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update PATMP
OPERATION PHASE								
The Land								
Soil contamination	Soil contamination due to generation of solid wastes	Status of solid waste management: - Volume of solid wastes generated and collected - Condition of solid waste collection and storage	Method Visual observation, reporting, and meeting with Contractors; Audit of subcontractor Frequency	SBT Section ROW including railway tracks and TSS-1 compound (including temporary onsite storage/ disposal facility/ area)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert At least two non-compliances that have not been closed out after one succeeding audit Action	Alert Engage lead person and discuss non-compliances and corresponding action items to address them Action

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		area (segregation, collection, packaging) • Disposal method (including transport) and management of solid wastes against the approved Solid Waste Management Plan (SWMP)	• Daily • Twice a week visual observation, monthly reporting and meeting; Regular audits (e.g., quarterly or semi-annually)				• At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits	• Investigate the root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Land and water contamination; aesthetic impacts; spread of diseases	Proper waste management and disposal	Method • Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances Frequency • Weekly	All 10 Stations			N.A	N.A
	Soil contamination due to accidental spills of oil, lubricants or other chemicals, generation of hazardous wastes and handling of contaminated ballasts	• Management of chemicals and hazardous substances/ wastes against the approved WMP and SPERMP - Stock inventory - Waste chemicals/ hazardous wastes generated - Handling of hazardous wastes (storage, treatment) - Hazardous waste disposal method	Method • Visual observation and reporting • Inspection of Vehicle, Equipment Parking, Storage Areas, generator set area for visible signs of leak, inspection of spill clean-up logs and audit of actions taken • Composite sampling Frequency • Weekly or as needed. Presence of hydrocarbon staining on the surface soil should be reported	SBT Section ROW including railway tracks and TSS-1 compound (including temporary onsite storage/ disposal facility/ area)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • At least two findings that have not been closed out after one succeeding inspection Action • At least two findings that have not been closed out after two succeeding inspections Limit • At least two findings that have not been closed out after three succeeding inspections	Alert • Engage lead person and discuss non-compliances and corresponding action items to address them Action • Investigate root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Physical soil condition (e.g., presence of hydrocarbon staining-dark stains, presence of rainbow or sheen)	immediately in order to determine the source and/or prevent further contamination into the subsurface soil - Regular inspections (e.g., quarterly or semi-annually) - Immediately in case of accidental spill until regular sampling until fully detoxified)					
Soil Contamination	Health impacts to workers / communities due to exposure to arsenic and other heavy metals	- Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb, - Other parameters may be measured as needed	Method - Composite sampling for surface layer and subsurface layer (0.5 m) Frequency - Semi-annual, - immediately (in case of spill)	SS01, SS02 and other potentially contaminated sites within SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Visible staining in soil Action - Soil laboratory results exceed USEPA RSL (> 3.0 mg/kg) – to be agreed with DENR-EMB Limit - At least 25 m³ of soil exceeded DIV (> 76 mg/kg) – to be agreed with DENR-EMB	Alert - Soil sampling - Take soil samples and verify arsenic concentration through laboratory analysis Action - Soil exposure management - Implement Contact Management Plan Limit - Site Assessment/ Remediation - A risk-based approach in the management of potentially contaminated site is recommended - If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
Terrestrial Vegetation and Wildlife	Increase biodiversity due to retention/ provision of urban green spaces along the Project alignment ROW	For relocated earth-balled trees: survival rate and growth rate, mortality rate, Provision of corresponding number of tree seedlings For out-planted seedlings used to replace earth-balled and/or cut trees: survival	Method - Periodic (Measurement) - Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) - Transect survey of full length of SBT line	Planting sites within the SBT Section ROW and replanted sites	DOTr Concessionaire/ Operator	PHP 300,000.00	Alert 10% mortality on seedlings - Mortality of at least 3 individuals of endemic plants balled-out individuals. Action	Alert - Replace seedlings and relocated plants that did not survive. - Conduct visual observations and interviews of locals to determine potential causes of mortality

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		rate and growth rate, mortality rate, provision of corresponding number of tree seedlings For monitoring of improvement in ecology : vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.	conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency • Semi-annual				• 20% mortality on seedlings • Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out individuals. Limit • 30% mortality on out-planted seedlings • Mortality of endemics and threatened plant species balled-out individuals.	• Expand list of native species through screening (by allowing them to grow) that are more adaptable to the site. Action • Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site. • Conduct a detailed soil nutrient analysis • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Make necessary adjustment based on result of soil nutrient analysis and investigation Limit • Replace seedlings and relocated plants that did not survive using species more adaptable to the site. • Consider other sites. • Review and revise relocation and revegetation plan to improve plant survival.
	Nara trees along the alignment from Caloocan to Tutuban and at the Valenzuela depot site might be affected and removed during the clearing operation. Other trees such as fruit bearing trees	Number of trees surviving	Method • Tree count Frequency • Bi-annual,	Tree planting site designated by DENR Region III and NCR		P20,000.00	Alert; Action • POST-ECC Agreement between DOTC, Contractor and EMBA as indicated in Annex 2-20 of the RPM for DAO 2003-30 Limit • 85-90% survival rate of the trees planted as prescribed	POST-ECC Agreement between DOTC, Contractor, DENR-EMB Region III and NCR

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	along the alignment will be removed						by the DENR-EMB Region III and NCR Mortality of endemics and threatened plant species balled-out individuals.	
Development of Depot site	Loss of habitat for migratory and resident birds	Restoration status of replacement site, seasonal bird count	Method - Ocular survey Frequency - Quarterly	Adjacent offset wetland of the Valenzuela depot	DOTC PMO, The Society for the Conservation of Philippine Wetlands (SCPW)	To be detained in preparation of Restoration Plan. (Note: monitoring cost is P20,000.00)	Alert; Action - POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30 Limit - N.A.	Alert; Action; Limit POST-ECC Agreement between DOTC and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30
Geologic Hazards	Ground subsidence	Level of ground subsidence/ change in ground level	Method - Visual observation / inspection, - Level survey as needed Frequency - Monthly visual observation - Semi-quarterly level survey or as needed	Railway structures and facilities	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - After any ground shaking event Action - Visually observed subsidence or minor damage to above ground structures Limit - Verified occurrence of subsidence and damage	Alert - Investigate possible damage due to event Action - Implement corrective actions as necessary if the observed subsidence poses threat to the workers and riders and nearby communities Limit - Implement corrective actions as necessary if the observed subsidence poses threat to the workers and riders and nearby communities
			Method - Visual observation - Level survey Frequency - Quarterly level survey	Valenzuela Depot	PCO of the Contractor and DOTC PMO	To be included in engineering cost	N.A.	N.A.
The Water								

