SILVERQUEST MINING RESOURCES, INC

SMRI SEABED QUARRY PROJECT

Environmental Impact Statement

Abstract

The proposed Project of Silverquest Mining Resources, Inc will involve dredging of mud, silts, and other suitable dredge fill materials from the borrow areas offshore within Manila Bay within the jurisdiction of Ternate and Naic, Cavite for use in Manila Waterfront City Reclamation development about 42 kilometers away near the City of Manila

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ACRONYMS

A & D	Alienable and Disposable
AO	Administrative Order
BOD	Biochemical Oxygen Demand
CADT	Certificate of Ancestral Domain Title
CDR	Crude Death Rate
CENRO	Community Environment and Natural Resources Office
DAO	DENR Administrative Order
dBA	Decibel
DENR	Department of Environment and Natural Resources
DIA	Direct Impact Areas
DILG	Department of Interior and Local Government
DOE	Department of Energy
DOLE	Department of Labor and Employment
ECC	Environmental Compliance Certificate
EGF	Environmental Guarantee Fund
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EQPL	Environmental Quality Performance Level
ERA	Environmental Risk Assessment
EU	Environmental Unit
FS	Feasibility Study
GHG	Greenhouse Gas
GLC	Ground-level Concentration
IEC	Information Education and Communication
IP	Indigenous People
LGU	Local Government Unit
MCLUP	Municipal Comprehensive Land Use Plan
MGB	Mines and Geosciences Bureau
MMT	Multi-sectoral Monitoring Team

MOA	Memorandum of Agreement
MPDC	Municipal Planning and Development Council
NAAQS	National Ambient Air Quality Standards
NAMRIA	National Mapping and Resource Information Authority
NCIP	National Commission on Indigenous People
NEDA	National Economic Development Authority
NOx	Nitrogen Oxides
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCO	Pollution Control Officer
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PM10	Particulate Matter (less than 10 microns)
PPE	Personal Protective Equipment
SB	Sangguniang Bayan
SDP	Social Development Plan
SMR	Self-Monitoring Report
SO2	Sulfur Dioxide
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
WB	World Bank

EXECUTIVE SUMMARY

E.S. 1.0 BASIC PROJECT INFORMATION and PROJECT DESCRIPTION

Table E.S. 1-1 Basic Project Information

Name of Project:	**SMRI SEABED QUARRY PROJECT**
Project Location	Municipal Waters off the coasts of the municipalities of Ternate and Naic, Province of Cavite
Nature of the Project	Dredge-fill materials/Non-Metallic Minerals Extraction pursuant to DAO 2000-25 guidelines on seabed quarry permitting
Project Duration	Approximately 10 years to dredge about 90 million cubic meters of dredge fill materials; may extend depending on weather condition and the number of days the dredge ships are able to operate.
Authority over the Project Area	Government Seabed Quarry Permit from Mines and Geosciences Bureau
Project size	The seabed quarry site has an area of about 2,124.3581 hectares off the coast of Cavite in the Manila Bay; within the municipal waters of Ternate and Naic. Total dredge fill material to be extracted is around 90 million cubic meters over the duration of 10 years.
Components:	There are two major components of the dredging project • Dredging of silt, sand, aggregates, and other suitable dredge fill materials from the seabed off the Manila Bay within the municipal jurisdiction of Cavite to support the reclamation activity of the Manila Waterfront City Project, which is a separate project of LGU Manila • Transferring the dredged fill materials from the borrow source (project site) and dump it into the reclamation site, also within the same Manila Bay offshore of the City of Manila The activities of reclamation project have been covered by the PEISS; in fact, already secured ECC for Manila Waterfront City Reclamation Project
Project Type:	Environmentally Critical Project (ECP) by EMB Memorandum Circular No. 2014-005 (July 7, 2014) – Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System, Amending Relevant Portions of MC 2007-002;

	Under Sub Heading 2.1.3 – Classified as extraction of non-metallic minerals such as Aggregates (sand, stone, gravel, including dredging with or intended for recovery and use of materials).
Total Project Cost:	P15 Billion
Total Manpower:	20 personnel per dredging ship or a total of 80 on 4 dredging ships; plus 20 more personnel onshore or a combined total of 100 personnel

Table E.S. 1-2 Proponent's Profile

Proponent Name and Profile	**SILVERQUEST MINING RESOURCES, INC. (SMRI)**
Proponent's Address	Unit 103A ZEN Bldg., 8352 Mayapis St., San Antonio Village, Makati City.
Authorized Representative	Ms. Ellen T. Balunsat
Designation	President
Contact Number	02-8529-4741
Contact Email	ednonog07@gmail.com silverquestmining@yahoo.com
EIS Consultant	PRISM EXPRESS CONSULTANTS, INC
Consultant's Address	Unit 11, Kingswood Arcade cor. Pasong Tamo Chino Roces and Vito Cruz Extension, Makati City
Consultant's Authorized Representative	Allan Plete Vice President and Project Manager
Contact Numbers	(+632) 8651223
E-mail Address	allanplete@yahoo.com

E.S. 2.0 Brief Summary of the Project EIA Process

The Silverquest Seabed Quarry Project falls under Category A: Environmental Critical Project (ECP) per EMB Memorandum Circular 2014-005. The content of the EIS is based on the checklist based on the results of the conduct of online Technical Review and Scoping held last January 18, 2021 per EMB-DENR Revised Procedural Manual (RPM). This checklist is provided as ANNEX 1.

E.S 2.1. EIA TEAM

The members of the multi-disciplinary team of researchers that conducted the Environmental Impact Assessment (EIA) study and their corresponding fields of expertise are shown in Table ES-3.1.

Table E.S. - 2-1 EIA Team

Consultant	Module
Engr. Allan Plete	Project Manager
Mr. Reynar Rollan	Team Leader/ Geotechnical
Engr. Aldwin A. Camance	Risk Assessment/General Ecology
Dr. Merlyn Rivera	Socio Economics
Mr. Manuel Potrido	IEC
Mr. Roy Aurelio Metin	General Geology
Mr. Delio Cimatu	Public Participation and Consultation
Mr. Rogerio Espiritu	Bathymetry Survey
Dr. Katherine Sanchez Escalona	Coastal Marine Ecology and Water Quality
Engr. Oliver Barbosa	Bathymetry and Survey and GIS mapping
Mr Rommel Peneyra	Climate Change and Disaster Risk Management
Mr. Jones Melendres	Terrestrial Ecology

E.S 2.2. EIA Study Schedule and Methodology

The EIA team started the environmental works on October 2020 to February 2021 including the preparation and holding of consultation meetings onsite in Ternate and Naic. It would be good to note that the Environmental Work Program for Offshore Exploration was done in 2017 and made to form part of the exploration works for issuance of the Government Seabed Quarry Permit.

Table E.S. 2-2 the EIA Study Period

ACTIVITY	DATE	AREAS COVERED
Environmental Work Program for Offshore Exploration	October 2016-July 2017	Landform
Exploration Work Program	October 2020 to January 2021	Literature Search: geophysical data, lithological data Geophysical survey
Application for a Government Seabed Quarry permit	November 2020 to January 2021	
Hydrography and Bathymetry	December 2020	Project Site and Immediate Vicinity
Secondary Data Researches	November 2020 to January 2021	Naic and Ternate, offshore areas, Manila Bay
Marine Study	December 2020	Proposed Project site and immediate vicinity
Water Sampling and Laboratory Tests	December 2017	Proposed Project site
Consultation with LGUs and stakeholders	November to December 2020	
Drafting of EIS Report	December 2020 to January 2021	
Final Review and Submission of Report	February 2021	

The direct and indirect impact areas are defined by DAO 2017-15 are provided below. EIA Approach and Methodology is also presented in Table ES 2-3.

E.S. 2.2.1. Direct Impact Area for Air Quality

Direct Impact areas for Air Quality are areas where ground level concentrations of emissions are higher than the ambient standards based on air modelling. Modelling is done based on the emissions of ships to

be used in dredging; the resulting data is not expected to exacerbate ground level ambient pollutant concentrations in Ternate and Naic neither affect the local air quality along the coasts.

E.S. 2.2.2. Direct Impact Area for Water Quality and Quantity Impacts

Direct Impact Areas for Water Quality is where water quality is projected to exceed the ambient standards. This likewise are areas where existing users of the natural resources will be impacted. There will be considerable turbidity where dredging operations would take place but these may be fleeting considering the high currents in the vicinity of the borrow area. Studies have shown that turbidity values usually go back to background from 300-400 meters from the source of dredging; however, the effects of continuous dredging activities must take into account the effects of calm waters; i.e. locations up to 2.5 kilometers from the dredging point or source must be taken into account, as shown below.

E.S. 2.2.3. Direct Impact Areas for Impacts on Land

Direct impact areas on Land are those directly vulnerable to the potential effects of flooding or which may cause changes in the deposition of sand in the shores particularly along beach fronts area. Erosion on the shoreline will be studied as part of the possible impacts of changes in the bathymetry due to dredging.

E.S. 2.2.4. Direct Impact Areas for Impacts on People

Direct Impact on the People Sector includes the local populations in the barangays and municipality that will benefit from taxes, royalties, social development fund provisions, and permit fees to be generated from quarry operations over the span or duration of the project. Since the seabed quarry area is in the municipal waters off Ternate and Naic, then the two municipalities will also benefit from the project.

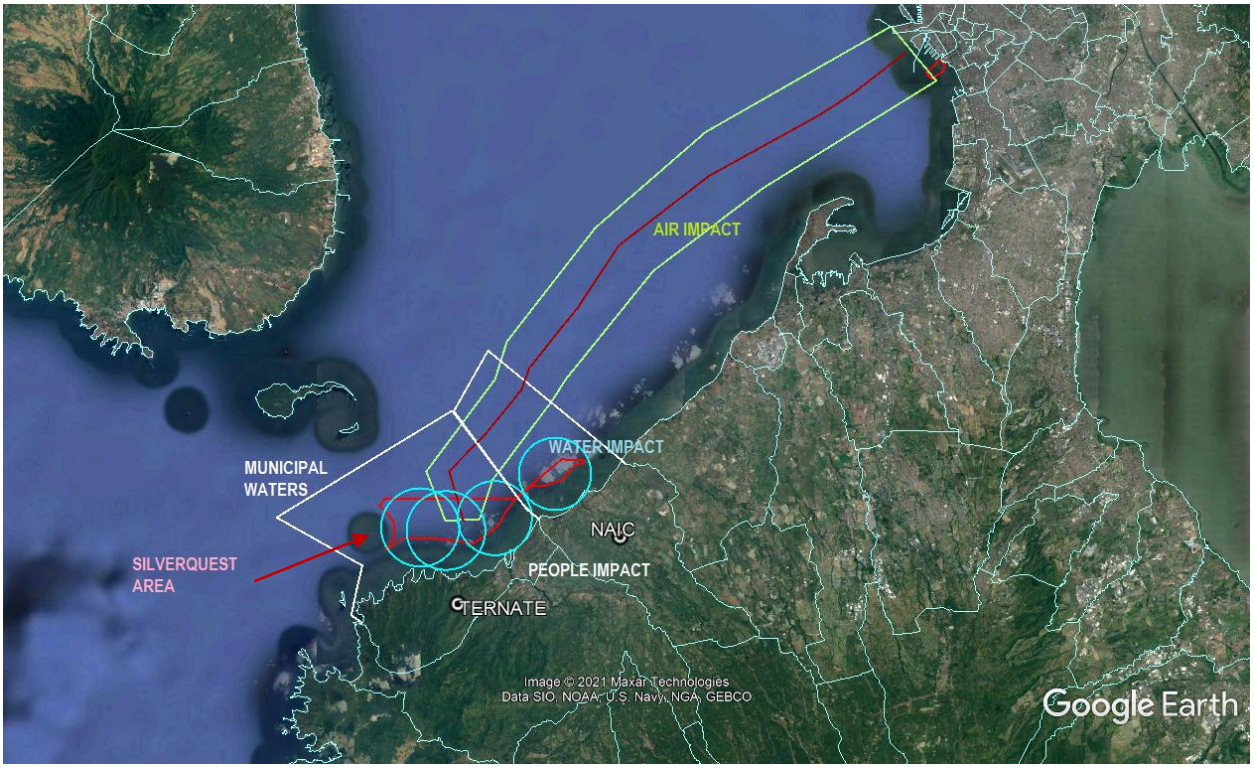


Figure 2-1 Conglomeration of Impact Areas

Table ES-2.3 presents the methodologies used for the gathering of primary and secondary data for the different components.

Table E.S.2-3 Methodologies for each component

Module / Section	Baseline	Methodology
LAND		
Land Use Classification	**Secondary data:** The Comprehensive Land Use Plan (CLUP) of Naic and Ternate	Assessment of the land uses in the coastal areas that may be affected by the dredging activities
Geology	**Secondary data:** Geologic, seismic, hazard maps and evaluation based on government data and maps.	Identify and assess project impact in terms of the changed in topography including existing hazard as maybe aggravated
Pedology	**Primary data:** Geotechnical Studies	Describe the physical properties and erodibility potential of the soil, ongoing erosion processes in the shoreline
WATER		
Hydrology / Hydrogeology	**Secondary data:** Existing drainage system. Historical flooding occurrences onshore	Identify and assess project impact on the change in drainage morphology, local drainage and resulting effects of flooding

Module / Section	Baseline	Methodology
Marine Water Quality	**Secondary Data:** Standard Methods for Water Quality Sampling and Monitoring. **Water Body Classification:** DENR Class SB for Manila Bay **Parameters Considered:** pH, BOD5, COD, DO, Oil and Grease, TSS, Heavy Metals, Fecal / Total Coliform, Nitrates / Phosphates	Assess impacts on siltation of surface and coastal marine waters
Sediment Transport	Secondary Data: Assessment of effect of Tides and wind on the transport of sediments	Use of a Sediment Transport Model
Oceanography	Topographic map covering the Manila Bay from NAMRIA. Depth surveys available in the project area. Post-processing of the interpolated bathymetry of the areas covering Manila Bay	To determine the topographic configurations of the seabed (referred to as "bathymetry"), available topographic map covering the Manila Bay from NAMRIA were digitized and merged with the depth surveys available in the project area.
Marine	**Primary data:** Abundance / density / distribution of ecologically and economically important species, mangroves, benthism plantons, coral reefs, algae, seaweeds, sea grasses	Transect, manta tow and spot dives surveys, marine resource characterization (e.g. city/municipal and commercial fisheries data), Key informant interview.
AIR		
Air Quality	No primary data since the operations are all off shore and far from populated areas. Secondary data using some air modelling to determine extent of plumes from ships	**Methodology:** use of a Gaussian Plume assessment model for SOx and Nox
Contribution in terms of GHG	Data in Greenhouse gasses	Estimate of projected greenhouse gasses (GHG) from Ship ping
PEOPLE		
Demographic Profile / Baseline	**Primary data:** Conduct of Public Perception Survey, Public Scoping **Secondary data:** Comprehensive Land Use Plan of Naic and Ternate	

E.S. 3.0 SUMMARY OF BASELINE CHARACTERIZATION

E.S 3.1. LAND SECTOR

Table E.S. 3-1 Summary of Land Sector Baseline Information

Environmental Component	Description
LAND	
Land Use and Classification	The project site will be situated off the shore and project activities would not touch on any landmass except to berth and maintain the dredge ships and to provide residential areas for the crew. This section of the baseline will focus on portions of the land that are closest to the activities and most likely may affect or get affected by the same. It covers the municipalities of Naic and Ternate, in the province of Cavite.
Municipal Coverage	Naic is a first-class municipality and located at the western part of the Province of Cavite. It has a total land area of 8,600 ha which is about 6.03% of Cavite's total provincial land area. It is politically subdivided into 30 barangays wherein 10 barangays are located along the coastal areas facing the Manila Bay.
	On the other hand, the Municipality of Ternate is a 4th class municipality and a total land area of 4,350 or 3.05% of the land area of Cavite. It has 10 barangays in which three are urban barangays while seven are rural areas. Both the municipalities of Naic and Ternate are classified as coastal municipality
Existing Water Use	In terms of coastal area, the province has a total coastal water area of 93,679.38 ha in which 6.75% (6,324.62 ha) is in Naic while 11.02% (10,331.23 ha) is in Ternate. Furthermore, the Province of Cavite has a total coastal line length of 122.57 kilometers. The coastal line in Naic is 9.12 kilometers long while in Ternate is 23.63 kilometers
Environmentally Critical and Sensitive Areas	The borrow or dredge area will not overlap with existing protected areas in Ternate; relatively close to the 3kilometer buffer zones of two municipal fish sanctuaries in Cavite.
	The nearest ECA is the Mt. Palay-palay protected landscape, which is onshore in the province of Cavite. Mt. Palay-Palay protected landscape is proclaimed a game refuge and bird sanctuary. It is home to a diverse bird species such as the Philippine eagle-owl, Philippine falconet, Philippine hawk-cuckoo, Philippine drongo-cuckoo, Philippine hawk-owl, ashy thrush, brahminy kite, crested serpent eagle, Philippine fairy-bluebird, Philippine trogon, black-chinned fruit dove, island swiftlet, Philippine bulbul, Pacific swallow, Luzon hornbill and Philippine pygmy woodpecker.
Geology/Geomorphology	The burrow or dredging area corresponds to a portion of Manila Bay known as the San Nicolas Shoal (SNS). It is located 4 to 6 kilometers north of the coast of Maragondon and Ternate in Cavite. Regionally, it occupies the south-eastern edge of Manila Bay. The SMRI dredging area occupies approximately 2,135 hectares.
Slope and Bathymetry	Spatially, the burrow area corresponds to 1.26% of the total expanse of Manila Bay. The narrow northern section has a depth range of 3 to 5 meters and has an average slope of 0.5%. The elongated and wide southern section varies in depth from 5 to 35 meters and also has an average slope of 0.5%.

Environmental Component	Description
LAND	
Techtonic Settng	The burrow site is located on the western shore of the Manila Bay along the chain of Quaternary volcanoes which extends from Pinatubo southwards to Natib, Mariveles, Corregidor, Taal, Palay-Palay and on the northeastern portion of Mindoro Island. In particular, the project site forms a part of the volcanic front related to the active subduction of the adjacent Manila Trench with resultant faulting, volcanism and rifting.
Lithology	The Holocene sediments found along the coastal section of Cavite, Bataan, Bulacan and Pampanga extend seaward into Manila Bay. Using NAMRIA data, Siringan and Ringor (1998) generated a sediment distribution map of Manila Bay and show sandy deposits are dominant along the coastal section of the project area. Available borehole data at the San Nicolas Shoal revealed interlayers of sand, silt and clay within the drilled depth of 20 meters
Sesimicity	The major earthquake generators and structures which can potentially affect the area include the Manila Trench, Lubang Fault, West Marikina Valley Fault, Philippine Fault, Philippine Trench and Macolod Corridor.
	The nearest fault line in the project area is the West Valley Fault and located more than 30 kilometers away.
	The strongest recorded quake within the vicinity of the area corresponds to a Magnitude 7.8 event, which was recorded on July 16, 1990. The epicenter of this quake is in Digdig, Nueva Ecija which is about 159 kilometers northeast of the Project Area.
Ground Rupture	The municipalities of Naic and Ternate are not susceptible to ground rupture. The significant distance of the area from major faults will make it not be susceptible to ground rupture.
Ground Shaking	Ground shaking due to earthquakes will affect the project the entire Manila Bay and its coastal rim including the project area. This phenomenon could stir up the partially consolidated sediments or soft soils. The regional peak ground acceleration map of the Philippines prepared by Thenhaus, Hanson and Algermissen of the United States Geological Survey and the Philippine Institute of Volcanology and Seismology (1995) indicate that a value of 0.60 g for the unconsolidated sediments of Manila Bay and the coastal areas . This g value has a 10% probability of being exceeded in 50 years
Earthquake induced landslide	Both the municipalities of Naic and Ternate are not susceptible to earthquake-induced landslide
Liquefaction	In Naic, 16 barangays are susceptible to liquefaction; 9 barangays are highly susceptible while 7 barangays are moderately susceptible. For Ternate, only 1 barangay is not susceptible to liquefaction; 4 barangays are highly susceptible, 4 are moderately susceptible and 1 has low susceptibility
Volcanic Eruptions	Based on previous eruption records, ash spewed from Taal Volcano and even Mt. Pinatubo in the north could reach the Manila Bay Area. Although these airborne deposits could locally and temporarily reduce visibility and safe movement of vehicles, ships and airplanes in the Bay area, these will have no significant impact on the Project Area.
Tsunami	Tsunamis generated by major seismic events could potentially damage the coastal areas depending on the wave height and the presence of coastal

Environmental Component	Description
LAND	
	protection measures. The passage of the tsunamis through the project area can potentially affect the seabed by stirring up the underlying sediments.
Storm Surge	The coast-lying barangays are susceptible to this kind of hazard. The municipalities of Naic and Ternate are both moderately susceptible to storm surge. Storm surges could affect the Coastal Plain but no effect on the submerged part of the area.
Soil Type	The lowland area of Cavite, including Naic, is generally made of Guadalupe clay and clay loam. It is characterized as coarse and granular when dry, but sticky and plastic when wet. Its substratum is solid volcanic tuff. The shoreline of Naic is composed of Guadalupe sand.
	In Ternate, is made of Tagaytay sandy loam with mountain soil undifferentiated. Tagaytay sandy loam is friable and granular. It has a considerable amount of volcanic sand and is underlain by adobe clay. Patungan sand, characterized as pale gray to almost white sand with a substratum of marine conglomerates, is seen along the coastlines of Ternate
Soil Erodibility	Both the municipalities of Naic and Ternate, being located along the coastal area of Manila Bay, are susceptible to coastal erosion due to flood and storm surge.