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SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
Surface Water Quality	Contamination of waterways with pollutant transfer from contaminated ballasts	Status of Surface water quality: Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, fecal coliform, Ammonia, Chloride, Cyanide, Phenols, Surfactants (MBAS) - Trace metals (As, Cu, Cd, Cr⁶⁺, Pb, Hg) - Other parameters may be measured as needed such as at the event of accidental spill	Method - For temperature, pH and DO – in-situ measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform - Other parameters may be sampled as needed	WQ1, WQ2 and other established discharge points along SBT Section	DOTr Concessionaire/ Operator with third party sampling firm	Operation and Maintenance Cost Estimated cost of laboratory fees = PHP 40,000 annually (or PHP 10,000 per quarter)	Alert 75% of DENR limit Action 85% of DENR limit Limit - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	Alert - Check and monitor the performance of the sediment control equipment/ facilities installed. Check equipment, operation activities, or facilities considered as source of leakage for inspection and maintenance. Action - Investigate if changes in water quality is attributable to the operation activities. - Once identified and verified to be part of the project activities, apply mitigating measures to stop/attenuate the water quality changes observed. Limit - Investigate if changes in water quality is attributable to the operation activities. - Identify main sources of pollution, leaks, or any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed
		pH, Oil & Grease, BOD, Total Coliform, and TSS	Method - DAO35 S.90 Revised Effluent Regulations of 1990 Frequency - Monthly	Effluent of wastewater treatment plant in Valenzuela Depot			Alert; Action - N.A. Limit Effluent standards of inland waters. For Class “C” freshwater - pH – 6.5 to 9.0 - Oil & Grease – 5.0 mg/L - BOD – 50 mg/L - TSS –70 mg/L	N.A.

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							Total Coliform – 10,000 MPN/100 ml	
	Contamination of waterways due to accidental spills of oil, lubricants, or other chemicals, and generation of hazardous wastes	- pH, TSS, BOD, color, and oil and grease - Other parameters may be measured as needed by type of spill	Method Visual inspection drainage leading to Antipolo creek. - For, pH– <i>in-situ</i> measurements using multi parameter water quality meter. - For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency - For visual inspection -- weekly, as needed, or during maintenance activities - For water quality monitoring – quarterly	WQ1, WQ2 and other established discharge points along SBT Section	DOTr Concessionaire/ Operator	Operation and Maintenance Cost Estimated cost of laboratory fees = PHP 40,000.00 annually (or PHP 10,000.00 per quarter)	Alert - Observed presence of oil films and concentrated flows from TSS-1 drainage to Antipolo Creek - Or 75% of DENR limit Action - Reported incident of spills or leaks. Visually evident oil films at drainage to Antipolo Creek - Or 85% of DENR limit - Complaints from the nearby communities due to water pollution attributable to the operation of TSS-1 Limit - Reported incident of spills or leaks. Visually evident oil films at drainage to Antipolo Creek - For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	Alert - Investigate if observed changes in visual appearance or water quality is attributed to maintenance activities - If attributable to the maintenance activities, engage responsible party and discuss non-compliances and corresponding action items to address them Action - Investigate the root-cause of the reported leak or spill - Apply mitigating measures to stop/attenuate the water quality changes observed - Respond to complaint through the Project's Grievance Redress Mechanism Limit - Investigate the root-cause of the reported leak or spill - Apply mitigating measures to stop/attenuate the water quality changes observed
Maintenance activities in the railway stations and depot Domestic wastewater sensation	Pollution of receiving water bodies	pH, Oil & Grease, BOD, Total Coliform, and TSS	Method - DAO35 S.90 Revised Effluent Regulations of 1990 Frequency - Monthly	Effluent of wastewater treatment plant in Valenzuela Depot	DOTr PMO	Total sampling cost shall be determined during implementation of the project (Note: P20,000.00)	Alert; Action N.A. Limit Effluent standards of inland waters. For Class "C" freshwater pH – 6.5 to 9.0	N.A.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
						sampling cost per sampling site)	Oil & Grease – 5.0 mg/L BOD – 50 mg/L TSS –70 mg/L Total Coliform – 10,000 MPN/100 ml	
Hydrology	Flooding	- Record of stream flow and water level - Visible signs of clogged cross drainage structure) - Reports of complaints related to flooding from nearby communities	Method - Ocular inspection and observation - Records on help/assistance desk - Check PAGASA weather bulletin Frequency - Daily during rainy season - Immediate in case of weather warning.	South Antipolo Canal and drainage within project area particularly in TSS-1	DOTr Concessionaire/Operator in coordination with LGU/PAGASA	Operation and Maintenance Cost	Alert - Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action - Occurrence of 10cm to 30 cm flooding not subsiding after rainfall event Limit - Occurrence of more than 30cm flooding not subsiding after rainfall event	Alert - Investigate and check drainage clearance Action - Investigate and clear drainage system Limit - If possible, conduct clearing or install new drainage system or pump out water
The Air								
Air Quality	Air pollution due to emissions of particulate and gaseous pollutants	- Particulate Pollutants: TSP, PM10, PM2.5 - Gaseous Pollutants: SO2, NO2,	Method 24-hour monitoring for: - TSP – High volume, Gravimetric - PM10 – high volume with PM10 inlet, Gravimetric - PM2.5 – High volume with PM2.5 inlet, Gravimetric - SO2 – Gas bubbler, Colorimetric Pararosaniline - NO2 – Gas bubbler, Griess Saltzman Reaction Frequency - Quarterly or as required by EMB	ANV1, ANV2 and/or other established sampling stations	DOTr Concessionaire/Operator	Operation and Maintenance Cost	Alert 75% of DENR Limit Action 85% of DENR Limit Limit - TSP: 230 ug/NCM; - PM10: 150 ug/NCM; - PM2.5: 50 ug/NCM; - SO2: 180 ug/NCM; - NO2: 150 ug/NCM	Alert - Continue monitoring and investigate possible causes of increase of point source emissions Action - Check efficiency of pollution control devices and conduct routine preventive maintenance until pollutant concentrations are down to acceptable levels. Limit - Check efficiency of pollution control devices and conduct routine preventive maintenance until pollutant concentrations are down to acceptable levels.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								• Implement corrective actions as necessary
Noise	The operation of the rail corridor causes an increase in noise affecting amenity at nearby sensitive receptors and/or an exceedance of criteria The operation of TSS-1 causes an increase in noise affecting amenity at nearby sensitive receptors	Noise level $L_{Aeq,T}$, dB	Method • 24 hours of continuous monitoring. • Observations should be undertaken during monitoring to determine the accuracy of the measurements Frequency • Monitoring should be undertaken to confirm compliance with the project requirements within six months of commissioning	ANV1, ANV2 and other established sampling locations closest to sensitive receptors potentially impacted by the new rail corridor.	DOTr Concessionaire/Operator	Operation and Maintenance Cost	Alert • Noise monitoring identifies isolated incidents where levels are 5 dB below the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 60$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 65$ dB(A). Action • Noise monitoring identifies isolated incidents where levels are higher than the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 65$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 70$ dB(A). Limit • Noise monitoring identifies multiple incidents where levels are higher than the criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual. • Category 2 (residential): $L_{dn} = 65$ dB(A) • Category 3 (institutional): $L_{eq}, 1hr = 70$ dB(A).	Alert • Continue monitoring and confirm compliance with criteria. Action • Investigate and identify cause and determine if suitable noise controls can be implemented Limit • Implement site mitigation measures to manage continuous exceedances above criteria
Operation of Trains	Occurrence of higher noise level	Noise level	Method	Noise sensitive receptors within 50	DOTr PMO		Alert; Action	N.A