E.S 3.2. WATER SECTOR

Table E.S. 3-2 Summary of Water Sector Baseline Information

Environmental Component	Description
WATER	
Hydrology	The general direction of the flow is from the highlands of Tagaytay going to Manila Bay and stretching from the Municipality of Bacoor up to Ternate. Cavite has six major rivers; Maragondon River, Labac River, San Juan River, Bacoor River and Imus River. The Municipality of Ternate is within the Maragondon River Basin while Naic is within the Maragondon River Basin and Labac River Basin. The Maragondon River and Labac River are discharging near the proposed project site.
Water Quality	Based on DENR Data, all the stations in NCR have dissolved oxygen below the limit in 2017 and were observed to have low dissolved oxygen since 2011. Stations in Region 3 and Region 4A have DO levels of 6-7 mg/L from 2011 to 2017. Only stations in NCR have available data on nutrients. Measured nitrate in NCR stations were below the standard limit for Class SB. This is also true for the measured phosphate concentrations in the stations. All the coastal beach monitoring stations contain high level of fecal and total coliform exceeding the standard limit. The stations in NCR were observed to have the highest measured coliforms. This indicates that the bathing beaches are not safe for human contact

Environmental Component	Description
WATER	
	Based on recent water quality sampling results, coastal waters of Cavite that are onshore of the proposed dredge area generally pass Class SB water quality standards except for high TSS levels and fecal coliform levels
Sediments	The sediments which underlie the project area and the rest of the Manila Bay were transported by river systems which drain 26 catchments. These catchments are bounded on the east by the Sierra Madre Mountains, to the north by the Caraballo Mountains, to the northwest by the Zambales Mountain Range and to the west by the Bataan Peninsula. The biggest river systems correspond to the Pampanga River to the north and the Pasig River to the west. At the Maragondon – Ternate area, the drainage systems which discharge into Manila Bay and in the vicinity of the Project Area correspond to the Maragondon River and small streams which drain the Volcanic Mountainous Area. These waterways form their respective deltas at the southeastern edge of Manila Bay
	De Las Alas in 1990 (as cited in Siringan and Ringor, 1998) predicted the sedimentation rates in various parts of Manila Bay. The predicted rate at the Project Area is less than 1 cm per year. The movement of the sediments within the bay is due to the combined effects of tidal, fluvial and wind patterns.
Marine Ecology	The project area is on the eastern coast of Manila Bay adjacent to Nasugbu Bay. The dredging area is estimated to be at 4 kilometers from Ternate coast. There is no known reef in the area but hard substrates or volcanic origins are known to occur. The proposed dredging area is about 10 to 30 meters in depth
Fish	Underwater visibility within the project area runs only for about a meter in which camera tows did not show any features that indicate biological activity within the project site. Interviews with fishermen, however, indicate pelagic fish species are being sourced from the area. Species caught mostly include species from the Scrombidae and Carangidae like Shortfin scad or “galunggong” (Decapterus macrosoma), Frigate tuna or “tulingan” (Auxis thazard), and Chub mackerel or “lumahan” (Scomber sp.).
Benthos	At Ternate River, the area has gravel-sand substrate with thick shells layer overlying the bottom. The site is known locally to be commercially exploited for *halaan*. At least two (2) species of clams were documented to be harvested from the site: *Katelysia hianta* (Family Veneridae) and *Anadara* sp. (Family Arcidae). *Tahong* (*Mytilus* sp.) also forms part of the benthic harvest but are usually discarded. Interviews with gleaners indicate a catch-per-unit effort of 10 liters for four (4) hours that is being sold at PhP 500.
	Spot diving in the area indicated recruitment of sponges, oyster spats, and hard corals. There were no observed large colonies of either sponges or hard corals observed, however. The site is visited by angler-hobbyists which reportedly can haul various fish species such as *lapulapu* (Serranidae), *mais-mais* (Luthjanidae and Lethrinidae), *tulingan* (Scrombidae) and *talakitok* (Carangidae).
Seagrass	There was no seagrass community observed in the area. Within Manila Bay, seagrasses are known to occur in Bataan at the northern coast of the bay

E.S 3.3. AIR SECTOR

Table E.S. 3-3 Summary of Air Sector Baseline Information

Environmental Component	Description
AIR	
Climatology and Meteorology	The climate in the site and in the municipalities of Naic and Ternate is classified as Type I under the Modified Corona's Classification System used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Areas under this climate type experiences two pronounced seasons: dry from the months of November to April and wet for the rest of the year.
Temperature	April and May are the hottest month of the year with a recorded mean temperature of 31 degrees Celsius (˚C) while January is the coldest month with average temperature of 26 ˚C.
Wind Direction	Based on the meteorological observations from 1974 to 2012, the prevailing wind in the area is east-southeast during the northeast monsoon ("Amihan") from October to March and west during the southwest monsoon ("Habagat") from June to September. The average speed of winds is 3.0 meters per second.
Rainfall	Based on the climatological normals in Sangley Point, Cavite the annual amount of rainfall in the area is about 2,078.4 mm with 127 days of rainfall. The highest rainfall was observed in August with amount of 457.2 mm and lowest in March with 9 mm. The greatest daily rainfall recorded was on August 7, 2012 with amount of 354.2 mm
Tropical Cyclones	Tropical cyclone paths from 1948-2017 show only about 18-20 typhoons and tropical cyclones pass near the area with only one hitting the project area directly
Air Quality	Air quality in the land area of Naic and Ternate is generally very good as the surroundings are mostly devoid of industries and is in a mostly agricultural and residential area. Air quality in the coastal area where the ships will be deployed has not been measured but is expected to be very good considering the effects of land and sea breezes.

E.S 3.4. PEOPLE SECTOR

Table E.S. 3-4 Summary of People Sector Baseline Information

Environmental Component	Description
PEOPLE	
Demography	Based on the 2015 Census of the Philippine Statistic Authority, the Province of Cavite had a total population of 3,678,301 of which 3.03% (11,454) is from Naic and only 0.63% (23,157) is from Ternate.
	In terms of population density, Naic is inhabited by 1,470 people while Ternate by 386 people. The total number of households is Naic is 26,131 with average household size of 4.2 while Ternate has 5,673 with average household size of 4.1

Environmental Component	Description
PEOPLE	
Literacy Rate and Education Attainment	In 2015, the literacy rate of Naic in terms of its household population of 10 years old and above is 99.4%. The percentage of people who are in schooling age (5 to 24 years old) that was attending school in 2015 was 68.49%. In terms of highest educational attainment, majority (30%) of the population were able to graduate in high school and about 11% were academic degree holder
	For Ternate, the literacy rate is 99.7% and about 67.3% of the population were attending school in 2015. The highest education attainment of the Municipality was high school graduate with 30% of the population followed by high school undergraduate with 15%. Only 8% were academic degree holder
Income	According to the 2015 Family Income and Expenditure Survey (FIES), the average annual family income in Region 4A at current (2015) prices was at 312,000. For all income class, majority (60%) reported wage/salaries as their main source of income. Only 15.7% reported entrepreneurial activities while 24.3% cited other sources of income.
	In Naic, there are a total of 42,795 gainful workers who are 15 years old and above. Of the major occupation groups covered in the 2015 Census of Population, the largest number of gainful workers 15 years were found to be engaged as Service and Sales Workers. For Ternate, the total gainful workers who are 15 years old and above is 8,810 in which majority were also engaged as Service and Sales Workers
Indigenous People	There is no known Ancestral Domain Claim (CADC) covering the project area nor Ancestral Domain Title (CADT) applied or issued within the project area
Industry	About 46% of the land area in Naic is used as agricultural area. As of 2018, there are 8,529 farmers in Naic and Ternate and about 14,938 MT of crops were harvested. These crops include rice, corn, vegetables and mango. Of all the crops harvested, majority (78%) is rice
	In Ternate, only 12% of the land area is used for agriculture and only 312 farmers were recorded in 2018. About 4,420.82 MT of crops were produced which consists of rice, vegetables, root crops, coffee, banana, mango and papaya. More than half of the crop produced was rice.
Aquaculture	Aquaculture fisheries is also observed in Naic. It has 3,791 registered municipal fisher folks and 178 registered commercial fisherfolks.
	Aquaculture fisheries in the municipality were mostly in brackish water fishpond. There are also 3,000 municipal fisher folks registered in the municipality.
Power Supply	The electric power supply in both municipalities is serviced by the Manila Electric Company (MERALCO). In 2017, there were 27,858 and 3,577 customers of MERALCO in Naic and Ternate, respectively. About 90% of the households in Naic and Ternate are served by MERALCO.
Water Supply	The water supply in Municipality of Naic is served by the Naic Water Supply Corporation. In 2018, there are 8,495 households and 348 commercial establishments connected to Naic Water Supply Corp. The minimum residential water rate is Php 120 for first 10 m3
	For the Municipality of Ternate, water is supplied by Western Cavite Water Supply and Service Corporation. There were 1,545 residential service connections in 2018 with minimum residential rate of Php 144 for first 10 m3

Environmental Component	Description
PEOPLE	
Tourism	In terms of tourism, Ternate is included in Metro Tagaytay which is famous for natural tourist attractions and conducive for meditation, sight-seeing, picnicking and other activities. Another tourism point in the province is the Tente-Corregidor-Naic-Maragondon area which is known for the presence of world-class beach resorts. There are also two major historical attractions in Naic, the Battle of Naik Site and the Recollect State House. For natural attractions, Ternate has the Mts. Palay Palay and Mataas na Gulod National Park.
Peace and Order	The Municipality of Naic has a police to population ratio of 1:2,055 while in Ternate, the police to population ration is 1:714.
Public Health Services	There are two private hospitals and one government-owned hospital in Naic with a total bed capacity of 90 however, there are no hospitals in Ternate. Furthermore, there are 1 RHU, 34 barangay health stations in Naic and 1 RHU and 2 barangay health stations in Ternate.
Perception Survey	The respondents mentioned of several serious problems in their respective barangays. Foremost of these is the occurrence of trash/garbage. According to them, garbage is normally observed as being disposed in the river and shorelines. Furthermore, there seems to be a shortage of garbage trucks which results to the irregular and untimely collection of garbage from the communities. It was also alleged that there is no designated disposal facility which results to improper waste disposal. In addition, a seemingly disregard for the environment was observed because domestic/human waste without treatment is directly discharged to the river and bay.
	Another problem experienced is the occurrence of flood waters coming from the Maragondon River. The rushing flood waters during strong rains and typhoon carry not only garbage but also silt, gravel and sand. This contributes to the siltation and shallowing of the river mouth which eventually caused the closure of one of the channels of the said river. The obstruction has resulted to barangay Bucana's being susceptible to flooding.
	According to the respondents, the strong waters of Maragondon River during typhoons and heavy rains, has now eroded almost 50% of the original area of Balut Island
	Fishing is the main source of income by majority of the respondents and harsh weather conditions extremely affect their source of income since there are no fishes to sell by the vendors. The source of food for those directly dependent on the sea is likewise drastically affected. Illegal fishing, which utilizes harmful chemicals/dynamite and trolling (gears destroy the corals) add to the burden of the fishermen from the barangays.
	The lack of job opportunities has been the predicament of seventeen (17) or 6% of the respondents. Also, shallow wells have allegedly disappeared, damaged and eroded. There is an acute problem as to where to source water for domestic use in the area. Water is fetched from distant sources since all the wells nearby were all reported to have been damaged by big waves.
	Furthermore, the insufficient annual barangay budget was forwarded by two (2) of the respondents from Sapang I. The inadequacy poses as a problem because it results to the lack or insufficiency of important resources during emergencies. These resources identified as rescue boats and vehicles which are badly needed during emergency evacuations

Environmental Component	Description
PEOPLE	
Community Concerns about Dredging	When asked about their opinion on dredging, there was a different trend observed on a per barangay basis. Majority of the respondents in barangays Bucana (75%), San Juan I (71.4%) and Sapang I (70.4%) had a negative outlook about dredging. While a smaller percentage of the respondents in the given barangays indicated a positive perception on dredging, there was a majority of the respondents in Poblacion III who was not sure of their perspective towards dredging. On the whole, there was 64.0% of the total respondents who had a thumbs down for dredging while 26.1% had a positive outlook on dredging. Over-all, there was only 10% of the interviewed residents who was not sure about dredging activities implying that they need more information to make a conclusive response.
	The respondents who replied in the negative, gave reasons such as the destruction of fish sanctuaries including the coral reefs which consequently will drive fishes away. Given this situation, a negative impact will be experienced on their source of livelihood. Furthermore, dredging according to them cause erosion which will make shoreline communities "disappear". In addition, erosion cause blockage of the waterways exacerbating flooding in the area. The respondents stated a negative perception of dredging because they are oblivious of any positive effect or benefit of the said activity.
	The proposed dredging project was seen by forty-two (42) or 20% of the total respondents as a catalyst for a cleaner Manila Bay. It was also perceived to control floods and a means to prevent destructive erosion. Flood control and erosion prevention infrastructures are perceived to be a component of the proposed project. There was 10% of the respondents who perceived to be provided with more job opportunities while 9% foresee that there will be additional revenues to the local government as a result of the proposed project.

E.S. 5.0 SUMMARY OF IMPACT ASSESSMENT and ENVIRONMENTAL MANAGEMENT PLAN

Table E.S. 5-1 Environmental Management Plan Summary

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
PRE CONSTRUCTION PHASE						
Marine Ecology Survey for EIS, Bathymetric Survey	Limited and non-destructive activities			SILVERQUEST and EIS contractor	P10million	Part of the Feasibility and EIA for Government Seabed Quarry Permit
CONSTRUCTION /OPERATION PHASE						
Extraction of sediments from the borrow area using trailing suction hopper dredgers	Dredging site/area	Possible Archaeological site / shipwrecks and other marine historical artifacts	Consult maps of possible historical wrecks / do inspection prior to extraction and deposition	Initial works made during the EIS and Bathymetric surveys	Included in pre-construction activities	ECC/ Contract between Silverquest and Dredging Contractor / Contractor environmental management plan
	Dredging site/ Seabed	Local terrain modification; generation of sediment plumes	Planning of dredging operations in consideration of the results from bathymetric surveys, current measurements and plume modeling	Dredging Contractor/Silverquest	Part of dredging cost estimated at P15 Billion	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
			Monitoring of dredging operations and volume of extracted materials	Dredging Contractor/Silverquest		
			Proper ship handling of dredged materials and eventual transport to the reclamation site in Manila	Dredging Contractor/Silverquest		
	Sea Water at Dredging Site	Wastewater generation aboard ships	Proper disposal of ship wastewaters	Dredging Contractor/Silverquest	Included in dredging cost	ECC / Requirement under current laws and regulations
		Sea Water turbidity and Silt dispersion	Use of silt curtain enclosure during dredging especially when activity is near coast	Dredging Contractor/Silverquest		ECC/ Contract between Silverquest and Dredging Contractor
			Periodic Water quality monitoring			
		Increased possibility of Spills from dredging vessels particularly	Proper maintenance of ship engines	Dredging Contractor/Silverquest	Maintenance cost on the part of the dredging operator	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
		lubricants due to heavy use of machineries	Audits of ship processes to ensure proper storage of oil and ballast		P150,000 per third party auditor	ECC/ Contract between Silverquest and Dredging Contractor
	AIR	Ship Emission, Particulate Matter, CO and Nox	Proper Maintenance of ship engines and pumps	Dredging Contractor/Silverquest	Maintenance cost on the part of the dredging operator	ECC/ Contract between Silverquest and Dredging Contractor
		Noise Generation	Dredging operation is far from coastal community areas; thus, minimal noise.	Dredging Contractor/Silverquest	Included part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
	PEOPLE: workers	Health and Safety Risk: Physical Hazards	Proper procedures followed by crews and staff onboard ships	Dredging Contractor/Silverquest	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
			Mandatory use of Personal Protective Equipment (PPE)	Dredging Contractor/Silverquest	P500,000 for the ship personnel / part of contractual obligations	ECC/ Contract between Silverquest and Dredging Contractor
			Implement policy for periodic health checks	Dredging Contractor/Silverquest	P500,000 for the ship personnel / part of contractual obligations	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
		Risk of Dredging During Extreme Weather conditions	Implement proper procedure for dredging during weather events; No dredging during typhoon signals	Dredging Contractor/Silverquest	Included part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
	PEOPLE: Fishermen	Risk of Collision between dredging and fishing vessels	Ensure communication between vessels, Promote public awareness of activities in Ternate and Naic	Dredging Contractor/Silverquest	P50,000 to provide proper communication channel between FARMC and dredge ships	ECC/ Contract between Silverquest and Dredging Contractor
		Impact of Turbidity on Fish Catches	Implement Social Development Plan; provide alternative livelihood for fishermen;	Silverquest	P250,000 to offer livelihood opportunities to fishermen	ECC
			Smaller-capacity TSHD will be deployed in area near the coast, while larger-capacity TSHD will be assigned far offshore	Dredging Contractor/Silverques	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
			Limit the dredging activities in areas the shore especially during periods of calm wind or during low tides	Dredging Contractor/Silverquest	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
	ECONOMY and PEOLE: LGUs	Generation of Employment	Priority will be given to the residents of Naic and Ternate for qualified residents	Silverquest	Included part of operations	ECC / SDMP
		Additional Revenue for the LGU	Pay the exact taxes and Quarry fees as required by law	Silverquest	Php50 M (estimate only)	National
			Participate in LGU activities	Silverquest	Php 100k/year	ECC/SDP
		Employment Opportunities	Priority for qualified barangay residents	Silverquest	Included as part of dredging operations	ECC/SDP
		Health/Safety	Security in the dredging site to prevent collisions and other activities	Silverquest	NA	ECC
			Advance information on dredging sites to warn fishing boats	Silverquest	Part of SDP	ECC/SDP

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
			Provision of communication equipment to prevent disasters	Silverquest	P100,000 for communication equipment for Ternate and Naic fishing boats	ECC/SDP
ABANDONMENT PHASE						
Completion of Dredging	PEOPLE	Reduction in available jobs and eventual termination of employment	Promote alternative livelihood at early stage of project	Silverquest	P100,00 per quarter for livelihood	ECC/SDP

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
	Seabed	Stirred-up sediments during dredging will eventually settle at rates dependent on particle size and the prevailing currents. The irregularity of the dredged slope to be created will favor deposition of the sediments coming from the northeast and southwest. The passage of currents will cause the subsequent adjustment of the slope of the seabed over time and in accordance with the natural angle of repose of the sediment deposit	Allow for natural attenuation of the seabed			

E.S. 6.0 SUMMARY OF ENVIRONMENTAL MONITORING PLAN

Table E.S. 6-1 Summary of Environmental Monitoring Plan

Key Environmental Aspects per Project Phase Activities	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location Note 1			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
I. PRE-CONSTRUCTION PHASE													
Potential disturbance of corals and marine ecology during the conduct of geotechnical survey of the seabed; mitigation is by avoidance through appropriate selection of test sites. Deemed not applicable inasmuch as the pre-construction phase activities are essentially completed.													
II. CONSTRUCTION / OPERATION PHASE													
Dredging	A. Land	Solid Waste	Visual	Weekly	Onboard	Project Manager (PM)	Monitoring will be through weekly visual count of the number of garbage cans/containers picked up from the vessels Solid Waste Management Office.						
	B. Water	Total Suspended Solids (TSS)	Gravimetric (Dried at 103- 105° C) (USEPA method 3010)	Quarterly During Dredging works	Downstream portion of dredging activities	Project Manager (PM)	Php2000	>50 mg/L < 55 mg/L	>55 mg/L < 60 mg/L	>60 mg/L	Inspection of dredging & filling for corrective action e.g. slow down dredging rate	Increase Silt traps, silt curtains, move closer to dredging	Temporary stoppage until issues are resolved
		O & G	Std Method		At strategic points	PM	Php1000	>2 mg/L < 2.5	>2.5 mg/L <2.5 mg/L	>2.5 mg/L			
		Arsenic	SDDC, Spectrophotometric		Dredging area	PM	Php 50,000 annual	>0.01 mg/L <0.015	>0.015 mg /L <0.02	>0.02 mg/L	Tighten performance of	Zero discharge to sea	Same Same

Key Environmental Aspects per Project Phase Activities	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location Note 1			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		Chromium	Flame AAS			PM	budget for heavy metals tests	>0.05 mg/L <0.06	>0.06 mg/L <0.075	>0.075 mg/L	onboard OWS Slow down dredging/ & filling rates	of bilge water Increase surcharge volume	
		Lead	Flame AAS			PM		>0.01 mg/L <0.015	>0.015 mg/L <0.02	>0.025 mg/L			
		Mercury	Manual Cold Vapor AAS			PM		>0.001 mg/L <0.0015	>0.0015 mg/L <0.002	>0.002 mg/L			
		Marine species	Underwater survey			PM	Php 200,000	10% decrease of significant Marine Species	15% decrease of significant Marine Species	20% decrease of significant Marine Species			
		Fecal Coliform	Coliform Count	Quarterly	Same as above	Project Manager	Php 10,000	>100 MPN/100 mL <200	>200 MPN/100 ML <500	.>500 MPN/ 100 mL	Tighten operation of onboard wastewater treatment	No discharge of bilge water to sea	Temporary stoppage until corrections are made
		Quantity of fish resource	Ocular inspection Audit of incident	Accident-Worst case scenario only	scene of accident	Dredging Operator	Part of dredging contract	1-Recorded Potential Accident /potential damage to fish lifts			PCG action and recommendations to be complied with in the absence of quantitative parameters		

Key Environmental Aspects per Project Phase Activities	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location Note 1			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
	Safety	Implement safety guidelines	observation	Daily	Dredging and Reclamation Site	PM	Part of dredging contract	No injuries or deaths No regulatory framework for quantitative evaluation			Progressive restrictions as imposed by the PCG and other concerned agencies		Temporary stoppage of work until corrective actions are complied

SECTION 1.0 BASIC PROJECT INFORMATION

Table 1-1 Basic Project Information

Name of Project:	**SMRI SEABED QUARRY PROJECT**
Project Location	Municipal Waters off the coasts off the towns of Ternate and Naic in the Province of Cavite
Nature of the Project	Dredge-fill materials/Non-Metallic Minerals Extraction pursuant to DAO 2000-25 guidelines on seabed quarry permitting
Project Duration	Approximately 10 years to dredge about 90 million cubic meters of dredge fill materials; may extend depending on weather condition and the number of days the dredge ships are able to operate.
Authority over the Project Area	Government Seabed Quarry Permit from Mines and Geosciences Bureau
Project size	The seabed quarry site has an area of about 2,124.3581 hectares off the coast of Cavite in the Manila Bay; the quarry is within the municipal waters of Ternate and Naic. Total dredge fill material to be extracted is around 90 million cubic meters over the duration of 10 years.
Components:	There are two major components of the dredging project • Dredging of silt, sand, aggregates, and other suitable dredge fill materials from the sea-bed in Manila Bay within the municipal jurisdiction of Cavite to support the reclamation activity of the Manila Waterfront City Project, which is a separate project of LGU Manila • Transferring the dredged fill materials from the borrow source (project site) and dump it into the reclamation site, also within the same Manila Bay off the City of Manila The activities of reclamation project have been covered by the PEIS; in fact, already secured an ECC for Manila Waterfront City Reclamation Project
Project Type:	Environmentally Critical Project (ECP) by EMB Memorandum Circular No. 2014-005 (July 7, 2014) – Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System, Amending Relevant Portions of MC 2007-002 Under Sub Heading 2.1.3 – Classified as extraction of non-metallic minerals such as Aggregates (sand, stone, gravel, including dredging with or intended for recovery and use of materials).

Total Project Cost:	P 15 Billion
Total Manpower:	20 personnel per dredging ship for a total of 80 on the dredging ship and 20 personnel onshore or a total of 100 personnel

Table 1-2 Proponent's Profile

Proponent Name and Profile	**SILVERQUEST MINING RESOURCES, INC. (SMRI)**
Proponent's Address	Unit 103A ZEN Bldg., 8352 Mayapis St., San Antonio Village, Makati City.
Authorized Representative	Ms. Ellen T. Balunsat
Designation	President
Contact Number	02-8529-4741
Contact Email	ednonog07@gmail.com silverquestmining@yahoo.com
EIS Consultant	PRISM EXPRESS CONSULTING, INC.
Consultant's Address	Unit 11, Kingswood Arcade cor. Pasong Tamo and Vito Cruz Extension Makati City
Consultant's Authorized Representative	Allan Plete Project Manager
Contact Numbers	(+632) 88651223
E-mail Address	allanplete@yahoo.com

SECTION 2.0 DESCRIPTION OF THE PROJECT'S EIA PROCESS

This section presents details by which this Environmental Impact Study was prepared and conducted. It also provides details of analysis of the experts and study personnel.

Silverquest Mining Resources, Inc. has contracted Environment and Climate Change Advisors, Inc. through its affiliate, Prism Express Consulting, Inc. to conduct an Environmental Impact Study for its proposed Seabed Quarry Project located offshore of Cavite in Ternate and Naic. The report called Environmental Impact Statement (EIS) details the dredging activities on the surrounding environment off Manila Bay. The same report will be submitted to EMB Central for the proper review and approval of ECC.

The EIS for Manila Waterfront City Reclamation Project had been completed in 2018 and, subsequently, ECC is issued in 2019. The Manila Waterfront City Reclamation Project shall become the beneficiary or recipient project of the SMRI dredging activities. The reclamation comprises of 318-hectare land mass development planned by the Manila City LGU in joint venture with Waterfront Manila Premier Development Inc. The reclamation which is a subject of separate and distinct compliance is located at the southwest side of the Quirino Granstand in Luneta Park. This reclamation is envisioned to become a self-contained mixed-use community.

Essentially, this proposed seabed quarry or dredging activities of SMRI is the subject of this EIS; which EIS focuses mostly on the dredging offshore of Naic and Ternate. As earlier stated, the reclamation of Manila Waterfront City, in which the dredged fill materials will be shipped to or transported, has been extensively discussed in the earlier EIA studies and in fact granted a separate ECC by the DENR.

Through this EIS, SMRI provides the environmental management strategies during the lifetime of the dredging activity, which is expected to last in more than 10 years. When completed, the dredging is expected to extract an estimated 60 million cubic meters of dredged fill materials. The EIA also considers measures to mitigate the effects of dredging on the surrounding local maritime areas and shoreline communities off Naic and Ternate.

This EIA follows essentially the DENR procedural guidelines under DAO 2003-30, DENR MC 2010-14 and EMB MC 20011-005. Cumulative effects/impacts, hazards and risks that could occur during the various activities of dredging are provided with integrated manner of management and remedy and offer inputs to further rationalize the planning of the various developments within the purview of climate change, resource efficiency, and environmental soundness.

2.1. Terms of Reference of the EIA Study

The SMRI Seabed Quarry Project falls under Category A: Environmental Critical Project (ECP) as defined in EMB Memorandum Circular 2014-005 or the Revised Guidelines for Coverage Screening and Standardized Requirements. The content of the EIS is also based on the results of the holding of Technical Scoping last January 18, 2021.

2.2. EIA TEAM

The members of multi-disciplinary team of researchers and specialists who participated in the conduct of the Environmental Impact Assessment (EIA) including their corresponding fields of expertise are shown in Table 2-1.

Table 2-1 EIA Team

Consultant	Module
Engr. Allan Plete	Project Manager
Mr. Reynar Rollan	Team Leader/ Geotechnical
Engr. Aldwin A. Camance	Risk Assessment
Dr. Merlyn Rivera	Socio Economics Specialist
Mr. Manuel Potrido	Sociologist/Social Development/IEC Specialist
Mr. Roy Aurelio Metin	General Geology
Mr. Delio Cimatu	Public Participation Specialist
Mr. Rogerio Espiritu	Bathymetry Survey
Dr. Katherine Sanchez Escalona	Coastal Marine Ecology and Water Quality
Engr. Oliver Barbosa	Bathymetry and Survey and GIS mapping
Mr Rommel Peneyra	Climate Change and Disaster Risk Management
Mr. Jones Melendres	General Ecology

2.3. EIA Study Schedule

The EIA team has started the preparation of EIA works from the staggered dates of October 2020 to February 2021. The EIA has took note of the SMRI Environmental Work Program for the Offshore Exploration which was done in 2017 and submitted to MGB. These form part of the required submissions of SMRI with MGB under the application for Government Seabed Quarry permit.

Table 2-2 the EIA Study Period

ACTIVITY	DATE	AREAS COVERED
Environmental Work Program for Offshore Exploration	October 2016-July 2017	Landform
Exploration Work Program	October 2020 to January 2021	Literature Search: geophysical data, lithological data Geophysical survey
Application for a Government Seabed Quarry permit	November 2020 to January 2021	
Hydrography and Bathymetry	December 2020	Project Site and Immediate Vicinity
Secondary Data Researches	November 2020 to January 2021	Naic and Ternate, offshore areas, Manila Bay
Marine Study	December 2020	Project site and immediate vicinity
Water Sampling and Laboratory Tests	December 2017	Project site
Consultation with LGUs and stakeholders	November to December 2020	Project site
Drafting of EIS Report	December 2020 to January 2021	
Final Review and Submission of Report	February 2021	

2.4. Direct and Indirect Impact Areas

Primary impacts are impacts that are direct while secondary impacts are referred to as induced impacts of any planned project activities. The term does not imply secondary importance but rather refers to the timing and scope of the impacts. Primary impacts generally occur at the same time and place as the action viz a viz dredging. They are associated with the developmental activities that are generally obvious and quantifiable. Secondary impacts likely occur later in time or different place as a result of the development, which include additional project development, traffic increases, change or increase in local population and migration occurrence. The direct and indirect impact areas further below.

2.4.1. Direct Impact Area for Air Quality

Direct Impact on Ambient Air Quality are areas where ground level concentrations of emissions more particularly nearby community concentrations would be higher than the standards. Air Modelling was actually prepared based on the emissions of ships to be used in dredging however found did not exacerbate ground level ambient pollutant concentrations at Ternate and Naic. It does not affect the local air quality condition in the area.

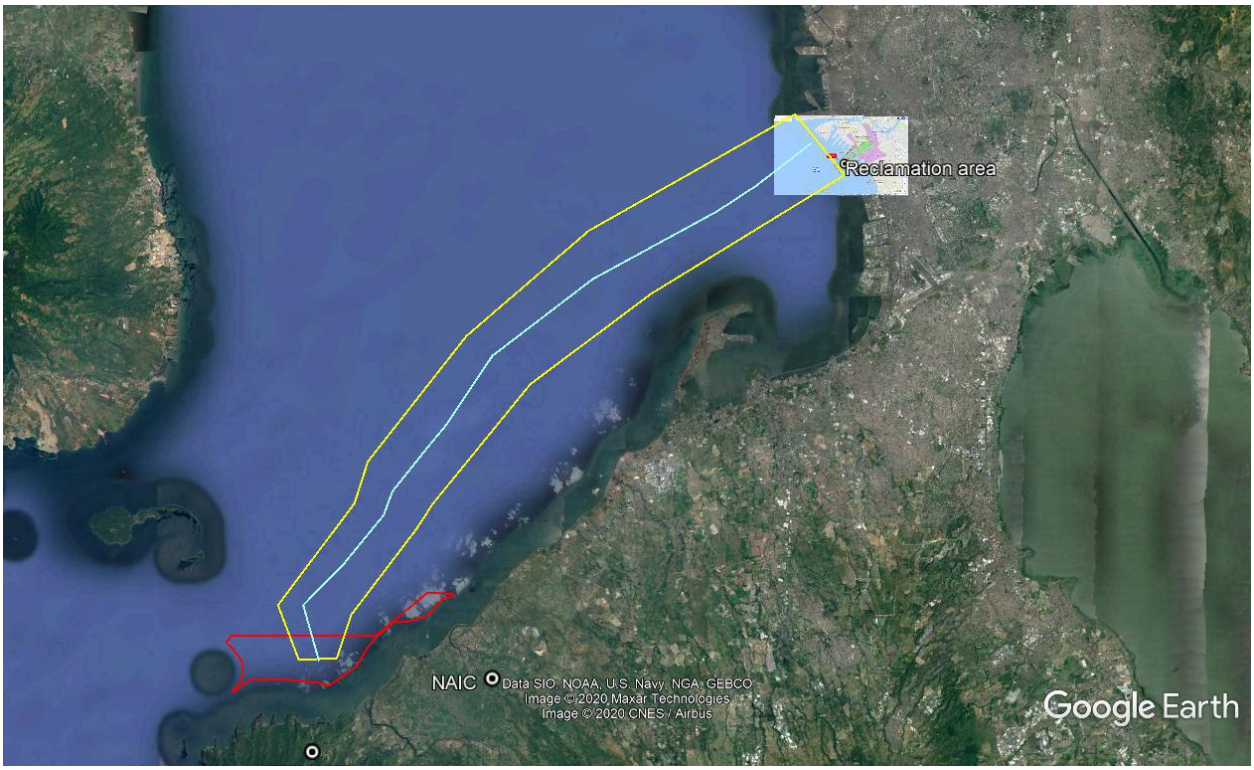


Figure 2-1 Impact Area for shipping traffic to and from the reclamation area

2.4.2. Direct Impact Area for Water Quality and Quantity Impacts

Direct Impact on Water Quality is where it will exceed the ambient standards or groundwater could be contaminated. There may become considerable turbidity where the dredging operations would take place but these may be fleeting considering the high currents in the Manila Bay area off Ternate and Naic. A modelling study has shown that turbidity values go back to a typical background from 300-400 meters from the source of dredging; on the other hand, the effects of continuous dredging and the effects of calm waters means it may activate at locations up to 2.5 kilometers from the dredging point, as shown.

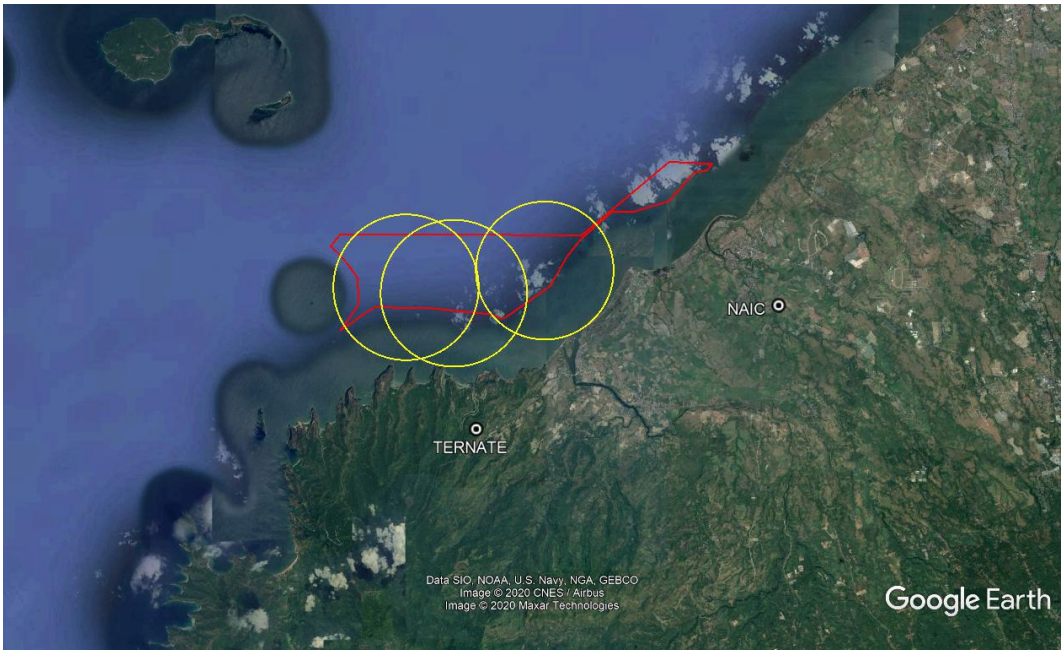


Figure 2-2 Turbidity impact areas considering 4 ships at different points along the area

2.4.3. Direct Impact Areas for Impacts on Land

Direct impact on Land environment are those directly vulnerable to potential flooding, which is mostly the coastal areas or which areas that may cause the deposition of sand or silts near shores off Ternate and Naic. Potential erosion of the shoreline off Ternate and Naic would need further study as it may become possible due to changes in bathymetry of the area.

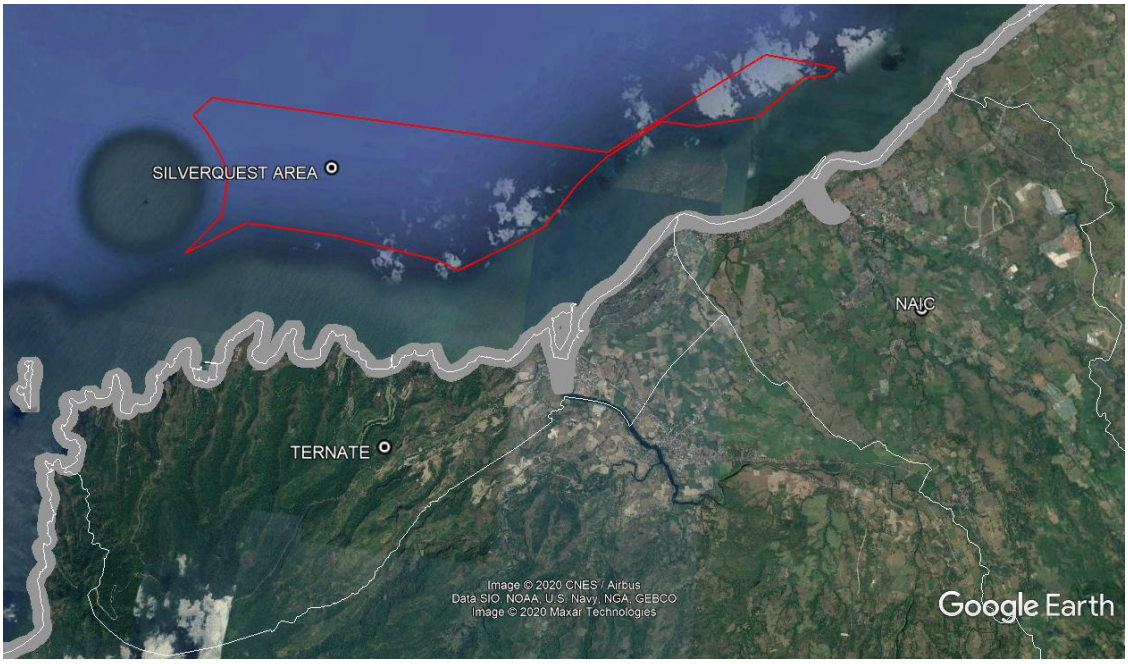


Figure 2-3 Direct Impact Area for Land (the shores of Naic and Ternate

2.4.4. Direct Impact Areas for Impacts on People

Direct Impact on the People Sector considers the local populations in the barangays and municipality which may likely benefit from the introduction of additional taxes, royalties, and social development fund, among others, to be derived from SMRI through the LGU. As the quarry area is within the municipal waters off Ternate and Naic, then these municipalities will surely benefit from the project.

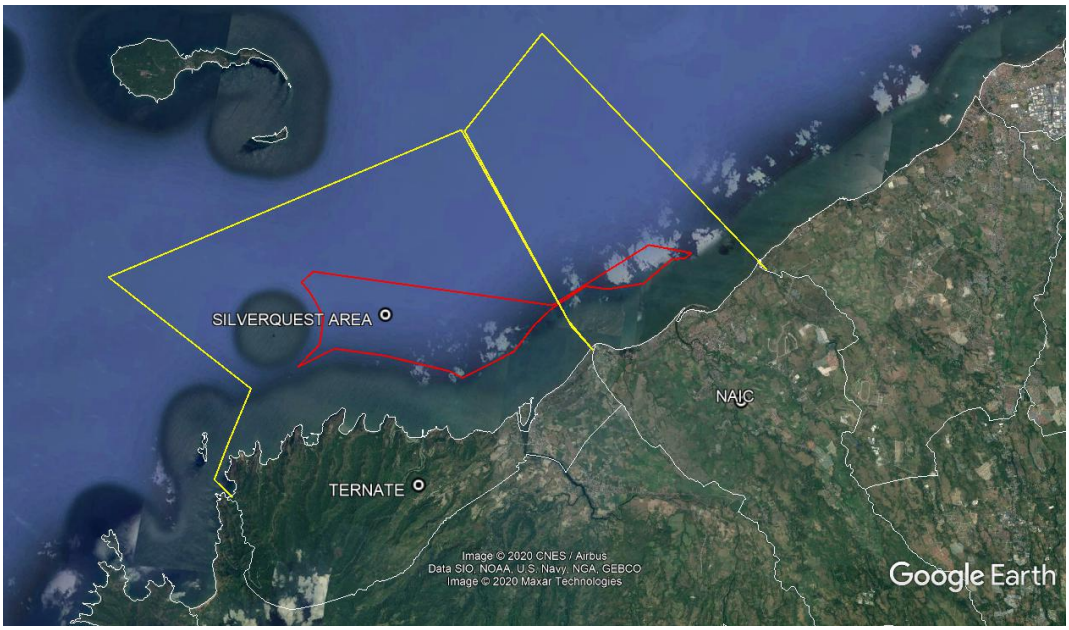


Figure 2-4 Naic and Ternate Municipalities as direct people sector impact areas

2.5. EIA Approach and Methodology

The EIA study was divided into components: air sector, water sector, land sector, and people sector. The approach and methodology are as follows:

Air Sector

- Determination of the current state of ambient air environment in the locality
- Introduce modelling application to determine the effect of emissions of dredge ships

Water Sector

- Determine data on tides and currents in relation to dredging activity
- Determine the sediment Flow
- Marine Biological survey

Land Sector

- Determine the official municipal waters zone or use of the site for dredging
- Look into the geology and geomorphology of the seabed quarry site

People Sector

- Use of data from the municipalities
- Conduct of Key Informant interview, Focus group discussion, household interviews despite the pandemic
- Prepare socio-economic assessment of the area

Table 2.4 presents the methodologies used for the gathering of primary and secondary data for the different components.

Table 2-3 Methodologies for each component

Module / Section	Baseline	Methodology
LAND		
Land Use Classification	**Secondary data:** The Comprehensive Land Use Plan (CLUP) of Naic and Ternate	Assessment of the land uses in the coastal areas that may be affected by the dredging activities
Geology	**Secondary data:** Geologic, seismic, hazard maps and evaluation based on government data and maps.	Identify and assess project impact in terms of the changed in topography including existing hazard as maybe aggravated
Pedology	**Primary data:** Geotechnical Studies	Describe the physical properties and erodibility potential of the soil, ongoing erosion processes in the shoreline
WATER		
Hydrology / Hydrogeology	**Secondary data:** Existing drainage system. Historical flooding occurrences onshore	Identify and assess project impact on the change in drainage morphology, local drainage and resulting effects of flooding
Marine Water Quality	**Secondary Data:** Standard Methods for Water Quality Sampling and Monitoring.	Assess impacts on siltation of surface and coastal marine waters
	Water Body Classification: DENR Class SB for Manila Bay	
	Parameters Considered: pH, BOD5, COD, DO, Oil and Grease, TSS, Heavy Metals, Fecal/Total Coliform, Nitrates / Phosphates	

Module / Section	Baseline	Methodology
Sediment Transport	Secondary Data: Assessment of effect of Tides and wind on the transport of sediments	Use of a Sediment Transport Model
Oceanography	Topographic map covering the Manila Bay from NAMRIA. Depth surveys available in the project area. Post-processing of the interpolated bathymetry of the areas covering Manila Bay	To determine the topographic configurations of the sea bed (referred to as "bathymetry"), available topographic map covering the Manila Bay from NAMRIA were digitized and merged with the depth surveys available in the project area.
Marine	**Primary data:** Abundance/ density/distribution of ecologically and economically important species, mangroves, benthos, planktons, coral reefs, algae, seaweeds, sea grasses	Transect and spot dives surveys marine resource characterization (e.g. city/municipal and commercial fisheries data. Key informant interview.
AIR		
Air Quality	No primary data since the operations are all off shore and far from populated areas. Secondary data using some air modelling to determine extent of plumes from ships	**Methodology:** use of a Gaussian Plume assessment model for SOx and Nox
Contribution in terms of GHG	Data in Greenhouse gasses	Estimate of projected greenhouse gasses (GHG) from Ship ping
PEOPLE		
Demographic Profile / Baseline	**Primary data:** Conduct of Public Perception Survey, Public Scoping **Secondary data:** Comprehensive Land Use Plan of Naic and Ternate	

2.6. Public Participation

Public participation was achieved through the conduct of assorted social methodologies such as site key informant interviews, focus group discussions, perception surveys and the Public Scoping. These activities, both formal and informal, have provided avenues for the stakeholders to express their issues, concerns and perception about the project. The Public Scoping was made on December 3, 2020 using the online platform.

Stakeholder	Question/concern	Response by the Proponent Representative and Consultant
Hon. Chairman Jun Gomez Linayao Brgy. Bucana, Ternate	Informed about the local government resolution on the proposed removal of sandbar that is blocking the river mouth of the Maragondon River (left river mouth when facing the sea) and removal of the old stockpile of armor rocks and boulders in the estuary. The communities along shore (Barangay Bucana) has opined that widening the river mouth and removing the blockade would relieve the flow of water from the Maragondon River onto the Manila Bay, which they suspect to contribute and cause local flooding of their area hence, affecting the coastal barangays.	Engr. Steve of SMRI: Explained that the Memorandum of Agreement (MOA) with the LGU Ternate governing the dredging of the river mouth is expected to become ready by December 2020. It means an initial arrangement has been made already for both parties (SMRI and LGU Ternate) to implement the request of the community to remove the suspected blockage at the river mouth.
Representative from Dalaroy Beach Resort, who is among local resort owners in the area and whose sentiments may be considered the same with other beach operators in the area.	Inquired about the duration of the environmental studies for the proposed project	Engr. Allan Plete: The studies to be done may take several weeks as it will entail sampling, analyses of results and more importantly the study on the water dynamic modelling to assess the movement of silts during quarrying. All these information will be based on data to be gathered on site with most particular area or region off the bay (quarry site some 2 to 6 km from the shore).
Mr. Erdie Del Rosario	Requested that part of the environmental studies to be conducted should include the analysis on the problems of erosion along the coastlines where most resorts are operating.	Engr. Allan Plete acknowledged that such concern will be included in the study. Data and information gathering is currently being done by member of the EIA Team.
Hon. Chairman Nelson Mendoza of Brgy. San Jose	Inquired about the possible effects of the proposed project to the fishermen.	Engr. Allan Plete assured the Chairman that the EIA study will deploy environmental specialists. It includes marine biologists, geologist, and engineers to get involve in assessing the implication of the project on the fisher folks.

Engr. Luis Ferma, Chief of Municipal Planning and Development Office, Ternate	He expressed concerns about Ternate's recently concluded talk regarding Bataan-Cavite Interlink Bridge Project in Manila Bay. This bridge project, though relatively away from the location of the quarry site of SMRI, had said that the Ternate Zoning Ordinance prohibits quarrying within the jurisdiction of Ternate. Accordingly, the Community Development Plan and Comprehensive Land Use Plan (CLUP) will both expire within the year (2020) and he inquired on the impact of such national strategy against the local plan. Engr. Ferma also informed the Ternate Coastal Use Plan does not allow reclamation as well.	Engr. Allan Plete responded and requested Engr. Ferma the posiblity to provide the EIA Team with the records of such local plan and ordinance. The EIA team will try to define or delineate the metes and bounds of such projects and translate them into readable maps. The intention of mapping is to clearly provide proper analysis and/or harmonize both the existing and planned projects, including the local policies and activities in the bay or area of jurisdiction. Engr. Steve explained that the San Nicolas Shoal is an area dedicated by PRA and DENR as green delineated area for seabed quarry or borrow pits. The quarry area awarded by DENR (MGB) to SMRI is also within the same San Nicolas Shoal.

SECTION 3.0 PROJECT DESCRIPTION

This section of the report provides the Project Description details of dredging activities to be undertaken by Silverquest Mining Resources, Inc. (SMRI), which quarry or dredging site is located within the San Nicolas Shoal (SNS) as identified offshore borrow area by the Philippine Reclamation Authority (PRA). Specifically, the site is about 2 to 6 km offshore areas of Ternate and Naic in the Province of Cavite. This offshore area has been previously identified by the PRA to be a possible source of dredge fill materials for the long-term expansion and reclamation of Manila Bay. It has been estimated to have a deposit of approximately 2 billion cubic meters. PRA have already conducted soil exploration as indicated in the feasibility study of the area. In fact, mostly of the SNS area is covered by substantial studies including EIA and ECC for the PRA.

The specific dredging activity of SMRI will support the Manila Waterfront City Reclamation Project. It intends to provide the necessary dredge fill materials coming from the shoal deposits (SNS).

Manila Waterfront City is project of LGU Manila which shall be composed of two land mass structures to be located west of the existing shoreline of City of Manila at the back of Quirino Grandstand and up to the breakwater of Manila South Harbor. It is bounded on the north by Manila South Harbor; on the south by the Army Navy Club; on the east are Hotel H2O, Manila Ocean Park, Quirino Grandstand and US Embassy; and on the west by Manila Bay. As reported, the activities of the reclamation project are already covered by previous EIS and some details relevant to dredging are replicated under this report.

3.1. Project Location and Area

Location and Area. The seabed quarry site will cover the approx. 2,124.3581 hectares off the coast of Cavite in Manila Bay; within the municipal waters off Ternate and Naic (shown in the following map). Generally, the quarry site/area is bounded by the Corregidor Island on the northwest, by Fort Drum to the west, by the province of Cavite on the east, and shoreline of municipality of Ternate, Cavite to the south.