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			- Noise Level monitoring using a noise level meter Frequency - Quarterly - Immediately based on complaint	m distance from the alignment			N.A. Limit Daytime: 60 LAeq. Night: 55 LAeq. For sensitive receptors night: 50 LAeq.	
	Vibration causing human disturbance at sensitive receptors generated by the project operation Vibration generated by TSS-1 causes human disturbance at close sensitive receptors	Vibration level VdB (vibration)	Method 24 hours of continuous monitoring. - Observations should be undertaken during monitoring to determine the accuracy of the measurements Frequency - Monitoring should be undertaken to confirm compliance with the US FTA manual within six months of commissioning	A minimum of four vibration monitoring locations (may include ANV1 and ANV2) at closest sensitive receptors potentially impacted by the new rail corridor.	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Vibration monitoring identifies vibration levels that are higher than 90% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 65 VdB (re 10-6 mm/s) Action - Vibration monitoring identifies isolated incidents where vibration levels are higher than the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 72 VdB(re 10-6 mm/s) Limit - Vibration monitoring identifies multiple occasions where vibration levels are higher than the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for human disturbance: 72 VdB (re 10-6 mm/s)	Alert - Continue monitoring and investigate possible causes of elevated vibration levels Action - Investigate and identify cause and determine if suitable vibration controls can be implemented Limit - Implement site mitigation measures to manage continuous exceedances above criteria

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
The People								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on: • SDP Implementation • IEC Meetings • Stakeholder Consultations –Public consultations –FGDs –KILs • Project awareness campaign materials • Information disclosure • Online • Mass media	Method • Documentation, recording and report monitoring Frequency • Semiannually	Impact barangays and relocation sites	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • 10% negative feedback from participants/ recipients Action • 20% negative feedback from participants/ recipients Limit • 30% negative feedback from participants/ recipients	Alert • Resolve complaints based on GRM • Review implementation of SDP and revise as needed Action • Resolve complaints based on GRM • Review implementation of SDP and revise as needed • Re-conduct SDP workshop Limit • Review implementation of SDP and revise as needed in coordination with LGU and relevant agencies • Implement corrective actions as necessary
Local economy, employment and business	Maintained and/or Improved living and livelihood conditions of PAPs)	Status of LRIP: • Number of affected persons persons/households including vulnerable local communities by type of livelihood/income (land based, businesses based, enterprise etc.) in and around the Project area and their livelihood status (amount in peso and no.) • affected household members and business compensated for livelihood (amount in peso and no.)	Method • Social Survey, recording, and progress reporting Frequency Semiannually until the end of monitoring period agreed with DENR and JICA	Impact barangays and relocation sites	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • 10% reduction in livelihood/ decrease in income Action • 20% reduction in livelihood/ decrease in income Limit • 30% loss of livelihood/ decrease in income	Alert • Review implementation of LRIP, SDP and revise as needed Action • Review implementation of LRIP, SDP and revise as needed • Re-conduct relevant workshops Limit • Review implementation of LRIP, SDP and revise as needed in coordination with LGU and relevant agencies • Implement corrective actions as necessary

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		• LRIP training type provided and record of training (no.)						
Local economy, employment and business	Generation of local employment and business opportunities	• Composition of workforce • Operation manpower required (no.) - Local and non-local manpower hired (no. & percentage) - Female and male employees hired (no. & percentage) - Members of the manpower from vulnerable group members (no.) • Status of LRIP - Eligible PAPs assisted in finding new location for business and in availing of soft loans; - Businesses who are to be relocated and PAPs with movable business asset provide with transportation allowance and/or assistance; - Vulnerable households assisted in re-establishing their livelihood in the relocation site; and - Eligible PAPs/businesses losing income during	Method • Recording and progress reporting Frequency • semi-annually until the end of monitoring period agreed with DENR and JICA	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • 60% of the employees are local residents (based on the skills and capacity) Action • 55% of the employees are local residents (based on the skills and capacity) Limit • 50 % of the employees are local residents (based on the skills and capacity)	Alert • Increase employability of local residents by undertaking skills training prior to job hiring Action / Limit • Investigate the reasons for not meeting the % local resident employment undertaking skills training prior to job hiring

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		transition period (not exceeding 6 months) provided income loss compensation						
		• Status of local economy: • Employment rate • Poverty incidence • Business renewal/registration • Capital investment • Tax revenue	Method • Recording and progress reporting Frequency • semi-annually until the end of monitoring period agreed with DENR and JICA	Affected barangay and LGU				
Cultural Heritage	Damage / destruction of physical cultural and archaeological resources	Status of relocation of Casitas de Tondo based on agreements with CAs and PNR	Method • Progress reporting and meetings with CAs and PNR Frequency • semi-annually	The relocation site (NSCR Project Tutuban Station)	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Any significant change in the relocation of the Casitas de Tondo	Report to the CAs and PNR and agree on immediate corrective actions and additional measures during operation
		Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method • Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency • semi-annually	Historical structures and buildings adjacent or close to the location of project with significant vibration source	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Limit • Exceeded FTA standard for vibration	Limit • Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
Occupational and Community Health and Safety	Threats to occupational health and safety (General)	Health, safety and environmental (HSE) • Complaints received • Action status against complaints, accidents	Method • Review of GRM implementation record • Review of records of operation-related accidents (inc. incidents, near-misses)	Affected barangays	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action	Alert • Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action • Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA)

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			- Interviews with LGUs, stakeholder representatives, and employees Frequency - Semi-annually - Immediately in case of accidents Immediately upon receipt of complain				- HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Limit Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)
		Working Environment Measurement (WEM) Compliance with DOLE OSH Standards	Method - BWC-OSHC/ NIOSH method Frequency - Semi-annually	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Parameters for good working conditions are near DOLE OSH limits Action - Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit - Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive quarters	Alert - Implement corrective actions - Review maintenance and housekeeping activities and revise as needed Action - Implement corrective actions - Conduct internal audit and monitoring after implementation Limit - Conduct third-party (external) audit of working environments
	Operation-related accidents	Accidents involving railway (including accidents at TSS-1) employees and passengers (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Record of operation-related accidents (inc. incidents, near-misses) Frequency - Quarterly or immediately in case of accidents	SBT Section including TSS-1	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - Internal Audit findings Action - External or Third-Party Audit findings Limit - Unresolved external Audit findings	Alert - Investigate accident and prepare/improve prevention plan - For railway employees: Safety re-training for workers involved in accident Action - Investigate accident and review effectiveness of prevention plan and revise as needed - For railway employees: Conduct departmental re-training of the workers on health safety rules and regulation