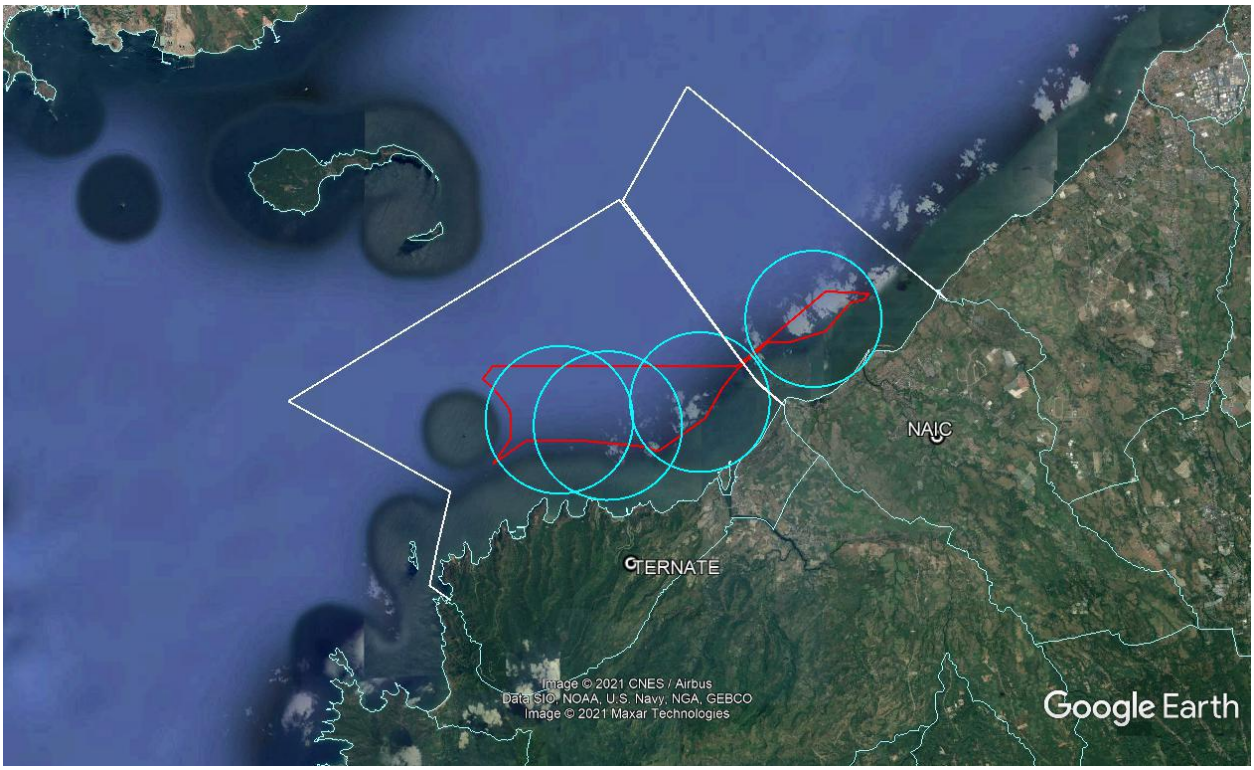


Figure 3-1 The proposed area within the municipal waters of Ternate and Naic

Figure 3-2 Nearby areas to the proposed seabed quarry

This quarry area is actually integral part of what is known as San Nicolas Shoal (SNS), located in the offshore areas of Rosario, Tanza, Naic and Ternate. The SNS was subjected to several studies and had investigated and developed as a major borrow area for the master reclamation plan of the Philippine

Reclamation Authority pursuant to E.O. 153 and its IRR1. There is an active Government Seabed Quarry Permit (GSQP) issued to the PRA by the DENR on August 11, 2008 for a 10,000hectare portion of SNS; however, an additional 10,000 hectares more are needed to ensure an adequate supply of sand fill materials to complete all the planned reclamation projects of the Manila Bay Sector Plan. The subject SNS expansion area that has been selected is actually adjacent to the GSQP site. It covers 4,393 hectares in the north and 2,696 hectares in the south, both within SNS.

Geographic Coordinates of Project Area. Twenty-five (25) corner points have been established that define the geographic coordinates of the planned seabed quarry area/site of SMRI as provided below. The geographical coordinates are vital for (a) identifying the extent of the area being applied for ECC; (b) providing footprints from which the environmental impact assessments would take place, e.g., water circulation, bathymetry; geotechnical investigation and marine surveys; c) determining the distances and boundary limits of the site from critical habitats and nearby environs for purposes of maintaining an adequate and safe buffer from such dredging activities; and (d) ascertain the boundaries of the LGUs municipal waters for securing other governmental permits as may deemed required.

Figure 3-3 Corner points of the proposed seabed quarry area

Table 3-1 Geographic Coordinates of the Project Area

Corner no	Latitude	Longitude
1	14°17'46.00"N	120°38'21.50"E
2	14°17'60.00"N	120°38'31.80"E

[1] Philippine Reclamation Agency. Feasibility Studies on 20,000 hectares PRA Marine Borrow Area in Manila Bay. August 16, 2013

Corner no	Latitude	Longitude
3	14°18'14.35"N	120°38'42.08"E
4	14°18'30.00"N	120°38'42.08"E
5	14°18'45.00"N	120°38'41.15"E
6	14°18'60.00"N	120°38'30.00"E
7	14°19'10.08"N	120°38'21.35"E
8	14°19'20.00"N	120°38'10.00"E
9	14°19'33.69"N	120°38'21.00"E
10	14°19'33.69"N	120°42'60.00"E
11	14°20'55.91"N	120°44'41.01"E
12	14°20'53.63"N	120°45'30.75"E
13	14°20'46.80"N	120°45'24.87"E
14	14°20'43.61"N	120°45'9.35"E
15	14°20'12.15"N	120°44'41.01"E
16	14°20'0.00"N	120°44'0.00"E
17	14°20'0.00"N	120°43'35.00"E
18	14°19'30.00"N	120°42'60.00"E
19	14°19'10.00"N	120°42'43.40"E
20	14°18'37.00"N	120°42'24.00"E
21	14°18'20.00"N	120°42'0.00"E
22	14°17'60.00"N	120°41'30.00"E
23	14°18'5.00"N	120°41'14.69"E
24	14°18'12.00"N	120°40'0.00"E
25	14°18'12.00"N	120°39'0.00"E

Accessibility. For the dredging activities, dredging ships will travel to the quarry site (location as described above) coming from an origin pier/jetty or near the port of Manila. It will conduct the needed dredging activities, extracts and carries and loads off the mud, silts, and sand to the designated operational station for hydraulic reclamation, which location is Manila Waterfront City in Manila.

For the auxiliary operations, service boats will sail off Ternate from a jetty pier or accessible shoreline; and plans to establish a small labor/workers camp in the town of Ternate, Cavite. These small labor camps are considered rented houses or apartments in the locality, therefore, will not entail new separate construction, though will add to local business contributions in Ternate. Locally motorized bancas in Ternate, which are readily available along its coastline will be hired and utilized to sail during the actual operations of dredging in the area.

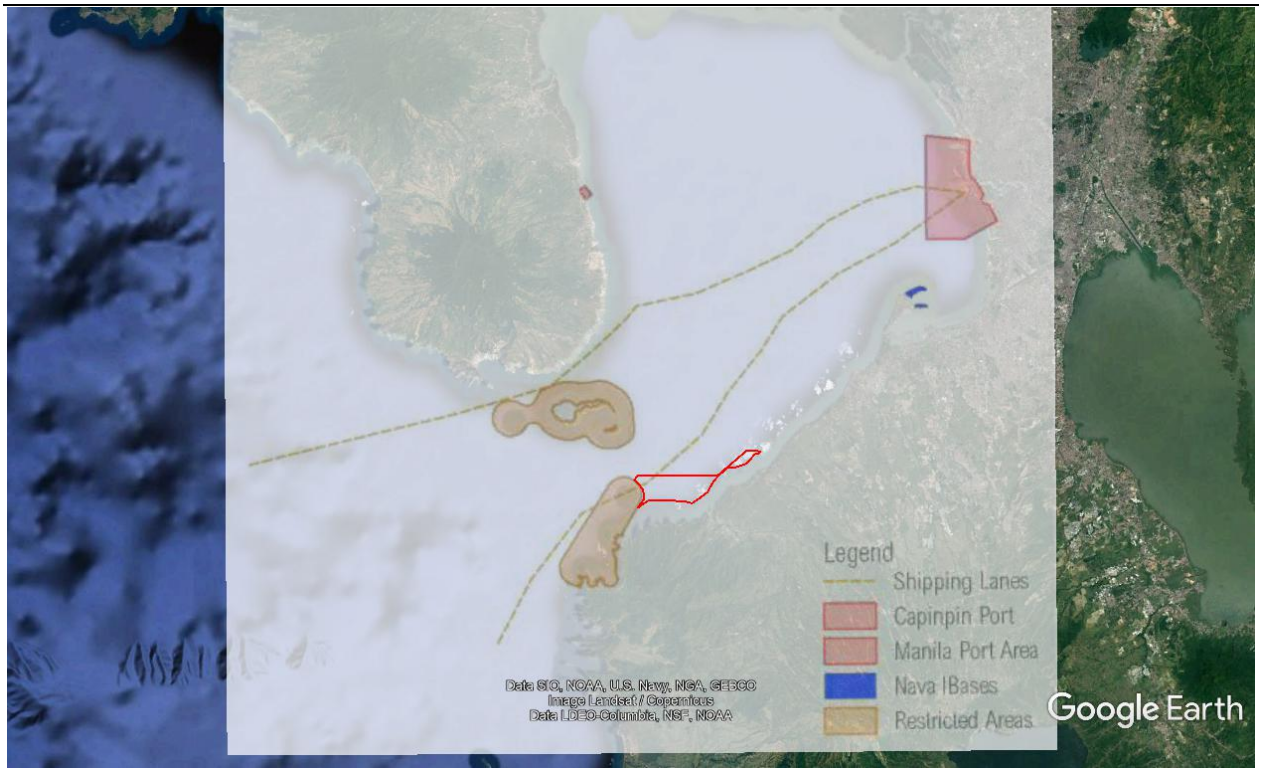


Figure 3-4 Existng Shipping Lanes in Manila Bay with the Silverqest area overlain in red

Figure 3-5 Possible ship path using shipping lanes for the dredge ships to the reclamation point

3.2. Project Rationale

Manila Bay is no doubt a prime gateway for socio-economic development of the Philippines and the country's most significant area in terms of economy and governance. However, the immense ecological, economic, cultural, historical and aesthetic values of Manila Bay and its sustainability are seriously under challenged by the interconnected environmental, social, and economic and developmental pressures.

In the same context, such developmental pressures can and may support the acceleration of growth in helping generate the much needed employment and revenues for LGUs around Manila Bay and other developmental or government owned and controlled agencies. Ultimately, development of Manila Bay aims to render the continuous development and social services, security and health care, among other services for the residents/people and stakeholders and businesses around the Manila Bay Area.

This planned seabed quarry project of Silverquest Mining Resources Inc. (SMRI) will be very important in supporting the Manila City Government's objective in reclaiming and developing more areas that will allow city government with much needed spaces for businesses, government facilities and economic destination. Manila has few alternatives to meet the increasing requirements for its areas to accommodate and satisfy the demand of rapid commercial and residential growth. One of these is the creation of more lands along its coastal areas for economic activities through reclamation developments and along the coastal areas of Manila Bay. It is imperative that the source of materials will be nearby (for economy) and should not contribute to the increase in pollution of the Bay. Thus, the option to obtain the dredge materials from the Bay itself was considered and finally chosen as the best alternative to supply the needs for the materials required for the reclamation.

It would not be the first time the site for the seabed quarry in Ternate and Naic was considered for dredging for reclamation purposes. A previous Environmental Impact Statement (EIS) done in 2007 had identified the San Nicolas Shoal (SNS) as prime area for dredging, and a Government Seabed Quarry Permit was in fact issued to the Philippine Reclamation Authority in August of 2008. The previous EIS Report of the SNS had stated the absence of major marine species in the area. It also showed no coral cover in the except for an approximately 2-4% coral swathe in the Municipality of Ternate while the rest of the identified quarry area has no coral communities. The proposed seabed quarry of SMRI has been covered in the EIA study area of PRA as shown on Figure 5. The current (2016) coastal resources mapping indicates the location of aforementioned coral areas off Ternate and shown in Figure 15. Note that the overlap between the Silverquest Seabed Quarry and the PRA Seabed Quarry was only for the new or additional areas as announced for PRA SNS; PRA obtained a Seabed Quarry permit for Phase 1 Area of 10,000 hectares.

In general, both these maps very clearly show the proposed Silverquest Seabed Quarry area is also within the already considered to be the source of reclamation materials for Metro Manila. It is the same area devoid of coral cover.

Based on the PRA EIS Report, the volume of reserve at the SNS may reach up to 2,009,336,597 m^3, which is way above the requirement for Manila Waterfront City Reclamation project, which would need some 90,000,000 m^3. There is thus more than enough dredge material in the SNS area for dredging and reclamation projects.

SMRI now subjects the proposed Seabed Quarry site to the Philippine Environmental Impact Statement System in order to obtain an ECC for dredging the said quarry.

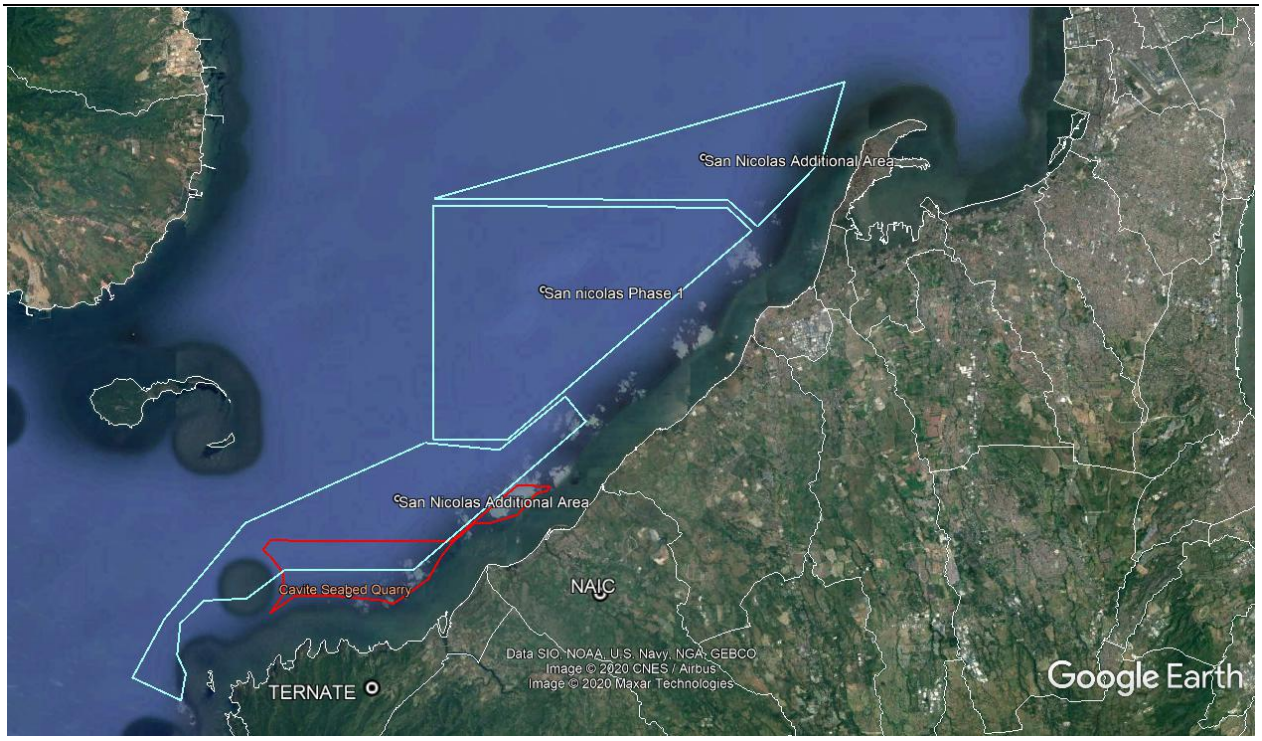


Figure 3-6 The Seabed Quarry vis-à-vis the PRA San Nicolas shoal area.

3.3. Project Alternatives

Project alternatives provide design concepts and options encountered at the early stages of project design development. Basically, it starts with a project description and comparison of the various alternative plans that had been considered during the feasibility study and project impact analysis; they are the bases for final approval of the quarry plans and permitting applications.

The EIA guidelines require discussion of the consequences of not carrying out the project activity as against the full project implementation of the proposed project plan.

3.3.1. No action, No use for the Area

The "no action – no use of the area" alternative means that the dredging project will not push through, and that no activity would take place in the SNS area. The probable impacts of construction and operation of the dredging project including the sediment plumes and the shipping emissions will not likely happen nor produce nor experienced at all. For some, this scenario may fit well for the surrounding environment. However, such a no action would mean that the already approved Manila Waterfront Reclamation Project will look for sources of much of its filling materials from other location or sources, which may make it more expensive to build. Offhand, filling materials may be sourced from Lahar flows of Pinatubo but needs to hauled out using trucks leading to the site of the proposed Waterfront City Reclamation, causing more traffic, congestions, emissions and other land based risks.

The reclamation project is actually part of the greater PRA Manila Bay Sector Plan; a comprehensive and long-term development plan that aims to develop Manila Bay Area into a center for growth. Eventually, it will create the needed economic effect to the commercial, industrial, residential, and recreational sectors,

founded on the creation of new land through reclamation. This type of development is seen to be carry the national development through significant creation of employment and business opportunities, and the urban renewal.

3.3.2. Full Project as to the Proposed Project Development Plan

The primary aim or objective of the SMRI Seabed Quarry Project is to provide the suitable dredge fill materials to the development of Manila Waterfront City Reclamation. Thus, the dredge fill are composed of specified materials only for reclamation and which is economical, environmentally safe, and expeditious to develop. These resources are made of mud, silt, sand and some rocky materials. The specifications for the dredge fill materials are as follows:

General Specifications for Dredge Materials (Preliminary)

- These materials shall be free of rock boulders, wood, scrap materials, and refuse
- These have no high organic content
- The particle size shall be more of fine to medium size sand
- It is capable of being compacted in the manner and to the density of not less than 95 %
- Shall have a soaked CBR value not less than 25 % as determined by AASHTO T 193.

Other requirements for dredging are made after full completion of geotechnical investigation and in consultation with the prospective Reclamation/Dredging Contractor.

Alternatives that were studied in order to provide the better reclamation materials include the following San Nicholas Shoal (SNS).

- Since the materials coming from the Manila Bay have the characteristics relatively similar to the seabed at quarry source or site, minimizing the introduction of foreign materials is evident.
    - Closest to project site.
    - Does not have or requires to get an ECC
    - Will be contracting with another agency for the materials, which may raise costs
- Lahar from Mt. Pinatubo
    - Suitability with respect to quality still to be evaluated
    - Transport considerations.
    - Cost considerations.
    - Permitting/Clearances consideration still to be established.
- Sources from river mouths or deltas in Pampanga, which sources are saturated with other quarry operators;
- Sources from river mouths or deltas in Mindoro, which locations are too far and expensive to operate.
- New Seabed Quarry situated in Cavite
    - Same advantage with regards to materials as SNS
    - Also close to the project site
    - Will also have to undergo the PEISS as the SNS will

- A new Seabed Quarry permit and new ECC means that SMRI can operate the quarry on its own and without further layer of royalty costs from operating a PRA quarry.

It is from these considerations that the new Seabed Quarry Site of SMRI was determined to be the best alternative for the Manila Waterfront Reclamation.

3.3.3. Comparison of the Project Alternatives

The full project development and the no action alternative are of contrasting objectives that may result either advantages or disadvantages.

Obviously, the "no action" alternative will cause no environmental impact as the SNS (shoal) will remain unutilized or unused for which the purpose of the PRA had initially envisioned. However, in order to provide the type of urban renewal for an already crowded Metro Manila, more new land space is needed. For instance, large portions of Singapore, Hong Kong, and Macau are reclaimed. Currently 10%, 5% and 33% of total land surfaces of Singapore, Hong Kong and Macau respectively comprise of land reclaimed from the sea. Even these proportions of the reclamation continue to increase in size.

Manila therefore should also adopt the same developmental tactic to sustain the forefront growth of the country.

3.4. Project Development Plan, Process/Technology Options and Project Components

The Manila Waterfront City will consist of two land mass islands approximately 318 hectares; or an 8.25% equivalent of the existing land base of City of Manila. The estimated volume of dredge fill material is 50 million cubic meters according to the EIS document submitted but this has been revised upwards to 90 million cubic meters under this submission. The PRA offshore study area (the entire 20,000+ hectares) has a deposit of approximately 2 billion cubic meters and considered more than enough to supply the needs of all planned reclamation of Manila Bay and other pending reclamation projects nearby the area. The following details and processes will be used to extract the materials in the SNS area.

3.4.1. Process/Technology Options

Seabed dredging falls under two types according to method of extraction of material as follows[2]:

A. Mechanical Dredger

Mechanical dredging means the works are done by way of digging or cutting. Excavation works will be done by using a bucket with many different forms. The effectiveness of these operations depends on the power that is channeled to the bucket / blade as well as the shape of the outskirts / blade bucket stuck

[2] Herbich, J. B. (1992). Handbook of dredging engineering (2nd ed.). New York:McGraw-Hill.

on the ground. Due to the large forced needed to cope with the rigors of the land, there are several type of the bucket that are used, such as;

a. Shovel shape at the Dipper Dredger;
b. Shape backhoe on Dredger;
c. Form chain on Dredger bucket;
d. Shape grab on Dredger;
e. Shape of a wheel on a wheel excavator;
f. Form drag on Dragline.

Job cuts are usually carried out by using a blade by way of "slicing" in order for the results of the excavation to be separated from the original soil mass.

B. Hydraulic Dredger

A hydraulic dredger is operated by using the power of water pressure. The force from the water jet can be directed toward the dredgers or away from the dredgers. The dredged material is hydraulically lifted from the sea floor using a centrifugal pump. These dredging pumps are not vastly different from ordinary large water pumps; its impeller is designed so as to allow the movement of large pieces of material.
The dredger effectiveness depends on the speed of the water jet and the characteristics of the material. Suction head shape assortment, includes:

a. Head-suction-flat as the Suction Dredger;
b. Ship-pull like the Trailing Suction Hopper Dredger;
c. Dust pan head as in Dustpan Dredger.

The selected technology for dredging is the use of Trailing Suction Hopper Dredgers thus, this technology will be applied. A further explanation of the choice of this technology is provided in the following section

3.4.1.1 The Trailing Suction Hopper Dredger[3]

The characteristics of the trailing suction hopper dredger is a self-propelled sea or inland waterway vessel, equipped with a hold (hopper) and a dredge installation to load and unload itself. In a standard design the trailing suction hopper dredger is equipped with:

- One or more suction pipes with suction mouths, called dragheads that are dragged over the seabed while dredging. In the case of the dredge ships to be used, two suction mouths are used/
- One or more dredge pumps to suck up the loosened soil by the dragheads.
- A hold (hopper) in which the material sucked up is dumped.
- An overflow system to discharge the redundant water.
- Closable doors or valves in the hold to unload the cargo.
- Suction pipe gantries to hoist the suction pipes on board.
- An installation, called the swell compensator, to compensate for the vertical movement of the ship in relation with the seabed.
-

The trailing suction hopper dredger has a very wide application area and is therefore called the workhorse of the dredging industry.

[3] Prof. Wim Vlasblom (2003). University Lecture Notes. Delft University of Technology https://www.dredging.org/dredging-equipment-and-technology/53

Because it needs no anchorage system to position the vessel when dredging, which can be an obstacle for passing ships, in the early days the trailing suction hopper dredger (TSHD) was mainly used for the deepening and maintaining of waterways. Nowadays the trailing suction hopper dredger is also used for land reclamation. Examples of that type of jobs are the large reclamation works executed in the Far East. The reason for a preference of the trailing suction hopper dredger above other types of equipment for this type of work is mainly the fact that the distances to the dump areas for the non-suitable material and distance from the sand pits are too large for a direct discharge and supply with pipelines.

The main advantages of a trailing suction hopper dredger are:

- The ship does not dredge on a fixed position. It has no anchors and cables, but it moves freely, which is especially important in harbor areas.
- The trailing suction hopper dredger is quite able to work under offshore conditions.

The materials that can be sucked are mainly silt and sand. Clay is also well possible but can give some trouble with congestions in the draghead and rutting. Rutting is the slipping back of the dragheads in their old rut or trail. Dredging rock with a trailing suction hopper dredger is in most cases not economical. It requires very heavy dragheads, also called ripper-heads, and the productions are usually very low.

3.4.2. Project Components

Since there is no further land based development will be built, the main seabed quarry component is actually the operations of the shipping vessels for dredging. There are four (4) sea vessels or ships to be used to dredge the designated quarry area as follows:

Table 3-2 Ships to be used by the Project

No	Name	Hold Capacity (m^3)	Total Installed Power (kW)	Laden Draught (m)	Light Load Draft (m)	Maximum Dredging Depth (m)	Manufacture date
1	Tong Tu	20,000	22,320	12.5	6.5	90	2011
2	Tong Cheng	18,000	20,290	12	6.5	85	2010
3	Tong Xu	13,000	20,280	9	6	45	2008
4	Tong Yuan	10,000	15,457	9	4.5	40	2012

Figure 3-7 Tong Tu Dredger Ship

Tong Tu is a Trailing Suction Hopper Dredging Ship operating under the Flag of China. It has a length of 165 meters, a width of 30 meters, and a draft of 9 m. It operates two dredging pipes with a suction pipe diameter of 1.2 meters.

Figure 3-8 Tong Cheng Dredging Ship

Tong Tu is another Trailing Suction Hopper Dredging Ship operating under the Flag of China. It has a length of 162.3 meters and a width of 28.5 meters. It can sail at a speed of 14.5 knots (26.85 km/hr). It operates two dredging pipes with a suction pipe diameter of 1.2 meters.