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								Limit - Implement corrective actions as necessary - Coordinate with LGU and relevant agencies to implement accident prevention plan - For railway employees: Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations
	Threat to public health and safety due to transmission of communicable diseases	Status among railway passengers and communities - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Barangay health records Frequency - Monthly - daily in case of outbreak - Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert - case counts are low but increasing Action - case counts are high and/or increasing Limit - case counts are high and/or increasing and area routes of the railway are declared as critical zones or high risk areas	Alert/Action - Limit the passenger capacity of the train - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP Limit - Temporarily suspend railway operations and provide safe alternative means of transportation for healthcare / essential workers - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
	Threat to occupational (workers) health and safety to	Status among the workers: Confirmed cases (no.)	Method Survey trend of epidemic disease	• SBT Section ROW	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert 5% of employees experience symptoms of disease	Alert Assess if illness is work-related;

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	transmission of communicable diseases	• Undergoing treatment (no.) • Recovered (no.) • Deaths (no.) • Close contacts of confirmed case among the workforce (no.)	• Barangay health records Frequency • Monthly • daily in case of outbreak • Immediately in case of confirmed cases				Action • 10% employees are infected with disease Limit • 15% of employees are infected with disease	• conduct interview of sick employees and assess health condition by medical health doctor Action • Implement site-wide investigation of cause • Conduct IEC campaign for illness prevention • Monitor health conditions by medical doctor Limit • Implement site-wide investigation of cause, • isolate cases and prevent spread of illness; • Conduct IEC campaign for illness prevention • Continue monitoring by health doctor
	Nuisance from dust, noise and vibration	• Operational railway noise and vibration level • Complaints from sensitive receptors	Method • Noise and vibration monitoring • GRM/ Recording/ Tracking of complaints Frequency • Quarterly or as required by EMB • immediately upon receipt of complaint or in case of any symptom	Co-located with air quality monitoring stations (ANV1, ANV2 and other established sampling station Sensitive receptors	DOTr Concessionaire/ Operator	Operation and Maintenance Cost	Alert • Negative feedback from surrounding residential and commercial areas. Action • Formal complaints filed by surrounding residential and commercial areas. Limit • Multiple complains filed by nearby residential and commercial areas, or by Contractor/ss and employees.	Alert • Investigate the extent of the damages, and the root cause of the complaint. Action • Coordinate with the LGUs and relevant stakeholders to properly address the issue. Limit • Update the affected surrounding communities about the actions done to address their complaints through written statements and assemblies. • Conduct necessary health programs for vulnerable groups, and massive public information about mitigation measures to avoid damages caused by elevated noise levels.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- Continue monitoring and documentation of complaints from residents to assess extent and gravity of disturbance. - Continue ambient noise level and vibration monitoring
Traffic Management	Traffic congestion	Traffic-related complaints from the residents and communities surrounding the SBT Section (no.)	Method - Record of traffic-related complaints against the project (physical or online feedback/help desk) Frequency - Monthly	Main intersection near SBT Section ROW	DOTr Concessionaire/Operator	Operation and Maintenance Cost	Alert - Five (5) valid complaints per month Action - Ten (10) valid complaints per month Limit - Fifteen (15) valid complaints per month	Alert - Resolve complaints based on GRM Action - Resolve complaints based on GRM - Review effectivity of Traffic Management Plan (TMP) and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update TMP
ABANDONMENT PHASE								
The Land								
Soil Quality and Contamination	Soil erosion and contamination due to debris or spoils	Occurrence of soil erosion	Method - Ocular inspection - reporting, - meeting with Contractor/s Frequency - Daily visual inspection - Monthly reporting and meeting or as needed	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Alert - noticeable soil erosion in active sites Action - Increased occurrence of soil erosion in active sites Limit - Excessive soil erosion in active sites and immediate vicinity	Alert - Investigate and report the areas with occurrence of soil erosion. Action - Investigate and report the areas with increased occurrence of soil erosion. Identify the cause of soil erosion and improve control measures. Limit - Investigate and report the areas with excessive soil erosion. Identify the

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								cause of soil erosion and fortify control measures and barriers.
	Soil contamination due to accidental spills of oil, lubricants or other chemicals	Visible soil staining	Method - Visual and odor observation/ immediate reporting of accidental spills and inspection of work site Frequency - Twice a week to daily	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Hydrocarbon staining or nauseating odor, reported spills/ leaks from the workers and community	- Isolate the work site, stop/contain any release followed by immediate clean up and dispose the contaminated soil in accordance HWMP, SPMP, SCMP and Contact Management Plan - Report to the local authority for appropriate response such as measuring the extent of contamination and evaluation for detoxification activities
		- Heavy metal levels: As, Ba, Cr (VI), Hg, Se, Pb - Other parameters may be measured as needed	Method - Composite sampling Frequency - Quarterly - Immediately in case of accidental spill	SBT Section/ Demolition area	DOTr and Contractor	Abandonment Cost	Alert Visible soil staining/ reported accidental spill Action - Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit - Soil laboratory results exceed DIV – to be agreed with DENR-EMB	Alert - Conduct soil sampling and verify heavy metal concentration through laboratory analysis Action - Conduct soil exposure management - Implement Contact Management Plan Limit - Conduct Site Assessment and Remediation - A risk-based approach in the management of potentially contaminated site is recommended - If risks such as direct contact to sensitive receptors, impact to surface water or groundwater is present at the site, urgent remediation is required.
	Soil contamination due to generation of solid wastes	Management of solid wastes against the approved Solid Waste Management Plan (SWMP) Status of solid waste generation and collection:	Method - Ocular inspection - Regular reporting, and meeting with Contractor/s Frequency - Daily visual inspection	Demolition area, disposal site and sites of temporary facilities	DOTr PMO and Contractor	Abandonment Cost	Alert At least two non-compliances that have not been closed out after one succeeding audits Action	Alert Engage lead person and discuss non-compliances and corresponding action items to address them Action