Figure 3-9 Tong Xu Dredger Ship

Tong Tu is another Trailing Suction Hopper Dredging Ship operating under the Flag of China. It has a length of 155 meters and a width of 27 meters. It has a maximum speed of 15.5 knots (loaded).

Figure 3-10 Tong Yuan Dredger Ship

Tong Tu is another Trailing Suction Hopper Dredging Ship operating under the Flag of China. It has a length of 131.2 meters and a width of 26.2 meters. It has a gross tonnage of 12023 tons and a DWT of 14500 tons.

3.4.3. Project Activities

The seabed quarry ships will adopt the construction technology of digging - transporting – blowing for dredging. During dredging process, the trailing suction hopper dredger enters the designated excavation area to pump in mud and sand and other materials from the seabed.

Afterwards the ship will carry the loaded mud, silts, and sand and bring to the designated reclamation operation location/area some 40-42 kilometers away from the quarry site. This cycle will depend on the volumetric rate of the suction dredger and the capacity of the hold of each of the dredgers.

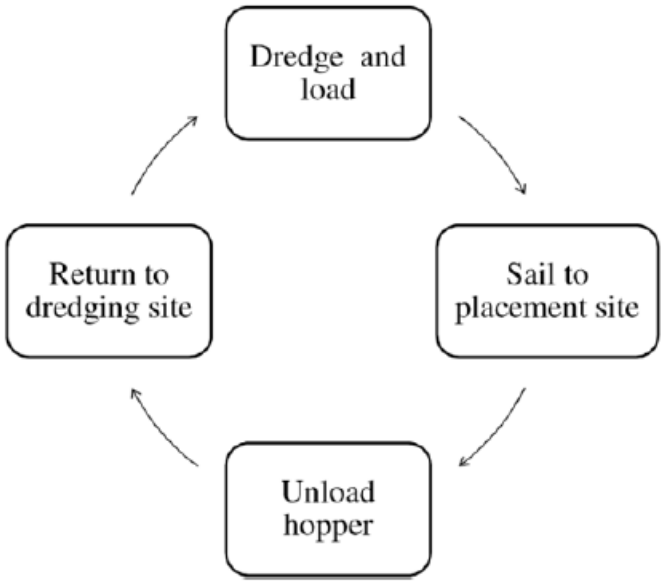


Figure 3-11 Dredging and Filling Cycle

The average speed of each dredger is about 10 knots or 18 km/hr to account for restrictions in speed of vessels entering the harbor area of Manila (limit to 5 knots according to PPA Admin order 03-2006; see also Figure 3-13 and the presence of other marine traffic). This means each dredger would take about 4-5 hours to reach the reclamation area in Manila and get back to the dredging site. Dumping of the dredge materials or cargo would entail a maximum of one hour as dredgers are equipped with mechanical opening doors at the bottom:

Table 3-3 No of hours per dredge cycle

No	Name	Hold Capacity (m^3)	Daily production (m^3)	Maintenance Days per month	Monthly Construction Days	No of hours to full load	No of hours sailing (40 km each way)	No of hours discharging	Total hours/cycle
1	Tong Tu	20,000	12,000	2	28	40	5	1	46
2	Tong Cheng	18,000	11,000	2	28	39.272727	5	1	45.272727
3	Tong Xu	13,000	10,000	2	28	31.2	5	1	37.2
4	Tong Yuan	10,000	7,600	2	28	31.578947	5	1	37.578947

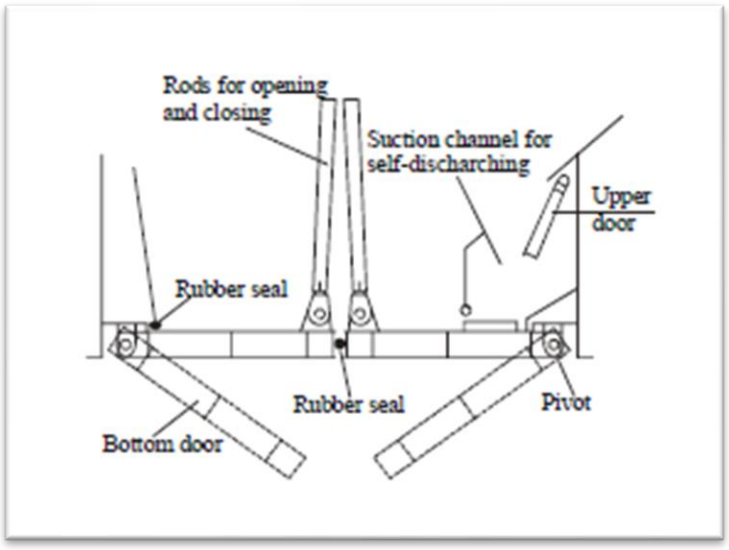


Figure 3-12 Bottom doors opened by rods

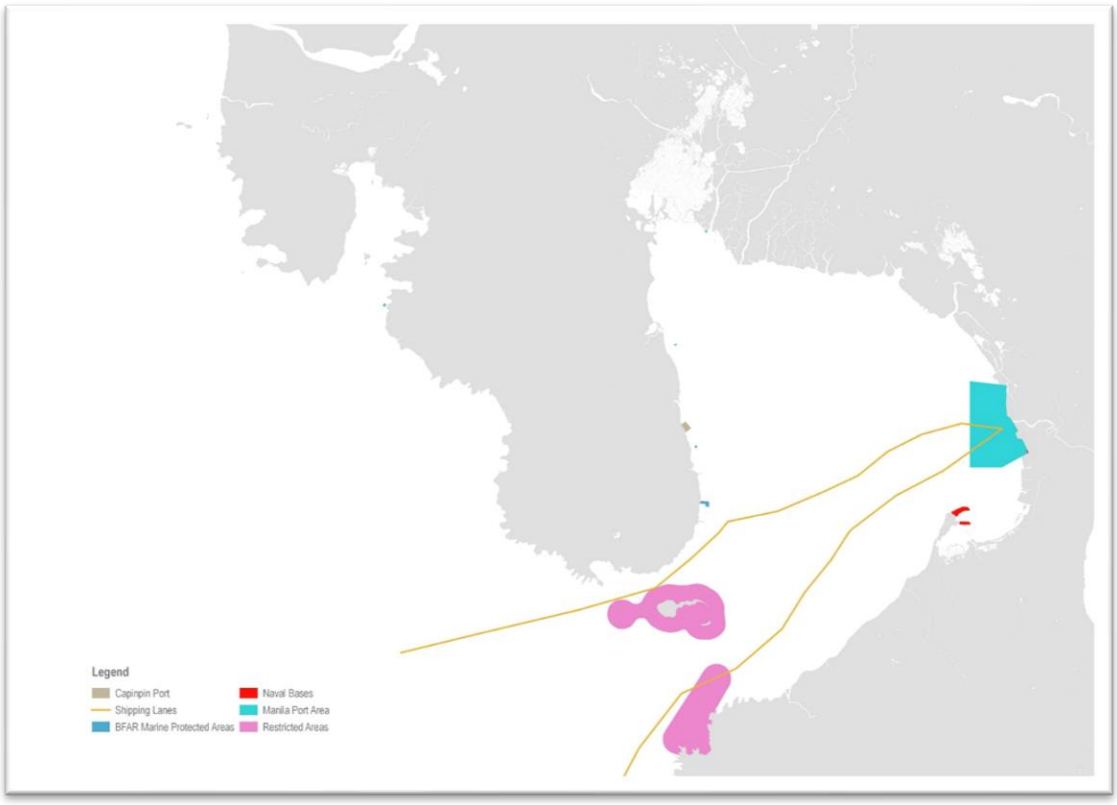


Figure 3-13 Manila Harbor Area

3.4.4. Mandatory Requirements

The implementation of Dredging, i.e. the start of Construction Phase can only be undertaken upon the issuance of the Government Seabed Quarry Permit from Mines and Geosciences Bureau. Some of the major prerequisites for GSQP are: (a) an Environmental Compliance Certificate (ECC); (b) Letters of No Objections (LONO) from concerned government entities; and (c) approval of Design and Engineering Details (DED), which are undertaken post ECC.

The entities that will grant the LONO will impose its own agency requirements that will also influence the dredging methodologies and final master planning. The Mines and Geosciences Bureau (MGB), which issues the GSQP will monitor the dredging operations as mandated in the DAO No.2000-25. These changes will influence the dredging methodologies and master planning.

The MGB evaluates the Feasibility Study and the associated seabed quarry plan. The buffer zone from edge of the dredging limits and the shoreline of nearby LGUs is presently assumed at 1500meters minimum from the shore being a protected or restricted zone.

3.4.5. Dredging Methodology

As earlier mentioned, the Trailing Suction method of dredging will be used to spread the potential environmental impacts of dredging as opposed to suctioning while the ship is on anchor. This is done in what is known as cohesionless deposits, such as sand or weakly cemented granular deposits. A trailing suction dredger is a hopper vessel with a trailing arm suspended over the side and dragged over the sea bed, Figure 3-14 shows an illustration of a trailing suction dredger

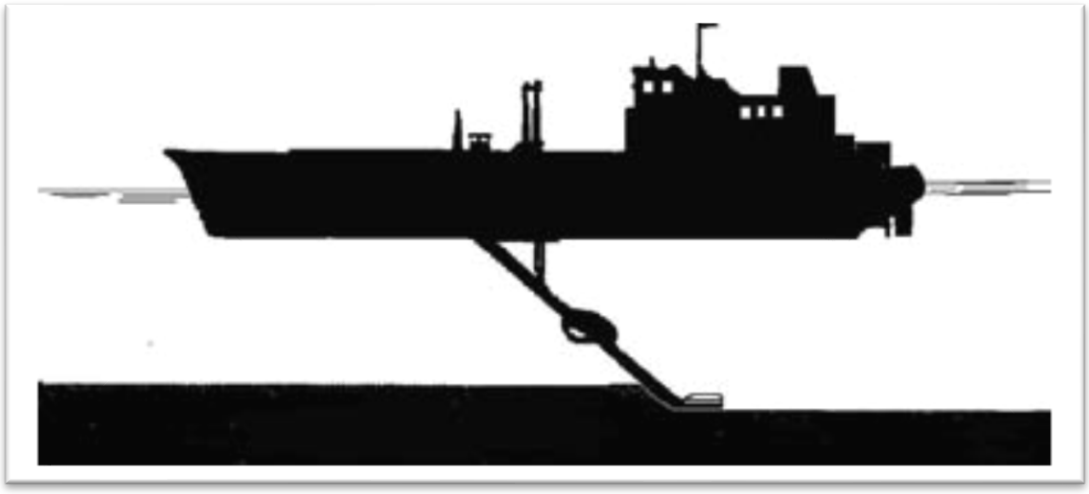


Figure 3-14 A trailer Suction Dredger

The vessel usually steams forward at around 6 knots or about 11 km/hour, automatically compensating for swell and tidal variations while maintaining the drag head in contact with the sea bed by means of a computerized hydraulic system.

The water/sand mixture is drawn on board by powerful pumps, passed through a series of decanters and the solids deposited inside the internal hoppers whose capacity ranges from 2,000 to more than 25,000 cubic meters. In this specific project, the ships to be used will have capacities of between 10,000 to 20,000 cubic meters. The relatively clear, decanted seawater is dumped overboard. The maximum dredging depth without intermediate pumps is around 35 meters. With one or even two intermediate pumps the dredging depth may be extended to 80 and 120 metres. These dredgers are fully automated and dredging generally takes place over a 24-hour period, non-stop.

The advantages of trailing suction dredgers are:

- minimum interference to sea traffic;
- versatility in handling both cohesionless and cohesive sediments;
- the dredged load may be pumped ashore as reclamation; and
- constructed in various sizes to suit most project sizes.

The disadvantages are:

- the final dredged depth is less precise, necessitating some overdredging; and
- mobilization costs can be considerable.

3.4.6. Unwanted Dredged Materials

The first few hauls of dredge materials from the SMRI Seabed Quarry site may contain some unwanted materials. These include wastes, debris, or scrap which have to be removed prior to use of the materials for the reclamation. These will be collected and disposed of properly or may use or commission an accredited third party entity or whose accreditation is considered valid by MGB and DENR/EMB.

Unwanted Seabed soils, if any, may also be disposed of at the Manila Bay with depths of 20 meters or more. Such disposal will become subject to prior approval by the LGU, the Philippine Coast Guard and the DENR/EMB and/or other concerned agencies. Laboratory tests shall be done first on these materials for further checking of trace elements/metal content. If found to have contents beyond the applicable EMB standards and disposal site is offshore, treatment/intervention will be done before final disposal.

3.5. Development Plan, Description of Project Phases and Corresponding Timeframes

3.5.1. Pre-Construction/Pre-Operational Phase

The activities of pre-construction involve preparation of engineering plans and design, and securing all regulatory requirements, such as environmental compliance certificate (ECC) from EMB, and corresponding local permits and clearances from MGB and DENR. Pre dredging activities within the project site entail the conduct of detailed bathymetric surveys to determine the configuration of the shoal and drilling of the exploratory holes and to ascertain the nature and properties of the various layers of sediments. These activities create localized and minor disturbance of the sediment layers.

3.5.2. Construction Phase / Operations Phase

Trailing suction hopper dredgers will be used in the progressive removal of the sediments from the quarry area. The volume is approximately 90 million m3 over a period of about 10 years. Dredging will lead to the partial modification of the gentle slope of the seabed. A series of local trenches or furrows will be generated upon removal of the sediments.

The illustration below provides the procedures of removing silts, mud, and sand from the seabed while the succeeding table provides a step by step procedure for the dredging process.

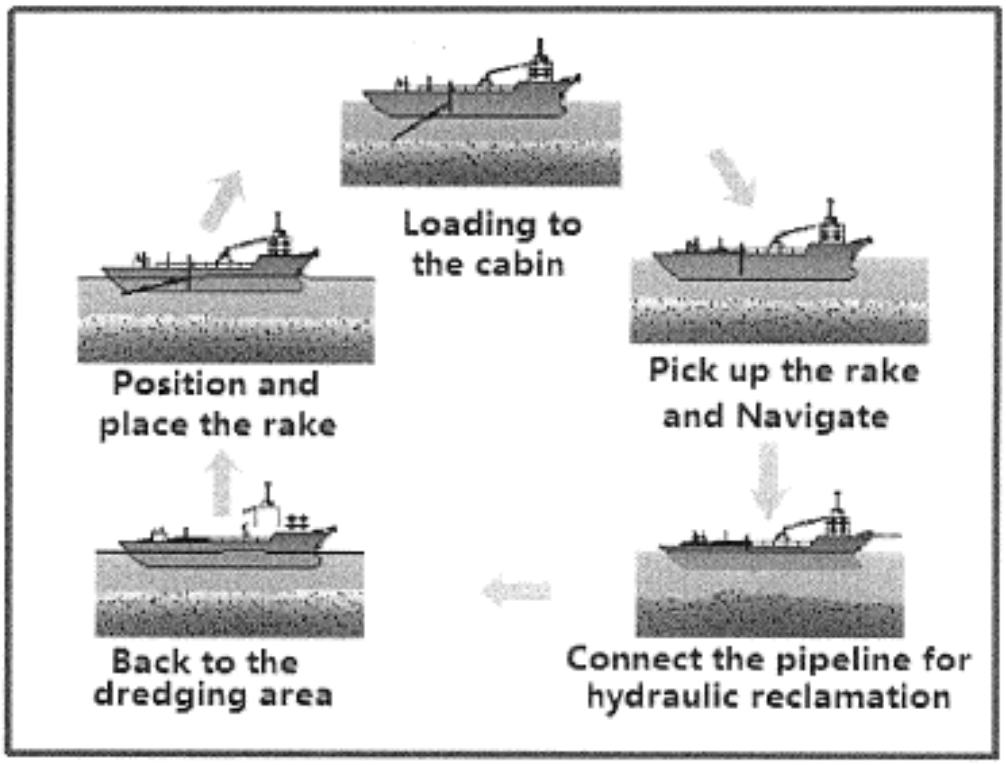


Figure 3-15 The cyclic nature of the dredging/quarrying operations

Table 3-4 Detailed Procedure in dredging operations

Procedures	**Responsibility of Navigator**	**Responsibility of the Dredging and Rake Operator**
1. Navigation from port to the dredging site	The route of the entry point is selected according to the direction of tidal and current within the excavation area.	Inspect dredging equipment to ensure that equipment is in good working condition.
2. Preparation for Dredging	Use the locator to further correct the navigational direction and sail in the right direction. Report and monitor the dynamic conditions of dredgers for appropriate corrective action, if needed.	Check whether the instrument and gate valve of the control console are in normal operating state; inform the pump cabin to prepare the pump, start the sealing pump, and adjust the overflow according to water depth and tide level. The rake operator also adjusts the pressure of wave compensator.
3. Put Rake to Dredge	Before reaching the excavation area, slow down the speed of dredger, control the position of the dredger, issue the rake instruction, and exchange information with the operator during dredging operations	The rake operator will inform the dredger operator when it reaches the optimum area for raking operations. The dredge operator starts the pump and adjusts the required speed. The rake operator then deploys the rake head to the seabed.
4. Controlling the Dredging Operations	Control the dredger's speed, dredging track, and exchange dredging status with the operator.	The dredging operator observes the situation and adjusts the speed of the sluice valve and mud pump and other equipment. The harrow operator pays close attention to the rake head, so that the rake arm and rake head are in the best condition, and keep the high mud concentration into the ship hold.
5. Completion of Dredging	Slow down the speed of the ship based on information from the rake operator. After the rake pipe leaves the water surface, adjust the position of the ship and sail to the reclamation area.	The rake operator lifts the rake head away from the mud surface. The dredge operator releases the mud pump clutch when the pump is removed and the rake is brought on the ship

Procedures	Responsibility of Navigator	Responsibility of the Dredging and Rake Operator
6. Sail to the Reclamation Area	Sail to the operation or reclamation area with full speed choosing the best route according to depth of water and conditions of the ships.	The dredging operator calculates the dredged earth volume and fills in the construction statement.
7. Hydraulic Reclamation	Drop the anchor after the suction dredger arrives at the reclamation area, and connect the hydraulic reclamation pipeline.	Dredging operator starts the mud pump, gradually opens/closes the small mud door control system, and carries out the hydraulic reclamation. After hydraulic reclamation, the pipeline is dismantled, the anchor is lifted, and the dredger again sails to dredging area.

3.5.2.1 Environmental effects

The potential environmental effects created by the sand and gravel extraction on seabed include the modification of sea bottom topography, the creation of turbidity plumes, substrate alteration, possible change in the local wave and current patterns that may impact or reach near the coast or shorelines, which distance is relatively close to Ternate or Naic. The other biological effects of dredging may include changes in the density, diversity, biomass, and community structure of the benthos or fish populations as a consequence of the physical effects on the quarry site.

One dredging activity may not have a significant direct or indirect environmental impact, but the cumulative effect of several (adjacent) dredging locations may induce changes.

For this project of SMRI, offshore mud, silts, sand and gravel extraction or so called dredge fills shall be performed using trailer suction dredging machines or ships. This was considered as opposed to anchor (or static) suction dredging. Both techniques utilize powerful centrifugal pumps to draw up the seabed material into the hopper dredger, through the pipes of up to 1 meter in diameter. The dredged fill material displaces seawater within the bottom hold of the ship, loaded previously as ballast.

Trailer suction dredging by ships under this quarry project requires the dredger to drag the lower end of its rear-facing pipe(s) slowly along the seabed, while the ship is underway. This technique permits optimally with relatively large areas with thin and evenly distributed deposits to be worked on. It is also used for thicker deposits, such as sandbanks, to limit the harmful environmental impacts to the superficial layers. At the bottom, the head of the pipe creates linear furrows, of 1–3m in width and up to 50 cm in depth (Figure 7). However, repeated trailer suction hopper dredging over an area can lead to larger dredged depressions.

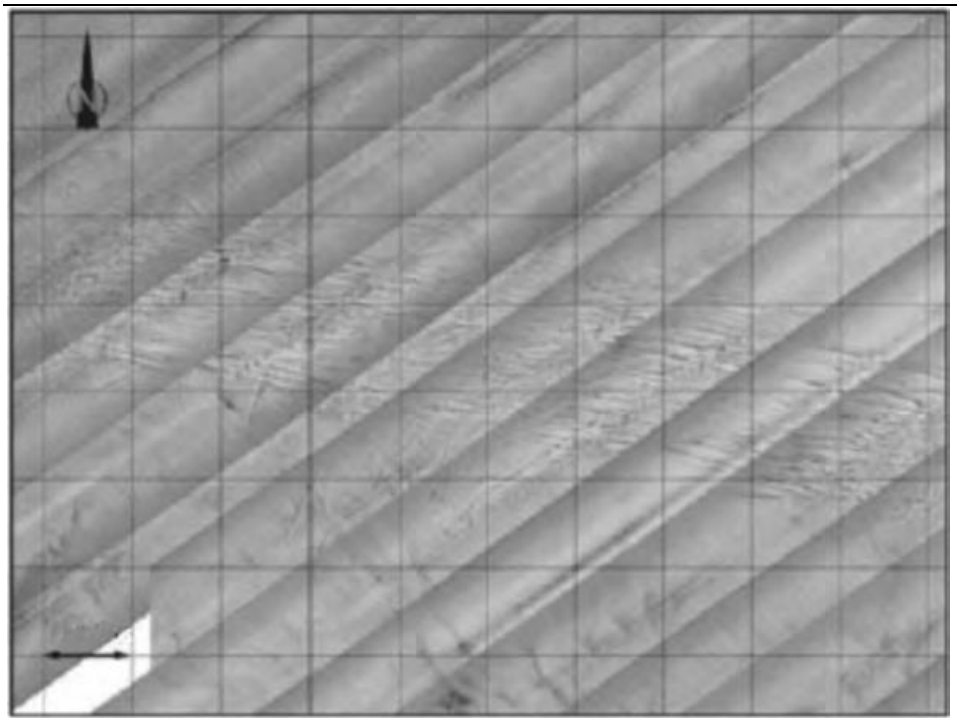


Figure 3-16 Sand furrows due to trailer suction dredging

Dredged area may actually regenerate but the estimation in respect of time is very difficult to establish. It actually depends upon the characteristics of the extracted material, the geometry of excavation, the water depth, and the hydrodynamic regime of the whole system. In some theory, the typical timescales for regeneration of dredged furrows in sandy dynamic substrates lie within months. In very energetic shallow sandy areas, such as those found in estuaries, they may recover after just one (or a few) tidal cycle. The Manila Bay area is benefited by high turbulence as shown in Figure 8 and 9 which will surely influence the regeneration rates of the substrate. These high velocities allow better regeneration rates of the substrates within the areas where the dredging occurs. This will be studied further in the succeeding reporting of the project as part of the EIA monitoring during the actual dredging happens onsite.

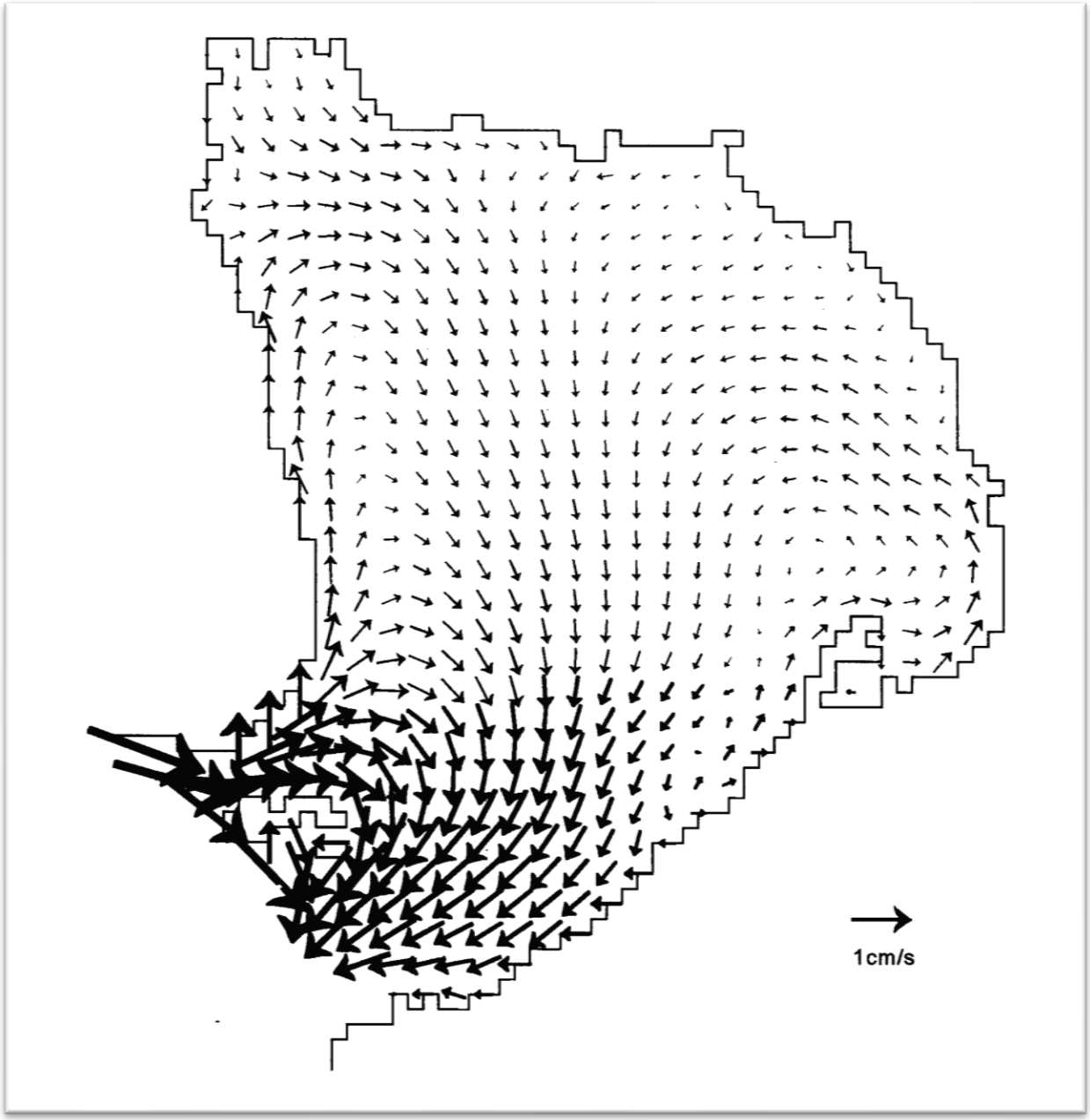


Figure 3-17 Residual Tidal Velocities4

[4] Villanoy, C. and Martin, M. (1997). Modeling the circulation of Manila Bay: assessing the relative magnitudes of wind and tide forcing. Science Diliman. 9:26-35.

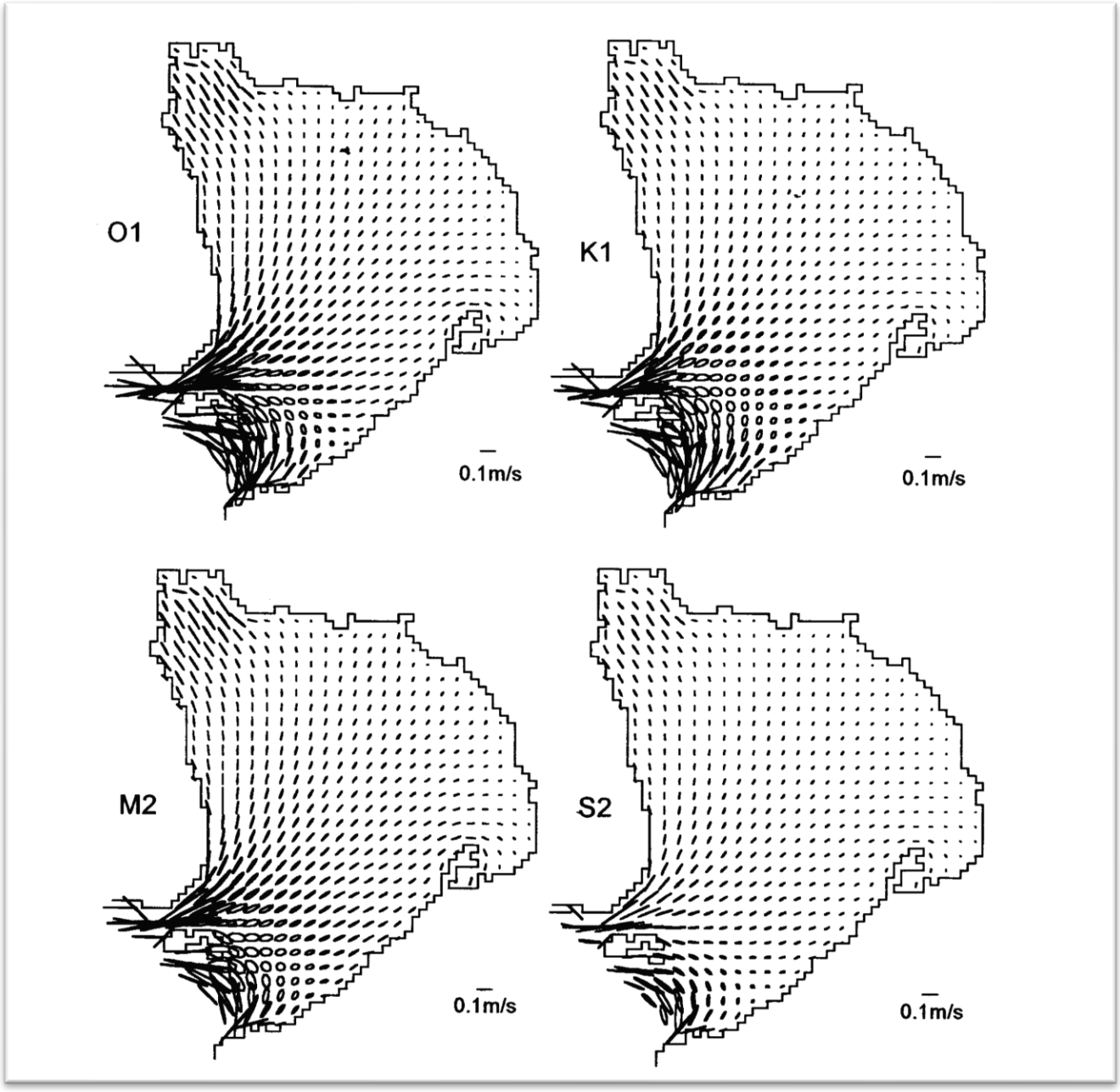


Figure 3-18 Tidal Ellipses of Manila Bay [5]

3.5.2.2 Wastes

Since the dredging ships hold water in their hold ballast, the same ballast water is released at the dredging/quarry area when mud and sand refills the hold. The distance between the two areas (dredging and reclamation) is marginal thus the ballast waters are disposed of from the same Manila Bay. However, the pollution effects, if any, from the ballast water and sediment plumes arising from dredging operations is considered tolerable. The details of the discussion is provided in separate section of this report.

[5] Ibid

Surface turbid plumes are generated from the screening process and the overflow of mud, silts and sandy materials from the hopper during the actual course of dredging. A further source of turbidity, with a far lesser quantity of suspended material becomes the result of the mechanical disturbance of the bed sediment caused by the dragging of head of the pipe on the seabed. However, the large increases in suspended solid concentrations tend to be short-lived and localized, close to the operating dredger. Though, turbid plumes with low suspended sediment concentrations may affect much larger areas of the seabed, over extended time periods (several days instead of several hours), especially when dredging activities are occurring simultaneously and expansively over the quarry claims or from adjacent extraction areas (beyond SMRI claims).

3.5.3. Air Emissions

Dredging equipment release emissions to the atmosphere depending on the ships' fuel use and required power for suction and pumps to extract the materials. The average consumption of diesel fuel from these dredgers are at 0.36 pounds of diesel per horsepower-hour[6] or 0.219 kg /kw-hr. In such case, the emissions for diesel consumption are computed as follows:

Table 3-5 Kg of emissions per kg consumption of diesel

Substance	lbs/1000 gallons diesel	kg/l diesel	Density of diesel kg/l	kg/kg diesel
CO_2	22,543.43	13.12915	0.85	15.44606
CO	117.070765	0.068181	0.85	0.080213
NO_2	0.5661	0.00033	0.85	0.000388
SO_x	4.9956	0.002909	0.85	0.003423
PM-10	13.7727	0.008021	0.85	0.009437
VOC	11.282	0.006571	0.85	0.00773

Source: EIA 2020

[6] Anderson, Mark J. P.E., "Comparison of common dredging equipment air emissions ", Master's Thesis, Michigan Technological University, 2008. https://doi.org/10.37099/mtu.dc.etds/215

Table 3-6 Emissions per hour of the dredgers

No	Name	Hold Capacity (m^3)	Total Installed Power (kW)	TOTAL hours to full capacity	Diesel Consumption (kg/cycle)	CO2 (kg/hr)	CO (kg/hr)	NO2 (kg/hr)	SOx (kg/hr)	PM-10 (kg/hr)	VOC (kg/hr)
1	Tong Tu	20,000	22,320	40	195,507.19	75,495.40	392.06	1.90	16.73	46.12	37.78
2	Tong Cheng	18,000	20,290	39.27273	174,494.47	68,629.11	356.40	1.72	15.21	41.93	34.35
3	Tong Xu	13,000	20,280	31.2	138,557.84	68,595.29	356.22	1.72	15.20	41.91	34.33
4	Tong Yuan	10,000	15,457	31.57895	106,888.61	52,281.92	271.51	1.31	11.59	31.94	26.16
TOTAL						265,001.72	1,376.19	6.65	58.72	161.90	132.62

Table 3-7 Emissions per year of the dredgers considering 9 months operation per year

No	Name	CO (kg/month)	CO (kg/year)	NO2 (kg/month)	NO2 (kg/yr)	SOx (kg/month)	SOx (kg/yr)	PM-10 (kg/month)	PM-10 (kg/yr)	VOC (kg/month)	VOC (kg/yr)
1	Tong Tu	229,097.50	2,061,877.53	1,107.81	9,970.28	9,775.96	87,983.67	26,952.00	242,567.99	22,077.91	198,701.21
2	Tong Cheng	207,759.29	1,869,833.63	1,004.63	9,041.65	8,865.43	79,788.84	24,441.68	219,975.14	20,021.57	180,194.12
3	Tong Xu	200,772.22	1,806,949.94	970.84	8,737.57	8,567.28	77,105.49	23,619.69	212,577.23	19,348.23	174,134.07
4	Tong Yuan	153,321.22	1,379,890.94	741.39	6,672.51	6,542.47	58,882.19	18,037.36	162,336.21	14,775.42	132,978.80
TOTAL		790,950.23	7,118,552.04	3,824.67	34,422.02	33,751.13	303,760.20	93,050.73	837,456.57	76,223.13	686,008.19

3.5.4. Abandonment Phase

The stirred-up sediments from the quarry source will eventually settle into the seabed at rates dependent on particle size and the prevailing currents. The localized irregularity of dredged slope will actually favor deposition of sediments coming from the direction of northeast and southwest, given the prevailing direction of current. The passage of currents will cause the subsequent adjustment of the slope in the subject quarry area over time and in accordance with the natural angle of repose of the sediment deposit.

There is no defined and immediate abandonment plan to be carried out upon completion of dredging, however, SMRI will facilitate conduct the following activities on the area as part of the compliance to the conditions of permits and clearances issued for the project.

3.6. Manpower Requirements

On the assumption that operations of the 4 ships for dredging happens simultaneously, it requires 100 personnel, of which 20 on each ship and 20 are working onshore for office requirements. The total complement is as follows:

Table 3-8 Total Manpower Requirements

Type	Number per ship	Number of ships	TOTAL
Master	1	4	4
Assistant Master	1	4	4
Mates (2nd or 3rd)	3	4	12
Dredge Operator	3	4	12
Chief Engineer	1	4	4
Assistant Chief Engineer	1	4	4
Assistant Engineer (2nd or 3rd)	3	4	12
Marine Electrician	1	4	4
Marine Oiler	3	4	12
Electronics Mechanic	1	4	4
Cook	2	4	8
	20		80
ONSHORE SUPPORT STAFF			20
TOTAL			100

Source: SMRI

3.7. Indicative Project Investment Cost (Philippine Peso)

3.7.1. Investment Cost

The capital investment cost for the dredging operations is estimated at P4 billion. This is spread over the cost of leasing the dredge ships, manpower requirements, and fuel costs to commence the dredging operations.

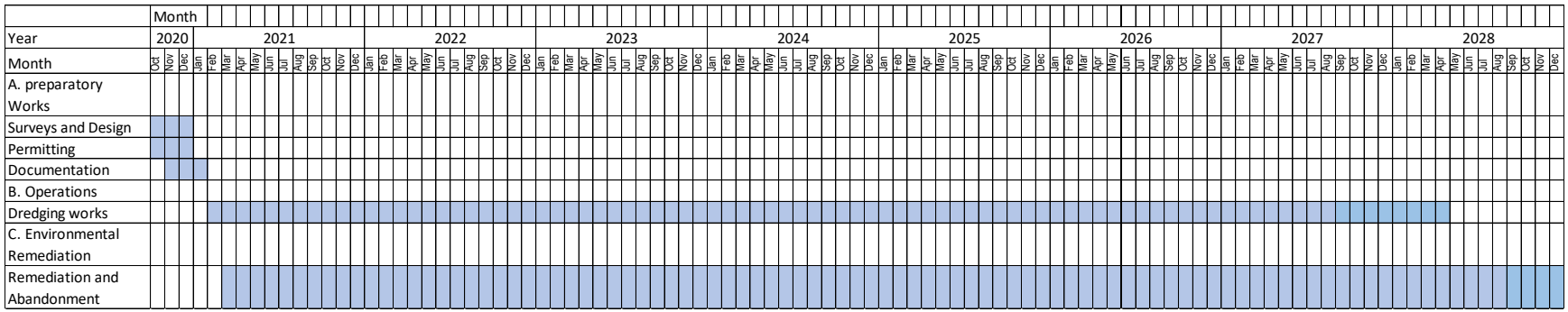
3.8. Project Duration and Schedule

The total dredging operations is estimated to take place from 220 to 270 days a year; downtime due to weather may account to about 3 to 4 months. Considering a yearly production rate of 8,757,152 cubic meters as provided below, the total dredging operations will take some 10 years and would yield about 90 million cubic meters of dredge materials. This is the optimistic scenario where all the dredge ships will operate almost continuously and with minimal weather delays.

Table 3-9 Yearly Production Rates

No	Name	Hold Capacity (m^3)	Daily production (m^3)	Maintenance Days per month	Monthly Construction Days	No of hours to full load	No of hours sailing (40 km each way)	No of hours discharging	Total hours/cycle	Cycles / month	Monthly Production (m^3)	Yearly Production (m^3) for 9 months
1	Tong Tu	20,000	12,000	2	28	40	5	1	46	14.608696	292,174	2,629,565
2	Tong Cheng	18,000	11,000	2	28	39.272727	5	1	45.272727	14.843373	267,181	2,404,627
3	Tong Xu	13,000	10,000	2	28	31.2	5	1	37.2	18.064516	234,839	2,113,548
4	Tong Yuan	10,000	7,600	2	28	31.578947	5	1	37.578947	17.882353	178,824	1,609,412
	TOTAL		**40,600**								**973,017**	**8,757,152**

Table 3-10 Gantt Chart for the Dredging Activities



Section 4.0 BASELINE CONDITIONS, IMPACT ASSESSMENT, AND MITIGATION

This section provides discussions on existing environmental conditions around Manila Bay within the jurisdiction of Ternate and Naic in Cavite and in relation to the operations of SILVERQUEST MINING RESOURCES, INC. seabed quarry project. Key environmental issues are presented as well as the recommended management measures to address them.

4.1 Land

The seabed quarry site will be situated off the shore in Manila Bay and dredging activities would not touch on any landmass except to berth and maintain the dredge ships and provide residential areas for the auxiliary operations. This section of the baseline information focuses on portions of the land closest to the dredging activities that most likely would get affected by the same. The portions of the areas would refer to the coastal barangays of the municipalities of Naic and Ternate in Cavite.

Naic is a first-class municipality and located at the western part of Cavite. It has a total land area of 8,600 ha or about 6.03% of Cavite's total provincial land. It is politically subdivided into 30 barangays and 10 barangays are located along the coastal areas facing the Manila Bay.

On the other hand, Ternate is a 4th class municipality with a total land area of 4,350 or 3.05% of the land area of Cavite. It has 10 barangays in which three are urban while seven are rural areas.

Both the municipalities of Naic and Ternate are classified as coastal municipality.

4.1.1 Land Use

As shown in **Table 4-1,** about 71,474.91 ha or 50.09% of land in Cavite is categorized as Production Land. These areas are where the agricultural activities and food production are taking place.

The low-lying flat areas are typically used for irrigated rice paddies while the central and upland areas are for non-irrigated rice lands, orchards, and livestock farms. The upland areas are known for production of coffee, pineapples, bananas, vegetables, cut flowers, and other fruit bearing trees.

The lowland areas covering the cities of Imus, Bacoor and General Trias, portions of the municipalities of Tanza, Naic and Rosario are primarily suitable for irrigated rice and freshwater fishponds. The central part of the Province covering mainly Dasmariñas, large portions of Tanza, Naic, Gen. Aguinaldo and Trece Martires City are suitable for cultivated annual crops.

Cavite's upland area of Silang, Amadeo, Indang, Alfonso, Magallanes and a small portion of Gen. Aguinaldo and Maragondon and the City of Tagaytay are principally suitable for perennial tree and vine crop production.

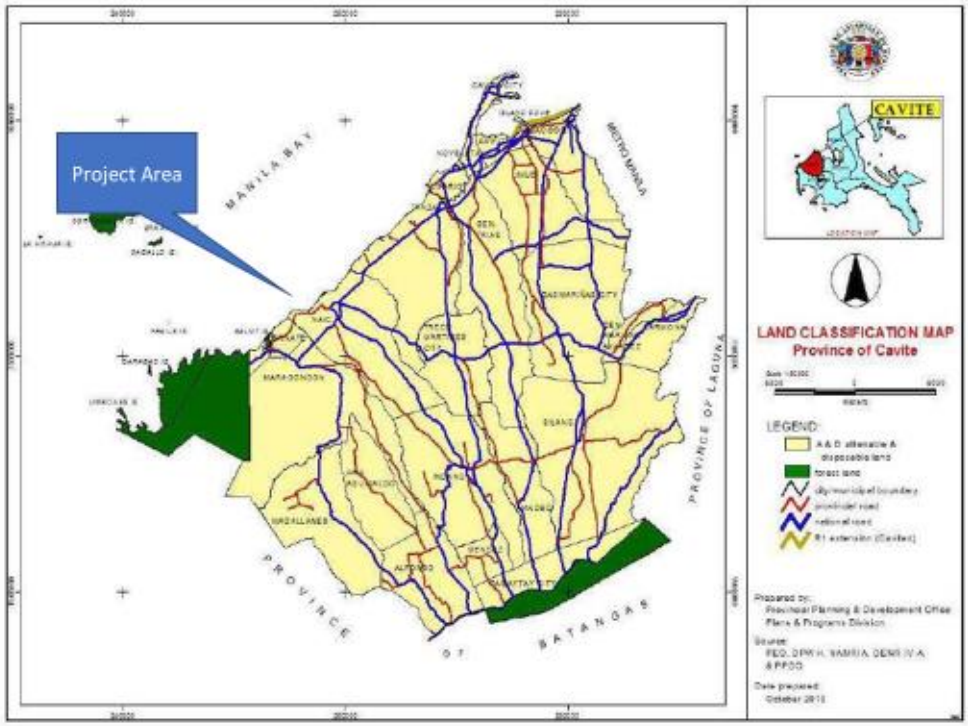
The Built-up Area, which includes settlements, industrial, commercial and tourism areas covers 57,916.09 ha or 40.58% of the land area. Another 13,315 ha or 9,33% is covered with forest or reserved for the growth of forest.

Figure 4-1 shows the land classification map of the Province of Cavite.

Table 4-1: Land Classification in the Province of Cavite

Land Classification	Area (ha)	% Share
A. Alienable and Disposal Land	129,391	90.67
Production Land	71,474.91	50.09
Built-up Area	57,916.09	40.58
B. Forest Land	13,315	9.33
Protected Areas/Natural Parks	3,91128	2.75
Military Reservation	808.99	0.57
Islands	620.37	0.43
Unclassified	7,957.64	5.58
Total	142.706	100

Figure 4-1: Land Classification map of the Province of Cavite



4.1.2 Impacts in terms of compatibility with existing land and water uses

The coastal area of Cavite province has about 93,679.38 ha in which 6.75% (6,324.62 ha) is found in Naic while 11.02% (10,331.23 ha) in Ternate. Furthermore, Cavite has a total coastal line length of 122.57 kilometers; or about 9.12 kilometers of coastal line is found in Naic while Ternate has 23.63 kilometers. The coastal land and sea use zoning map of the Province of Cavite is provided in **Figure 4-2**. The seabed quarry is located nearby the municipal fishing zones of Naic and Ternate.

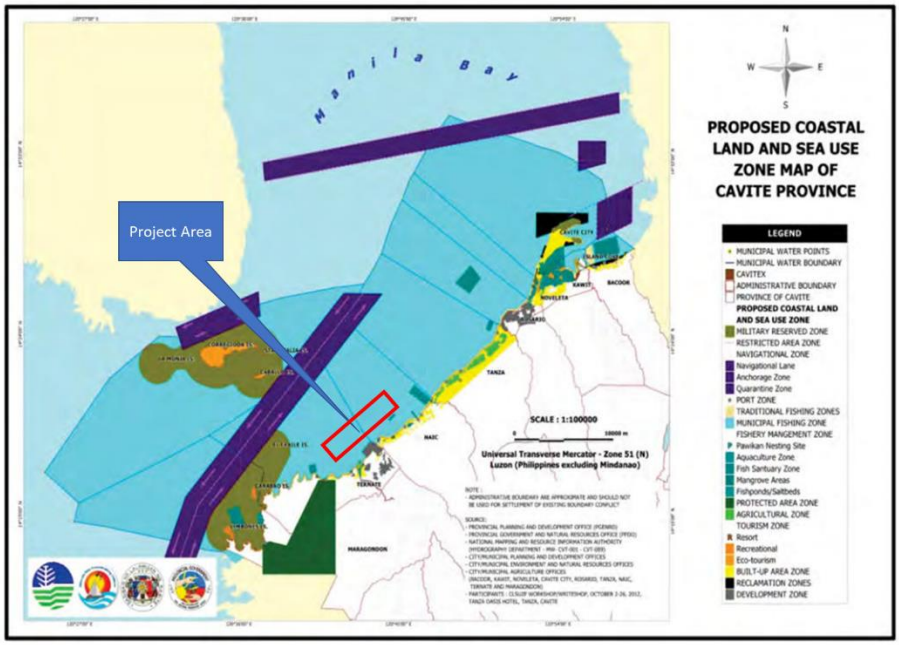


Figure 4-2: Proposed Coastal Land and Sea Use Zoning map of the Province of Cavite

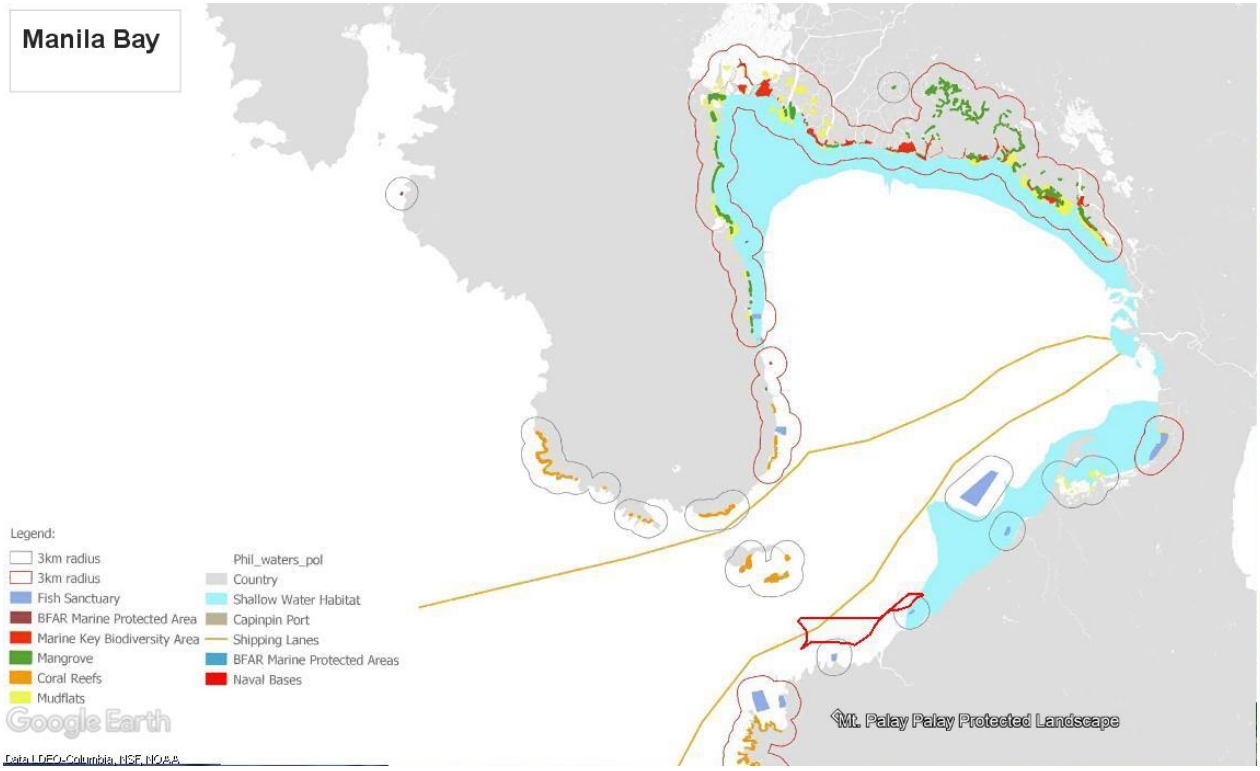
4.1.3 Encroachment in Environmental Critical Areas

Environmentally Critical Areas (ECA) are areas ranging from national parks to areas frequently exposed to hazards or areas that are historically interesting. These areas are identified in Presidential Proclamation 2146. The matrix below shows the characteristics of ECAs and how the project site conforms to such characteristics. Such matrix is important in understanding the general conditions of the surroundings around the site and explain as to why the quarry is sited in the area.