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		• Solid wastes generated (cu.m.) • Solid wastes collected (cu.m.) • Solid waste storage and collection • Solid waste disposal method (transport and disposal)	• Monthly reporting and • Quarterly or semi-annually Regular audits				• At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits	• Investigate the root-cause of non-compliances and sanction involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward
	Soil contamination due to accidental spills of oil, lubricants or other chemicals, generation of hazardous wastes	Management of chemicals and hazardous substances/ wastes against the approved Hazardous Waste Management Plan (HWMP) and Spills Prevention and Management and Emergency Response Plan (SPMERP) • Stock inventory • Waste chemicals/ hazardous wastes generated • Handling of hazardous wastes (storage, treatment) • Hazardous waste disposal method • Physical soil condition (e.g., presence of hydrocarbon staining) • Fuel condition of demolition heavy equipment and other machineries	Method • Visual and odor observation, reporting, and meeting with Contractors; Inspection of fuel storage sites, hazardous materials storage, generator set area for visible signs of leakage along with general inspection of work sites, inspection of spill clean-up logs and audit of actions taken • Composite sampling Frequency • Daily to Twice a week visual observation, • Monthly reporting and meeting; Regular inspections (e.g., quarterly or semi-annually) • Immediately in case of accidental spill until regular sampling until fully detoxified	Demolition area, disposal site and sites of temporary facilities	DOTr and Contractor	Abandonment Cost	Alert • At least two non-compliances that have not been closed out after one succeeding audits Action • At least two non-compliances that have not been closed out after two succeeding audits Limit • At least two non-compliances that have not been closed out after three succeeding audits • excavated soil is considered as hazardous waste as per DAO 2013-22	Alert • Engage lead person and discuss non-compliances and corresponding action items to address them Action • Investigate the root-cause of non-compliances and sanction the involved parties as necessary; Implement corrective actions and way forward Limit • Investigate root-cause of non-compliances and provide heavier sanctions to involved parties as necessary; Implement corrective actions and way forward

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Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Health impacts to workers / communities due to exposure to arsenic and other heavy metals	Heavy metal levels in surplus soil: As, Ba, Cr (VI), Hg, Se, Pb Other parameters may be measured as needed	Method - Visual and odor observation - Toxicity Characteristic Leaching Procedure (TCLP) Frequency - Daily - Monthly until fully detoxified.	- SS01, SS02 (especially areas that exceeded soil contamination standards during baseline sampling (e.g. SS02 for As)) - demolition area and disposal site (including sites of temporary facilities)	DOTr PMO and Contractor	Abandonment Cost	Alert - Visible staining in soil - Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action - Soil laboratory results exceed USEPA RSL – to be agreed with DENR-EMB Limit - Cd, Pb, Cr (VI), As: 5 mg/L; - Hg: 0.2 mg/L; Se: 1 mg/L; - F and B – no standard – to be agreed with DENR-EMB	Alert - Soil sampling - Take soil samples and verify arsenic concentration through laboratory analysis - Post ECC Agreement between DOTr, Contractor/s, and DENR – EMB Action - Soil exposure management - Implement Contact Management Plan Limit - Conduct Site Assessment and Remediation - A risk-based approach in the management of potentially contaminated site is recommended - If excavated soil is considered as hazardous waste as per DAO 2013-22, soil should be treated/disposed of by accredited TSD facility
Terrestrial Vegetation and Wildlife	- Vegetation removal and habitat loss - Threat to existence and/or loss of important local species - Threat to abundance, frequency, and distribution of important species	For relocated earth-balled trees: survival rate and growth rate, mortality rate, Provision of corresponding number of tree seedlings For out-planted seedlings used to replace earth-balled and/or cut trees: survival rate and growth rate, mortality rate, provision of corresponding number of tree seedlings For monitoring of improvement in ecology :	Method - Periodic (Measurement) - Quadrat sampling (10 m x 10 m in replicates covering at least 3 stations) - Transect survey of full length of SBT line conducted between 6:00 a.m. to 8:00 a.m. and 3:30 p.m. to 5:30 p.m. Frequency - Semi-annual	Rehabilitated/ revegetated abandoned site	DOTr and Contractor	Abandonment Cost	Alert 10% mortality on seedlings - Mortality of at least 3 individuals of endemic plants balled-out individuals. Action 20% mortality on seedlings - Mortality of at least 3 individuals of endemics and 3 individuals of threatened species balled-out individuals. Limit 30% mortality on out-planted seedlings	Alert - Replace seedlings and relocated plants that did not survive. - Conduct visual observations and interviews of locals to determine potential causes of mortality - Expand list of native species through screening (by allowing them to grow) that are more adaptable to the site. Action - Replace seedlings and relocated plants that did not survive using species more adaptable to the relocation site.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		vegetation community types; species range distribution and endemism; conservation status; and wildlife assemblage.					• Mortality of endemics and threatened plant species balled-out individuals.	• Conduct a detailed soil nutrient analysis • Investigate other possible causes of mortality not related to soil nutrient deficiency or site and species incompatibility to determine other causes of mortality • Make necessary adjustment based on result of soil nutrient analysis and investigation Limit • Replace seedlings and relocated plants that did not survive using species more adaptable to the site. • Consider other sites. • Review and revise relocation and revegetation plan to improve plant survival.
Geologic Hazards	Ground subsidence	Level of ground subsidence/ change in ground level	Method • Visual observation • Level survey Frequency • Daily visual observation • Weekly level survey or as needed	SBT Section ROW/ demolition area	DOTr and Contractor	Abandonment Cost	Alert • Complaints within impact area Action • Visually observed subsidence or minor damage to aboveground structures Limit • Verified occurrence of subsidence and damage associated with demolition activities	Alert • Investigate complaints if attributable to project activities Action • Implement corrective actions as necessary if the observed subsidence poses threat to the workers and community Limit • Temporarily stop work to recalibrate works and legitimate complainants agreed on resolution
The Water								
Surface Water Quality	Siltation and sedimentation	Visual indication of siltation, sedimentation and clogging of drainage canals (e.g. turbidity, accidental spills)	Method • Ocular inspection Frequency	WQ1, WQ2, and other established surface water quality sampling stations	DOTr and Contractor	PHP 10,000.00 estimated laboratory fees per monitoring	Alert • Observed presence of concentrated flows from	Alert

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
	Contamination of waterways with domestic wastewater and solid waste	Status of Surface water quality: • Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform • Other parameters may be measured as needed such as at the event of accidental spill	• Daily during rainy season Method • For temperature, pH and DO – <i>in-situ</i> measurements using multi parameter water quality meter. • For the other parameters, grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency • Quarterly for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform • Other parameters may be sampled as needed	near active demolition area, and discharge points		event for temperature pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform, and PHP 25,000 sampling fee and expenses Estimated to be around PHP 140,000.00 for four quarterly monitoring events	demolition sites to drainage canals which causes siltation • Compare observed in-situ parameters from the baseline data. Action • Observed presence of concentrated flows from demolition sites to drainage canals which causes siltation • For ambient surface water quality: DAO 2016-08 / DAO 2021-19 Water Quality Guidelines (WQG) for Class C waters Limit • Visually evident changes in surface water quality, such as increased siltation, concentration flows of wastewater, and oil/grease sheet forming above the water. • Complaints from the community due to water pollution attributable to the Project. • For effluent: DAO 2016-08 / DAO 2021-19 General Effluent Standards (GES) for Class C waters	• Check and monitor the performance of the sediment control equipment/ facilities installed. • Check equipment, demolition activities, or facilities considered as source of leakage, and halt operations for inspection and maintenance. Action • Investigate if changes in water quality is attributable to the demolition activities. • Once identified and verified to be part of the project activities, temporarily halt the specified activity. Apply mitigating measures to stop/attenuate the water quality changes observed. Limit • Investigate if changes in water quality is attributable to the demolition activities. • Once identified and verified to be part of the project activities, temporarily halt demolition activities to identify main sources of pollution, leaks, or any drastic changes in water quality. Apply mitigating measures to stop/attenuate the water quality changes observed. • Respond to complaint through the Project's Grievance Redress Mechanism
	Contamination of waterways by accidental spills of oil, lubricants, and other chemicals and concrete / drilling wastewater spills	• Temperature, pH, DO, color, BOD, TSS, oil and grease, nitrates, phosphates, and fecal coliform • Other parameters may be measured as needed by type of spill	Method • In-situ measurements and grab sampling consistent with the DENR-EMB Water Quality Monitoring Manual Frequency • Immediately in case of accidental spill					
Hydrology	Climate-induced flooding, aggravated by demolition works	• Daily record of stream flow and water level • Visible signs of clogged cross drainage structure)	Method • Ocular inspection and in-situ measurement • Check PAGASA weather bulletin	South Antipolo Canal and drainage within project area	DOTr and Contractor in coordination with LGU/ PAGASA	Abandonment Cost	Alert • Occurrence of low-level flooding (not more than 10cm) not subsiding after rainfall event Action	Alert • Investigate and check drainage clearance Action • Investigate and clear drainage system