Table 4-2 ECA categorization of the project site

ECA Class	Remarks
A – Area declared by law as a national park, watershed, reserve, wildlife preserves or sanctuary	The quarry site does not encroach on any protected areas nor marine sanctuaries but partially nearby and almost overlaps within the 2kilometer buffer zone of two municipal fish sanctuaries/reserves in Cavite. The protected area under NPAS is the Mt. Palay-Palay protected landscape to the southwest, which is relatively far from the proposed dredge area.
B – area set aside as aesthetic, potential tourist spot	Mostly beaches and beach resorts are found and located onshore of the coastal region of Ternate and Naic; or about 2km away from the boundary limits of the dredge area.
C – area which constitutes the habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna)	There is little to no coral cover and seagrass population in the dredged areas. The closest habitat for wildlife is Mt. Palay-Palay protected landscape, which is a proclaimed game refuge and sanctuary. It is home to a diverse bird species such as the Philippine eagle-owl, Philippine falconet, Philippine hawk-cuckoo, Philippine drongo-cuckoo, Philippine hawk-owl, ashy thrush, brahminy kite, crested serpent eagle, Philippine fairy-bluebird, Philippine trogon, black-chinned fruit dove,

ECA Class	Remarks
	island swiftlet, Philippine bulbul, Pacific swallow, Luzon hornbill and Philippine pygmy woodpecker.
D – area of unique historic, archaeological, geological or scientific interest	None
E – area which is traditionally occupied by cultural community or tribe	None
F – area frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)	Typical of the areas in Luzon
G – area with critical slope	None
H – area classified as prime agricultural land	None
I – recharge area of aquifers	None
J – waterbody	Manila Bay
K – mangrove area	None
L – coral reef	Relatively far



4.1.4 Geomorphology

The proposed dredging area corresponds to portion of the Manila Bay known as the San Nicolas Shoal (SNS). It is located 4 to 6 kilometers north of the coast of Maragondon and Ternate in Cavite. Regionally, it occupies the south-eastern edge of Manila Bay and an area embracing approximately 2,135 hectares (**Figure 4-3**). The southeastern edge of the dredging Area is 2 to 4.3 kilometers northwest of the coastal section of Ternate and Maragondon.

Figure 4-3 Location Map of the Proposed Dredging Area

The province of Cavite represents a landmass closest to the SNS. Together with Rizal, Batangas, Laguna and parts of Bulacan and Quezon, they make up a regional physiographic unit of the Southwest Luzon Uplands (BMG, 1982). It is made up of gentle to moderate slopes with flat to deeply incised drainage systems and bounded by ridges and volcanic centers which include Taal Volcano and Mt. Banahao.

Cavite is divided into four (4) terrain units namely: Coastal Plain, Lowland, Upland and Mountainous Area (**Figure 4-4**).

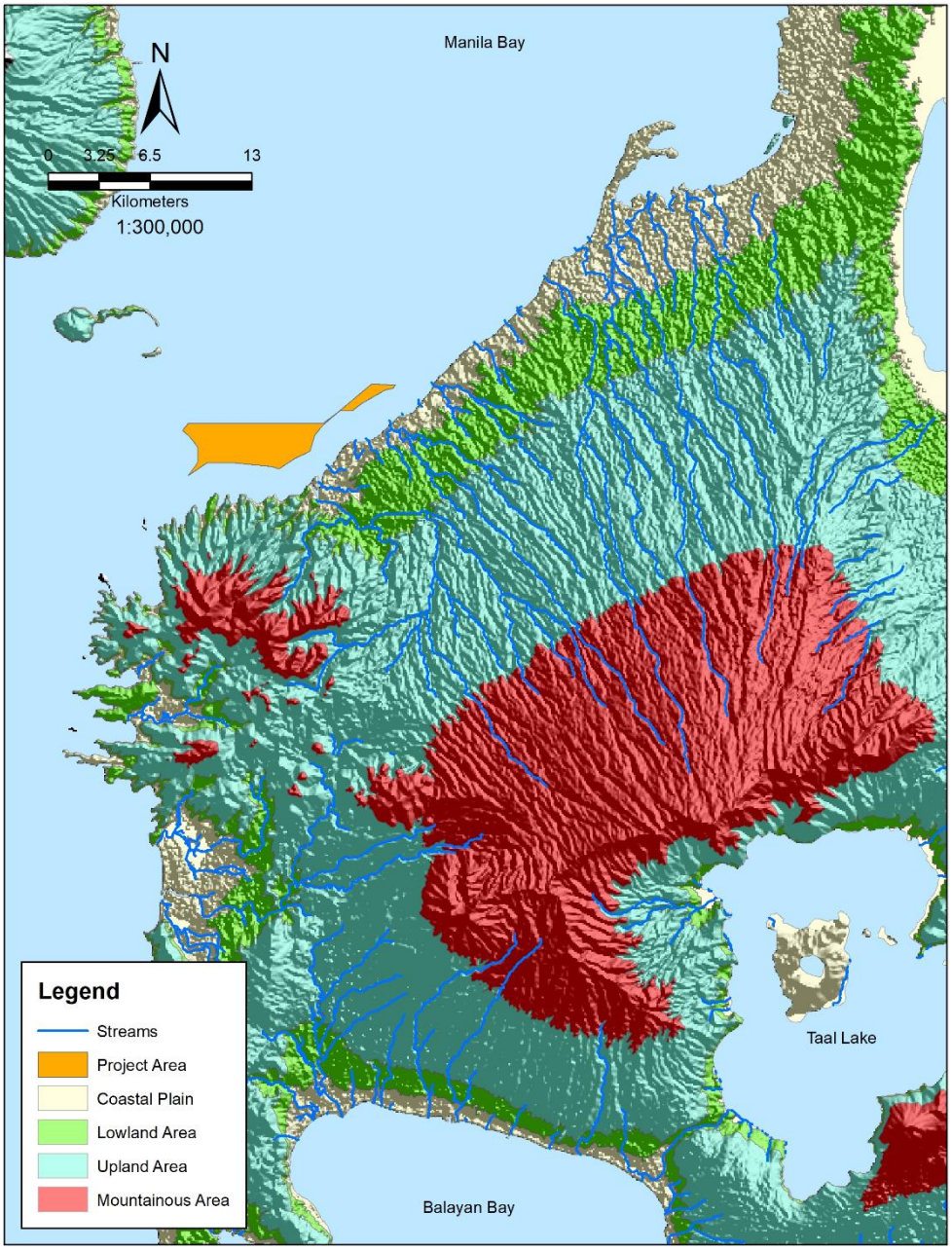


Figure 4-4 Geomorphological Map of Cavite Province showing the location of the Project Area within the adjacent Manila Bay

The Coastal Plain refers to the flat to nearly level area from which extends from Maragondon in the west to Bacoor in the east. Elevation ranges from 0 to 15 meters above sea level. This terrain unit is characterized by the presence of wetlands, estuaries and deltas of the rivers which drain the upper elevated southern section of the province. It includes the coastal sections of the towns of Maragondon, Naic, Tanza, Rosario, Noveleta, Kawit, Bacoor and Cavite City.

The proposed dredging area occupies a narrow strip nearly parallel to and about 4 to 6 kilometers north-northwest of the Coastal Plain.

The Lowland Area occupies the gently sloping strip within the elevation range from 15 to 40 meters above sea level. The average slope is 2%. It includes parts of the towns of Maragondon, Naic, Tanza, General Trias, Imus and Bacoor.

The Upland Area includes the hilly to moderately sloping sections of Naic, Trece Martires City, General Trias, Dasmarinas City, Carmona, Amadeo, Silang, Mendez, Indang, Alfonso, General Emilo Aguinaldo, Magallanes and Tagaytay City. It occupies upper southern half of the province within the elevation range from 40 to 250 masl and with a slope range of 2 to 14 %. This terrain unit is characterized by deeply incised drainage systems which flow through the Lowland Area and exit at the seaward edge of the Coastal Plain.

The Volcanic Mountainous Area corresponds to the northwestern section of the province under parts of the municipalities of Ternate and Maragondon and Magallanes and the deeply incised slopes of Mt. Mataas na Gulod. It also includes parts of the towns of Indang, Mendez, Amadeo, Silang and Tagaytay City.

The river systems which traverse the province of Cavite emanate from the Volcanic Mountainous Area and flows from south to north towards Manila Bay in a generally sub-parallel pattern.

Manila Bay corresponds to a large marine body in the western part of Luzon Island, which is bounded on the west and northwest by Bataan, on the north by Bulacan and Pampanga and on the east by Cavite and Metro Manila (**Figure 4-5**). The southwestern section is linked to the South China Sea. Jacinto et al (2006) provided the following geophysical characteristics of Manila Bay: (i) surface area: 1,700 km^2, (ii) length of coastline: 190 km and (iii) estimated volume: $2.89 \times 1010\ m^3$.

Spatially, the dredging Area corresponds only to 1.26% of total expanse of Manila Bay. **Figure 4-5** shows the bathymetry of the Area. The narrow northern section has a depth range of 3 to 5 meters and has an average slope of 0.5%. The elongated and wide southern section varies in depth from 5 to 35 meters and also has an average slope of 0.5%. (**Figure 4-6**).

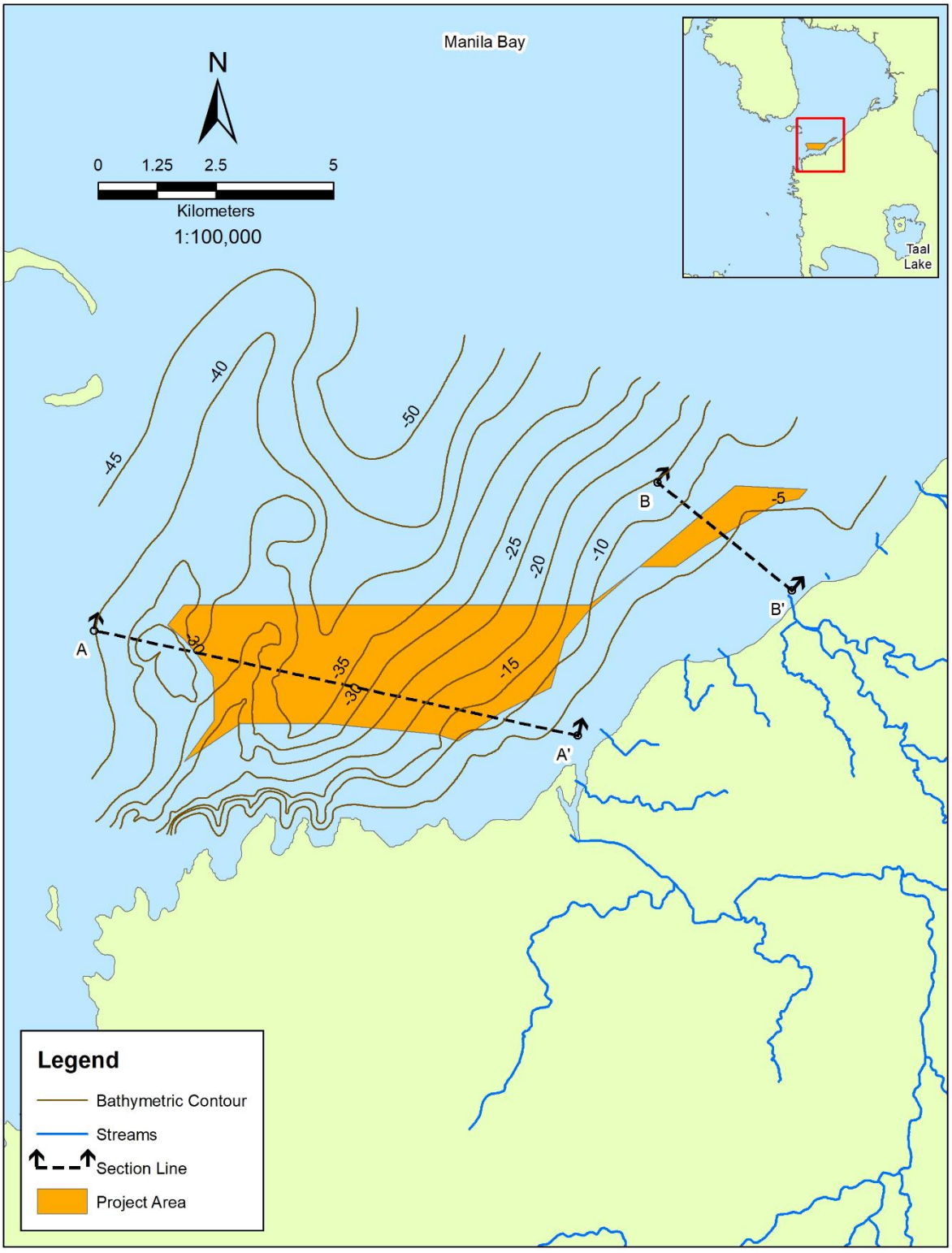
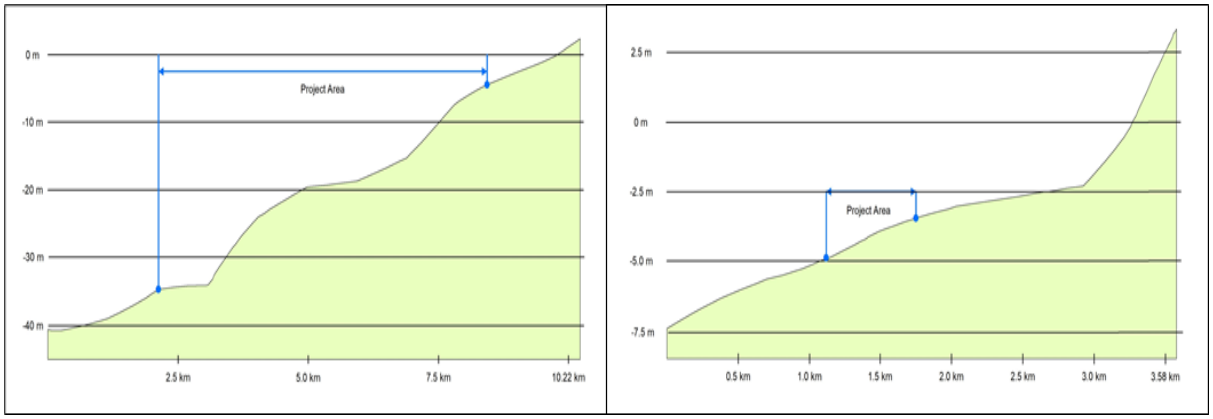


Figure 4-5 Bathymetric Map of Project Area



Section A-A'[1] Section B-B'[2]

Figure 4-6 Seabed Profiles from Cavite Coastal Plain to the Project Area

4.1.5 Slope

The municipality of Naic is flat or level land with slope of 0 to 3%. On the other hand, the Municipality of Ternate, on the west most portion have slope of 30 to 50% which are characterized as moderately to steeply mountainous. However, majority of the land in Ternate is flat or level land (0 to 3%). The slope map of the Province of Cavite is shown in **Figure 4-7**.

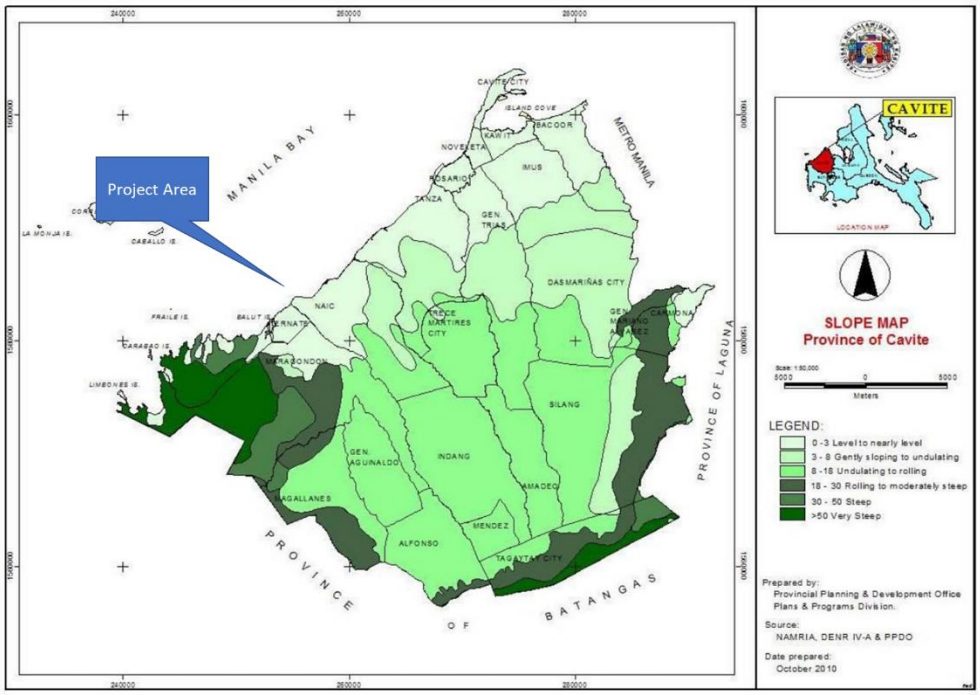


Figure 4-7: Slope Map of the Province of Cavite

[1] Factor of 95 applied on the vertical scale
[2] Factor of 198 applied on the vertical scale

4.1.5.1 Elevation

The Municipality of Naic and the eastern part of Ternate have elevation of 11 to 50 meters above sea level. The remaining areas in Ternate have elevation of 51 to 200 meters above sea level. The elevation map of the Province of Cavite is shown in **Figure 4-8.**

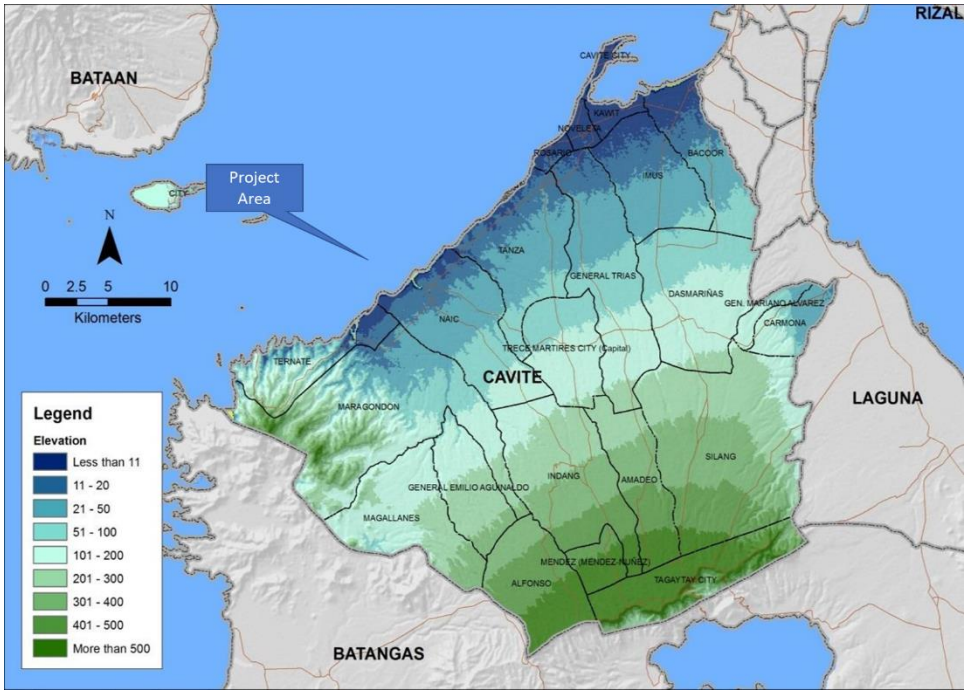


Figure 4-8: Elevation Map of the Province of Cavite

4.1.6 Regional Geology

4.1.6.1 Tectonic Setting

The Province of Cavite is bordered by the Manila Trench on the west, the Philippine Trench and West Valley Fault on the east and Lubang Fault to the south. It is also being transected by the Philippine Fault that traverses from Luzon in the north to Mindanao southwards cutting across Bicol and the Visayas as shown in **Figure 4-9**.

The dredging site is located on the western shore of Manila Bay along the chain of Quaternary volcanoes which extends from Pinatubo southwards to Natib, Mariveles, Corregidor, Taal, Palay-Palay and on the northeastern portion of Mindoro Island. These volcanoes were formed from the subduction along the Manila Trench whose segment could be traced around 158 kilometres from the site. In particular, the site forms part of the volcanic front related to the active subduction of the adjacent Manila Trench with resultant faulting, volcanism and rifting.

The volcanic chain serves as the border to lowlands of Lingayen Gulf, Central Luzon, Manila Bay and Laguna de Bay. Farther north, the volcanic chain blends with the Zambales Mountains with series of isolated smaller volcanic cones in the northern part of the plains of Central Luzon as it merges with the Cordillera Mountains.