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Reports of complaints related to flooding from nearby communities	Frequency - Daily - Immediate in case of weather warning.				- Occurrence of 10 cm to 30 cm flooding not subsiding after rainfall event Limit - Occurrence of more than 30cm flooding not subsiding after rainfall event	Limit Temporary stop work until flooding has subside (clearing/creating new drainage system or pump out water)
The Air								
Air Quality	Air pollution due to particulate and gaseous pollutants as well as fugitive dusts from demolition activities including: Use of heavy equipment, machineries, and service vehicles Storage or stockpiling of solid wastes/debris from demolition sites	- Particulate Pollutants: TSP, PM₁₀, PM_{2.5}, Pb - Gaseous Pollutants: SO₂, NO₂, CO₂, O₃	Method 24-hour monitoring for: - TSP: High volume, Gravimetric - PM₁₀: high volume with PM₁₀ inlet, Gravimetric - PM_{2.5}: High volume with PM_{2.5} inlet, Gravimetric - SO₂: Gas bubbler, Colorimetric Pararosaniline - NO₂: Gas bubbler, Griess Saltzman Reaction Frequency - Quarterly or as required by EMB - Immediate if complaints received	ANV1, ANV2 and other established sampling stations (including demolition area)	DOTr and Contractor	- PHP 50,000 per monitoring event; 24-hour monitoring of TSP, PM₁₀, PM_{2.5}, SO₂, and NO₂: PHP 30,000 - Mobilization/ Demobilization Cost: PHP 20,000	Alert 75% of DENR Limit Action 85% of DENR Limit Limit - Complaint lodged by comm - TSP: 230 ug/NCM; - PM₁₀: 150 ug/NCM; - PM_{2.5}: 50 ug/NCM; - SO₂: 180 ug/NCM; - NO₂: 150 ug/NCM uni	Alert - Continue monitoring and investigate possible causes of increase of particulates and gaseous pollutants, determine, and address the root cause Action - Check efficiency and conduct routine preventive maintenance of dust suppression systems - Investigate cause of complaint and determine and address the root cause. - Increase frequency of dust suppression Limit - Consider modifications to dust suppression system (i.e., changes to spray nozzle type, upgrade to air-and-water dust suppression system, etc)
		Dust generation	Method - Visual inspections - Interview with residents of affected barangays and pedestrians Frequency - Daily	- Demolition area and storage and/or stockpiles - Access road, dust-generating facilities outside the ROW - Sensitive receptors nearby project area	DOTr and Contractor	N/A	Alert - Visually evident dryness Action - Noticeable dust suspension/deposition, and/or presence of haze Limit - Complaint lodged by community	- Conduct smoke emission tests of vehicles and demolition equipment, as necessary - Review traffic management guidelines

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Monthly interview and Immediate if complaints received					
Noise	Noise levels that affect the amenity at nearby sensitive receptors Out of hours night work produces noise that affects amenity and causes sleep disturbance at sensitive receptors	Noise level ($L_{Aeq,T}$, dB)	Method - Ocular observation - In-situ measurement using sound meter - Interview with residents of affected barangays Frequency - Daily and Monthly - Immediate In response to complaints or a significant change of demolition methodology	ANV1, ANV2 and, In and around demolition area, temporary facilities, affected barangays and nearby sensitive receptors including socially ecologically significant area/s (if any) likely to be affected	DOTr and Contractor	- Monthly monitoring - PHP 200,000.00 - Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.00	Alert - Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are within 5 dBA of noise criteria outlined in the WBG (EHS) Guidelines: - Residential or institutional receptor: Daytime (07:00 - 22:00) 50 dBA / Nighttime (22:00 - 07:00) 40 dBA - Or background level - Whichever is higher. Action - Complaint lodged by community or Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are occasionally above the noise criteria outlined in the WBG (EHS) Guidelines: - Residential or institutional receptor: Daytime (07:00 - 22:00) 55 dBA / Nighttime (22:00 - 07:00) 45 dBA - Or background level +3 dB - Whichever is higher. Limit - Noise monitoring identifies levels ($L_{Aeq,(1hr)}$, dB) that are continuously above the noise criteria outlined in the WBG (EHS) Guidelines: - Residential or institutional receptor: Daytime (07:00 -	Alert - Continue monitoring and investigate possible causes of increased noise emissions Action - Investigate and identify cause of complaint and determine suitable noise control in accordance with the NVMP. Limit - Determine suitable noise control in accordance with the NVMP.

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
							22:00) 55 dBA / Nighttime (22:00 - 07:00) 45 dBA, or -background level +3 dB Whichever is higher.	
Vibration	Vibration from demolition works may cause human disturbance, and structural damage to buildings and other service structures	Vibration level VdB (vibration)	Method - Ocular observation - Interview with residents of affected barangays Frequency - Daily monitoring for continuous works that generate vibration - Monthly interview - Immediate In response to complaints or a significant change of demolition work methodology:	- In and around demolition temporary facilities, - affected barangays including socially ecologically significant areas/s (if any)	DOTr and Contractor	Attended measurements in response to a public complaint (2 hours per month) PHP 55,000.00 Quarterly monitoring PHP 70,000.00	Alert - Vibration monitoring identifies levels that are higher than 75% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:75 VdB (re 10-6 mm/s) Action - Complaint lodged by community or Vibration monitoring identifies levels that are higher than 90% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:90 VdB(re 10-6 mm/s) Limit - Vibration monitoring identifies levels that are higher than 95% of the vibration criteria outlined in the US FTA Transit Noise and Vibration Impact Assessment Manual for structural damage:100 VdB(re 10-6 mm/s)	Alert - Continue monitoring and investigate possible causes of increased vibration emissions Action - Investigate and identify cause of complaint and determine suitable vibration control in accordance with the NVMP. Limit - Investigate and identify cause of complaint and determine suitable vibration control in accordance with the NVMP.
			Method 24-hour monitoring 1 – 5 minutes of monitoring for a source producing steady continuous vibration levels 5 – 15 minutes of monitoring for a source producing variable or impulsive vibration levels Frequency 24 hours to occur quarterly at most impacted receptors - immediately in response to complaints or a significant change of demolition work	- ANV1, ANV2 and/or other established sampling locations closest to sensitive receptors along the ROW impacted by the works being undertaken at the time of monitoring - Other sensitive receptors along vibration-generating temporary facilities and access roads outside the ROW				

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			methodology is conducted for each event.					
The People								
Public Participation and Information Disclosure	Conflict of interest, social acceptability	Status, issues and concerns on Project: • SDP Implementation • IEC Meetings • Stakeholder Consultations - Public consultations - FGDs - KIIs • Project awareness campaign materials • Information disclosure - Online - Mass media • GRM	Method • Documentation • Recording • Report monitoring Frequency • Quarterly, • immediate received complaints	• Impact barangays and general public	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert/Action • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities Limit • Issues and concerns raised by stakeholders/ participants during public participation/ information disclosure activities and thru helpdesk • Negative feedback from participants/ recipients	Alert/Action • Respond and address the issues and concerns during the public participation and information disclosure activities; If unresolved, apply the GRM • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered Limit • Resolve issues, concerns and complaints thru the Helpdesk or GRM • Evaluate the reasons for the low social acceptability rate based on survey results and improve the IEC, public consultations and SDP together with the LGU and relevant agencies • Review the IEC, Consultation, SDP and integrate relevant issues and concerns raised if not adequately covered • Re-conduct the IEC, Consultation, SDP workshop if necessary
Local Employment and Business	Generation of local employment Influx of demolition labor (increase in migrants)	• Demolition manpower required by job position (no.) • Local and non-local manpower hired and their position (no. & percentage) and salary paid	Method • Survey, recording, and progress reporting Frequency • Quarterly until the end of demolition	SBT Section/ Demolition area	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert • 70% of the employees are local residents (based on the skills and capacity) Action • 60% of the employees are local residents (based on the skills and capacity)	Alert • Increase employability of local residents by undertaking skills training prior to job hiring Action • Investigate the reasons for not meeting the % local resident employment

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		- Employees hired by gender and vulnerability (no. & percentage) - Working environment provided in consideration of gender equality and needs of vulnerable group					Limit 50 % of the employees are local residents (based on the skills and capacity)	- Undertaking skills training prior to job hiring Limit - Investigate the reasons for not meeting the % local resident employment - skills training prior to job hiring
Public Utilities	Disruption in public utility services by relocation	- Affected public utility lines, poles or structures relocated (no.) - Households per barangay affected by the relocation of public utilities (no.) - Status of relocation of public utility lines, poles or structures - Extent of disturbance and actions taken - Complaints received during relocation activities	Method - Coordination with the LGU - Interviews with affected barangays Frequency - monthly until relocated - daily to weekly during relocation activity	SBT Section ROW	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert - Planned power outage or water service interruption due to relocation of facilities Action - Complaints on failure to restore power and water on the given ETR Limit - Complaints on uninformed / unplanned power outage or water service interruption caused by factors that are beyond the control of the public utility companies	Alert - Provide advisory to the affected barangays at least 72 hours before the actual time of service interruption and provide estimated time of restoration (ETR) Action - Coordinate with public utility companies to implement contingency measures such as deployment of generator sets and water tankers to affected areas and conduct rationing - Provide regular updates to the public on electricity and water supply conditions Limit - Coordinate with public utility companies to investigate the cause, assess the damage and necessary repair - Implement contingency measures if the repair or service restoration may take a while
Public Utilities	Increased demand for local resources, resource depletion	- Electricity, fuel and water consumption - Complaint received	Method - Meter readings, utility bills, leaks monitoring - Reporting - meetings	Demolition area, yards, camps and offices Barangays	DOTr PMO and Contractor	Abandonment Cost	Alert 1% increase in consumption/ utility expenditures Action	Alert Implement conservation measures and monitor for possible leaks Action

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			Frequency Daily, monthly, annually				5% increase in consumption/ utility expenditures Limit 10% in consumption/ utility expenditures	- Implement conservation measures and monitor for possible leaks Limit - Conduct calibration testing of utility meters and submeters - If found defective, replace the meters/submeters - Continue implementation of conservation measures
Cultural Heritage	Damage/ destruction risk to physical cultural/ archaeological resources	Other affected historic structures and buildings based on identified locations of temporary facilities and access routes	Method - Baseline/ Building condition survey or other surveys required by CAs and PNR in coordination with the cultural heritage property owners Frequency - Monthly	Historical structures and buildings adjacent or close to the location of project temporary facilities and access routes with significant vibration source	DOTr PMO and Contractor	Contractor's Service Cost	Limit Exceeded FTA standard for vibration	Limit Analyze and evaluate the results and provide recommendations or proposed actions for the approval of the CAs and PNR
Occupational and Community Health and Safety	Threat to public and occupational health and safety (General)	Health, safety and environmental (HSE) - Complaints received - Action status against complaints, accidents	Method - Review of GRM implementation record - Review of records of operation-related accidents (inc. incidents, near-misses) - Interviews with LGUs, stakeholder representatives, and employees Frequency - Monthly - Immediately in case of accidents immediately upon receipt of complain	Affected barangays	DOTr PMO and Contractor in coordination with LGU	Abandonment Cost	Alert - HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action - HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit - HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert - Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action - Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit - Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Working Environment Measurement (WEM) • Compliance with DOLE OSH Standards	Method • BWC-OSHC/ NIOSH method Frequency • Quarterly throughout demolition/ abandonment phase	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert • Parameters for good working conditions are near DOLE OSH limits Action • Parameters for good working conditions are equal to or exceed DOLE OSH limits Limit • Parameters for good working conditions exceed DOLE OSH limits for 2 consecutive audits	Alert Implement corrective actions • Review maintenance and housekeeping activities and revise as needed Action • Implement corrective actions Conduct internal audit and monitoring after implementation Limit • Conduct third-party (external) audit of working environments • Update/Improve working environment
	Demolition-related accidents	• Status of accident involving communities • Demolition-related accident/s involving communities (no.) • Cause of accidents • Date and location of accidents • Measure acted to mitigate future accidents	Method • Survey occurrence of accidents with local communities • Monitoring • Coordination with LGU officials and police • Interview with affected communities Frequency • Daily or Immediately in case of accidents	Affected barangays	DOTr PMO and Contractor in coordination with the LGU	Abandonment Cost	Alert • HSE-related grievance to be resolved by N1 Frontliners (PMO Admin, Helpdesks, LGUs, Contractors, PNR) Action • HSE-related grievance to be resolved by PMO HSE, HSEC or TPA Limit • HSE-related grievance to be resolved by EGF Committee or DENR Pollution Adjudication Board (PAB)	Alert • Follow HSE GRM Level 1 Procedure (Local Help Desk/ Central Help Desk) Action • Follow HSE GRM Level 2 Procedure (PMO HSE, HSEC or TPA) Limit • Follow HSE GRM Level 3 Procedure (EGF Committee or DENR PAB)

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		Demolition-related accidents among the workers (no.) - Demolition-related accidents among the workers (no.) - Cause of accidents - Date and location of accidents - Measure acted to mitigate future accidents	Method - Occurrence of accidents related demolition work - Monitoring - Documentation Frequency - Daily or immediately in case of accidents	SBT ROW / demolition area and sites of temporary facilities, and access roads	DOT and Contractor	Abandonment Cost	Alert/Action - External HSE Audit findings Limit - Unresolved External HSE Audit findings	Alert - Conduct safety re-training for workers involved in accident Action - Conduct departmental re-training of the workers on health safety rules and regulation Limit - Inspect the area where most accidents happen - Hire a 3rd party safety practitioner to conduct safety audit and implement recommendations
	Transmission of communicable diseases	Status of affected communities - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Barangay health records - Interviews Frequency - Daily - Immediately in case of confirmed cases	Affected communities and/or barangays surrounding the SBT Section/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert - case counts are low but increasing Action - case counts are high and/or increasing Limit - case counts are high and/or increasing and area declared as critical zone	Alert/Action - Require workers and employees to conduct self-health check prior to going onsite - Require workers and employees with symptoms of a communicable disease to consult a doctor and stay home/ work from home - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP Limit - Temporarily suspend demolition activities and require workers and employees for testing - Require workers and employees who tested positive and their close contacts as well as those with symptoms of a

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
								- communicable disease to consult a doctor, isolate and take quarantine - Strictly implement minimum public health standards (PPE use, social distancing) - Consult and coordinate with relevant LGUs and NGAs for disease control and prevention protocols and update OCHSMP and implement a Pandemic Response Plan (PRP) as applicable
		Status of transmission of communicable diseases among the workers: - Confirmed cases (no.) - Undergoing treatment (no.) - Recovered (no.) - Deaths (no.) - Possible transmittal pathways, Close contacts of confirmed case among the workforce (no.)	Method - Survey trend of epidemic disease - Interview and health records of workers - Health check of workers Frequency - Daily or Immediately in case of confirmed cases	SBT Section ROW/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert 5% of workers experience symptoms of disease Action 10% workers are infected with disease Limit 15% of workers are infected with disease	Alert - Assess if illness is work-related; - conduct interview of sick employees and assess health condition by medical health doctor Action - Implement site-wide investigation of cause - Conduct IEC campaign for illness prevention - Monitor health conditions by medical doctor Limit - Implement site-wide investigation of cause, - isolate cases and prevent spread of illness; - Conduct IEC campaign for illness prevention - Continue monitoring by health doctor
	Nuisance to onsite demolition workers and communities to demolition noise and vibration and dust generation	- implementation and effectivity of PPE during workhours - health condition of workers	Method inspection, strict and reinforcement and maintenance of PPE	SBT Section ROW/ demolition area	DOTr and Contractor (HSE Officer)	Abandonment Cost	Alert Health problem reported by employees and workers on-site, or reported damaged PPE Action	Alert Determine equipment, machines, or activities that caused the complaints Action

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			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
			- Noise and vibration, air quality sampling/measurement - Regular health check Frequency - Daily, monthly, immediately upon receipt of complaint or in case of any symptom				- Verbal or non-verbal complaints filed by employees and/or workers Limit - Multiple complaints filed by employees and workers on-site, and if the permissible noise levels, as suggested by DOLE, exceeded the limits.	- Coordinate with demolition team to address the root cause, or; coordinate with a health institution for necessary medical check-up Limit - Conduct maintenance of demolition equipment or machineries or use equipment that produce lesser noise. - Schedule strategically shifts to integrate the permissible noise level exposure in the safety of the workers. - Conduct inspection and maintenance of PPE, and repair of damages (if repairable). - Implement strict wearing of PPE on-site. - Record equipment that produce harmful noise levels, and keeping its nearby area off-limits to workers
Public Access and Traffic Management	Restrictions to public access	- Public access closed (no.) - Public access for temporary closure and permanent closure (no. and location) - Barangays affected by public access restriction (no.) - Public access and traffic-related complaints from the community (no.)	Method Record of complaints Frequency Immediately	SBT Section ROW, Public access (roads and pedestrian access) temporarily and permanently closed Existing and temporary access roads utilized for the demolition activities	DOTr and Contractor	Abandonment Cost	Alert - Temporary closure of public access for 3 months or more Action - Temporary closure of public access throughout demolition Limit - Permanent closure of public access	Alert/Action Inform/ Coordinate with affected barangays and residents Provide alternate public access Update Public Access and Traffic Management Plan (PATMP) Limit Update Public Access and Traffic Management Plan (PATMP) in consultation/coordination with the LGU, affected barangays and residents Compensate displaced families and businesses due to landlock or provision of access road
	Traffic congestion	Observed road traffic condition in public access roads within 200 m from the	Method Survey traffic volume	Main intersection near demolition area	DOTr and Contractor	Abandonment Cost	Alert	Alert Resolve complaints based on GRM

Supplemental Environmental Impact Assessment Report for the
North-South Commuter Railway Project (Malolos-Tutuban)
SOLIS-BLUMENTRITT-TUTUBAN SECTION

Environmental Aspect	Potential Impact	Parameters to be Monitored	Sampling and Measurement		Lead Person	Annual Estimated Cost	EQPL Management Scheme	
			Method, Frequency	Location			EQPL Range (Alert, Action, Limit)	Management Measure (Alert, Action, Limit)
		SBT Section/demolition area during incoming or outgoing trips: - Travel distance from origin to destination - Travel time from origin to destination - Roads with heavy traffic within 200 m from SBT Section - Number of hours, days that road is restricted/closed. - Public access and traffic-related complaints from the community (no.)	- Actual traffic observation and documentation Frequency - Weekly monitoring of traffic condition	and temporary facilities Existing and temporary access roads utilized for the Project			- Grievance to be resolved at the GR Officer Level - Five (5) valid complaints per month Action - Grievance to be resolved at the ROWSA Committee/ DOTr's Legal Department - Ten (10) valid complaints per month Limit - Grievance to be resolved by the DOTr PMO, as necessary - Fifteen (15) valid complaints per month	Action - Resolve complaints based on GRM - Review effectivity of PATMP and revise as needed - Provide traffic signage and personnel Limit - Resolve complaints based on GRM - Implement corrective actions as necessary - Coordinate with LGU and other agencies to update PATMP