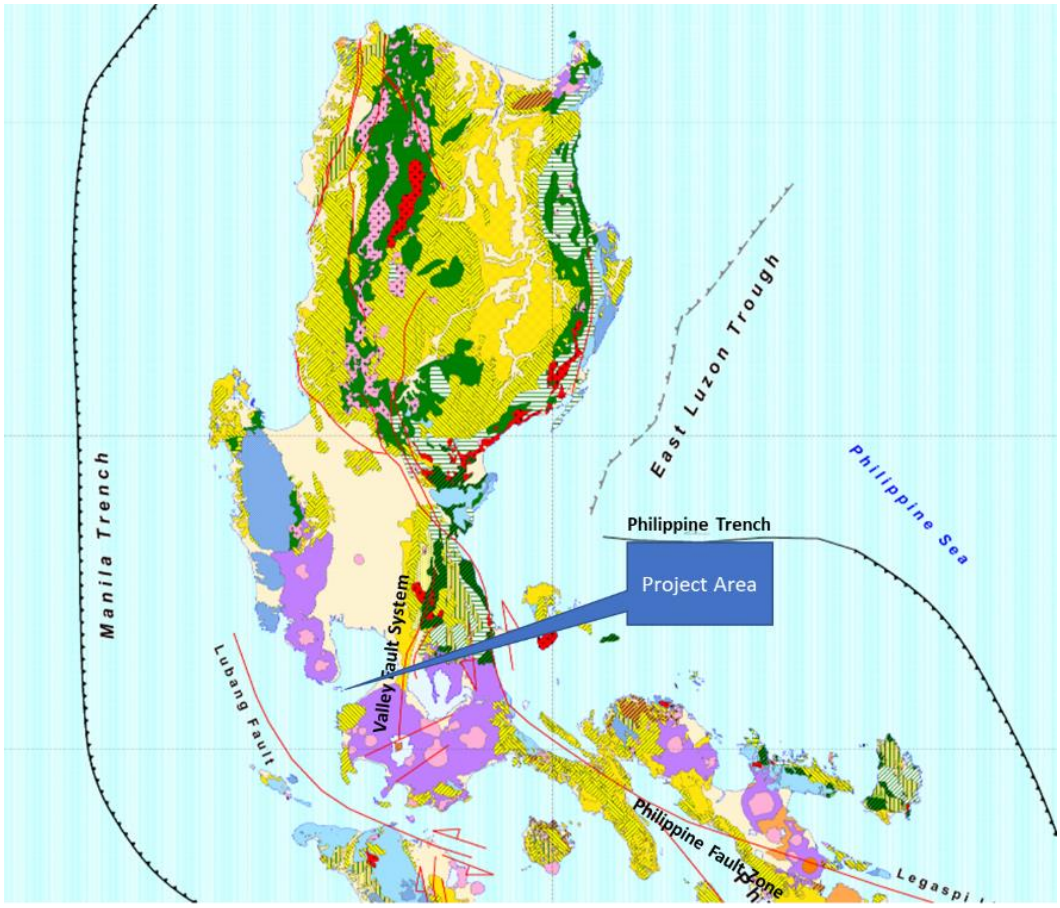


Figure 4-9: Tectonic Map of Luzon

4.1.7 Lithology

On a regional level, Cavite and the rim of Manila Bay is underlain by five (5) major rock formations (**Figure 4-10**). **Table 4-3** lists these formations and their corresponding lithologic components.

Table 4-3 Major Rock Formations of Cavite and the Rim of Manila Bay

Formation	Epoch	Explanation
Quaternary Alluvium (R)	Holocene	Unconsolidated sediments
Quaternary Active Volcano (QAV)	Quaternary	Taal Volcano
Quaternary Volcanic Pyroclastics (QVP)	Pliocene - Quaternary	Pyroclastics and volcanic debris with varying degrees of consolidation
Quaternary Volcano (QV)	Pliocene - Quaternary	Non-active volcanic cones
Sedimentary Rocks (N3 + Q1)	Pliocene - Pleistocene	Interbeds of sedimentary rocks, pyroclastics and tuffaceous sedimentary rocks

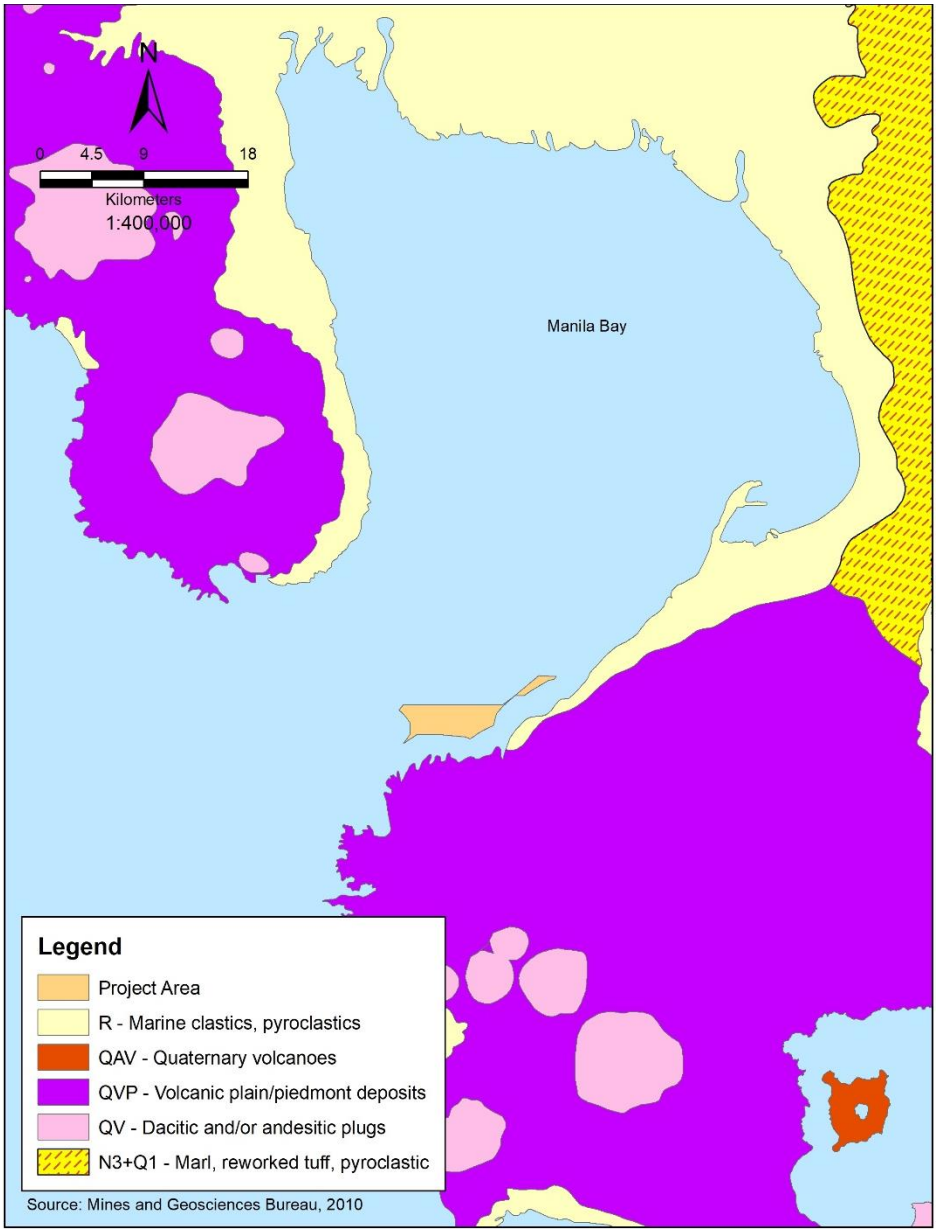


Figure 4-10 Regional Lithologic Map of Cavite and Rim of Manila Bay

The Holocene sediments found along the coastal section of Cavite, Bataan, Bulacan and Pampanga extend seaward into Manila Bay. Using NAMRIA data, Siringan and Ringor (1998) generated a sediment distribution map of Manila Bay (**Figure 4-11**). As shown, sandy deposits are dominant along the coastal section of Cavite including the project area. Available borehole data at the San Nicolas Shoal revealed interlayers of sand, silt and clay within the drilled depth of 20 meters (**Table 4-4**)

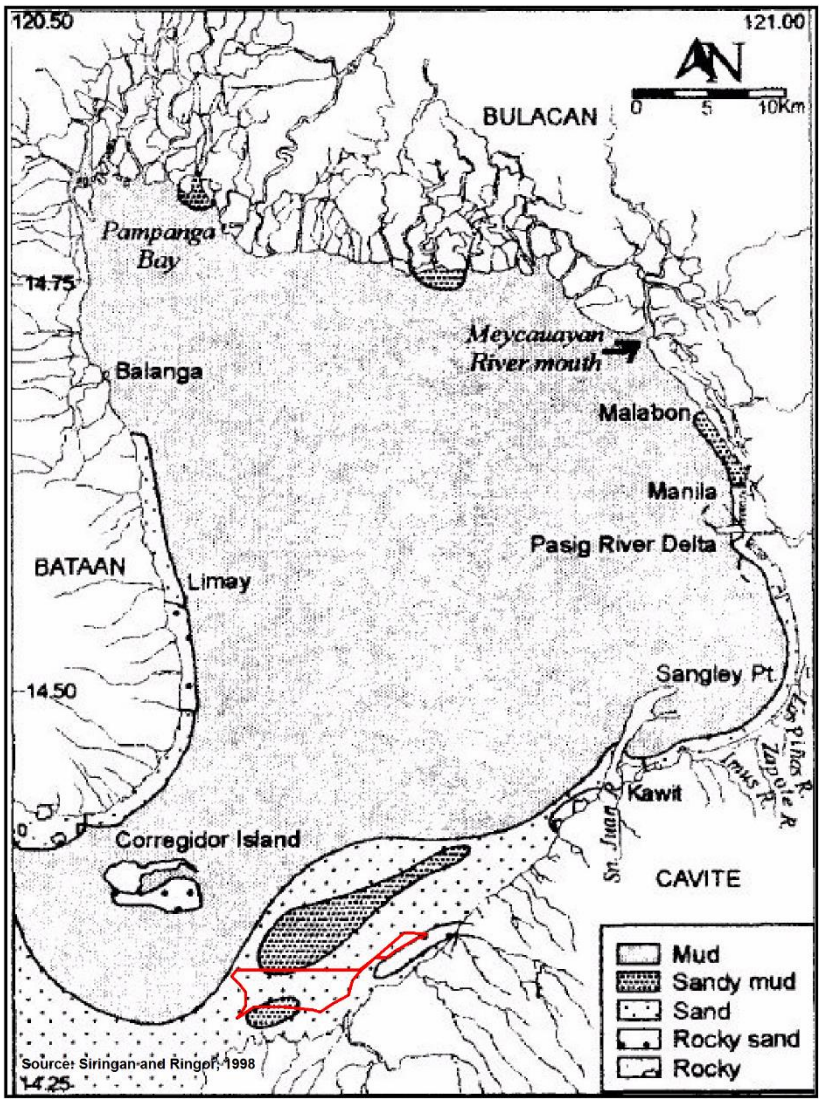


Figure 4-11 Bay-wide sediment distribution based on NAMRIA Data3

[3] Source: Siringan and Ringor, 1998

Table 4-4 Summary of Borehole Data on San Nicolas Shoal4

Borehole No.	Log Summary
20	Clayey sand, clay, clayey sand
N1	Clayey silt and sandy silt
N2	Clayey silt, sandy clayey silt
N3	Silty sand
N4	Silty clay, sandy silt, silty sand
N5	Clay, sandy clay, silty sand
N6	Clay, sandy clay, fine sand
N7	Clay, silt, sand
N8	Silty clay, silty sand
N9	Silty clay, sand, clayey sand, sand
N10	Silty clay, sand, gravel
N11	Clayey sand, sand
N12	Silty sand
N13	Clay, silty sand
N14	Sand
N15	Clay, clayey sand, silty sand
N16	Sand, silt, gravel
N17	Silty clay, sandy silt, sandy clay
N18	Clayey sand, sand, sandy clay
N19	Sandy silt, sand,
N20	Sandy silt, silty sand
N21	Sand
N31	Silty clay, clayey silt, sandy silt
N32	Clayey silt, silty sand

4.1.8 Earthquakes and Seismicity

The Philippines is situated in a tectonically active region near the boundary between the Philippine Sea Plate and the eastern margin of the Eurasian Plate. The active zone of deformation between these two (2) plates is referred to as the Philippine Mobile Belt (Gervasio, 1966). It is characterized by a system of subduction zones, collision zones and marginal sea basin openings (Geology and Mineral Resources of the Philippines, 2004). The island of Luzon where the proposed dredging area is located occupies the northern section of the Philippine Mobile Belt.

The major earthquake generators and structures which can potentially affect the project area include the Manila Trench, Lubang Fault, West Marikina Valley Fault, Philippine Fault, Philippine Trench and Macolod Corridor (Figure 4-12).

[4] Source: Geotechnics Philippines Inc.

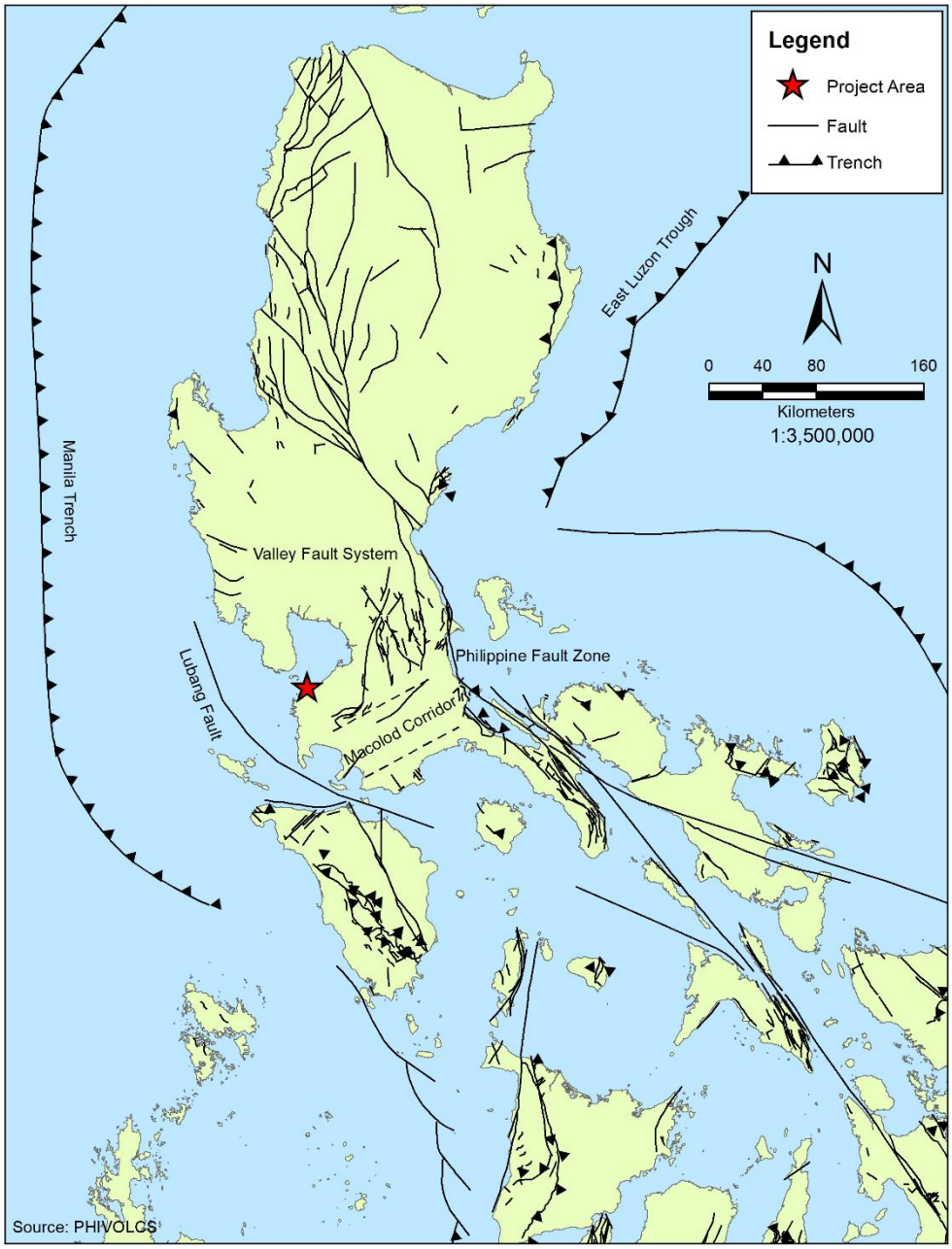


Figure 4-12 Major Earthquake Generators in Luzon

The Manila Trench is a broad arcuate geological structure located west of the island of Luzon and spans the length of about 1,100 kilometers from 13° north to 22° north latitude. It corresponds to the physiographic expression of the subduction of the oceanic crust of the West Philippine Sea beneath the Luzon Arc. This earthquake generator is located approximately 170 kilometers west project area. The Lubang Fault is a left-lateral, northwest-southeast trending offshore fault located between Batangas and Mindoro Island. The magnitude 7.1 Mindoro earthquake in November 1994 is attributed to the activity of this fault. The project area is located 58 kilometers northeast of the Lubang Fault.

The West Marikina Valley Fault is an active right lateral geological structure which traverses a distance of about 135 kilometers from Bulacan in the north to as far south as Tagaytay area. Its trace is located 38 kilometers east of the project area.

The Philippine Fault the largest 0n-land structural feature of the Philippines. It corresponds to a left lateral fault zone which transects the Philippine Mobile Belt from Luzon though the Visayas to Mindanao over a length of more than 1,200 kilometers. The July 16, 1990 magnitude 7.8 earthquake is attributed to the movement of the northern segment of this fault in Nueva Ecija. The projected trace of the fault in Luzon is approximately 113 kilometers east of the project area.

The Philippine Trench corresponds to the morphological expression of the subduction of the Philippine Sea Plate beneath the eastern Philippine Arc (Geology and Mineral Resources of the Philippines, 2004). The trace of the trench is about 477 kilometers east of the project area.

The Macolod Corridor refers to a 40-kilometer-wide strip which includes Tagaytay Ridge in the north and Batangas Bay and Mount Banahao to the south. The corridor has a northeast-southwest orientation and is characterized by intense Quaternary volcanism. It includes two (2) volcano-tectonic depressions (Laguna de Bay and Taal Lake), three (3) stratovolcanoes (Mt. Banahao, Mt. Makiling and Mt. Malepunyo), several domes and more than 200 small monogenetic volcanic centers (Forster et al, 1990). The northern edge of the corridor in 40 kilometers southeast of the project area.

The nearest fault line in the proposed project site is the West Valley Fault and is located more than 30 kilometers away.

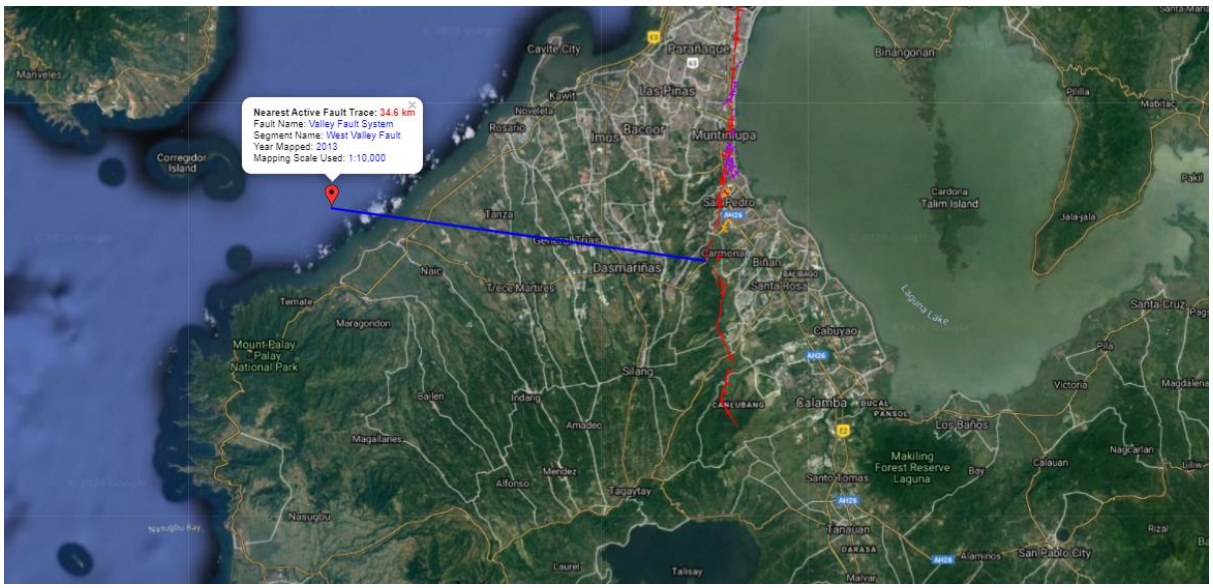


Figure 4-13: Nearest Fault Line in the Proposed Project Site

4.1.8.1 Seismicity

Figure 4-14 shows the plot of earthquakes with magnitude's greater than 5 within a 300 - kilometer radius from the project area. The clusters of earthquakes are found in western Central Luzon to the north and offshore to the south between Mindoro and Batangas to the southwest. *The listing of these events is presented as* **Annex 1.** The strongest recorded quake corresponds to a Magnitude 7.8 event, which was recorded on July 16, 1990. The epicenter of this quake is in Digdig, Nueva Ecija which is about 159 kilometers northeast of the Project Area.

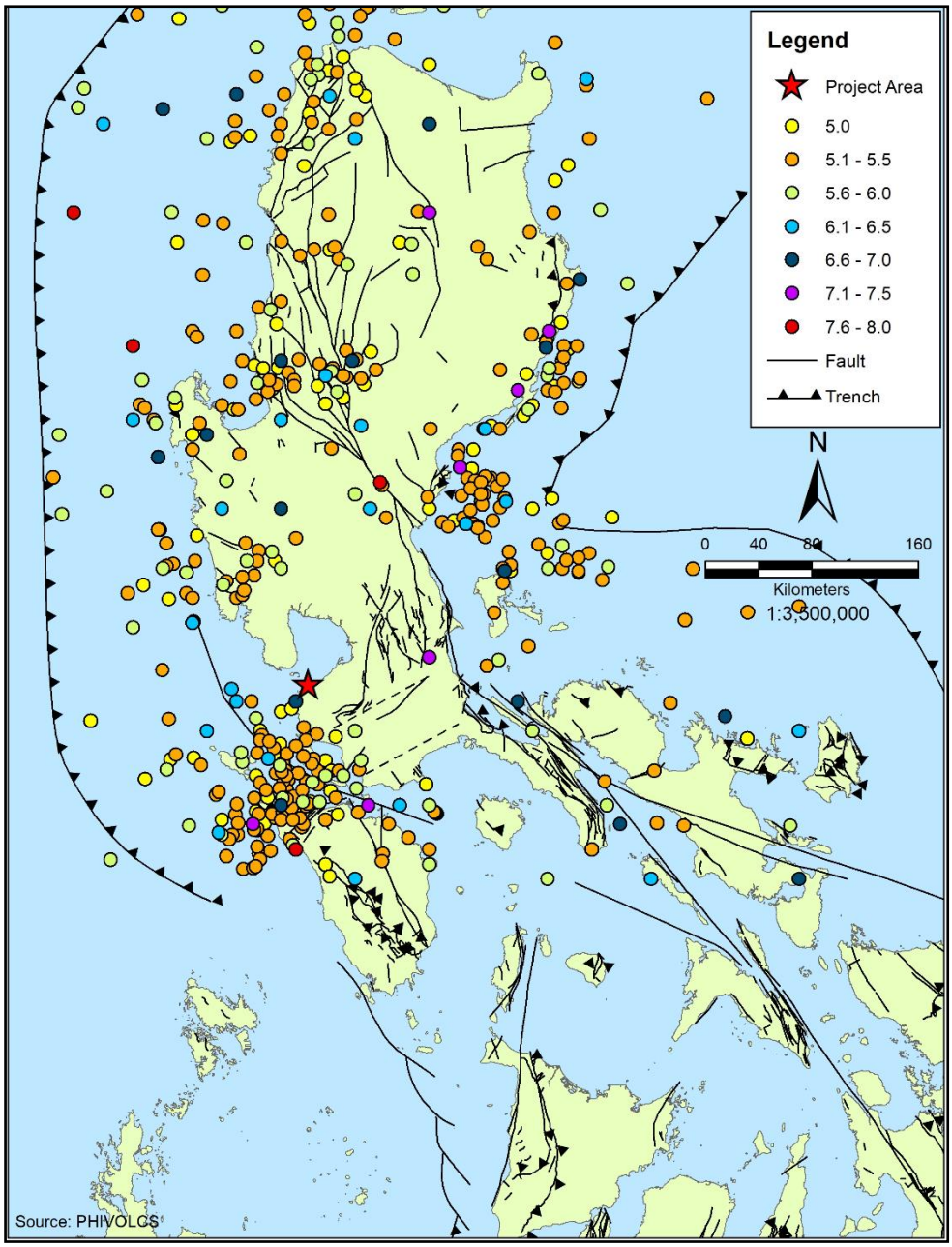


Figure 4-14 Plot of Earthquakes with Magnitudes ≥ 5.0 within a 300-km radius from the Project Area

Table 4-5 presents the list of the destructive earthquakes in the Philippines. Among the 17 listed events, four (4) quakes affected the project area. These are the Central Luzon Earthquake of 2019, the Mindoro Earthquake of 1994, the Luzon Earthquake of 1990 and the Casiguran Earthquake of 1968 (**Figure 4-15**)

Table 4-5 Destructive Earthquakes of the Philippines[5]

No.	Earthquake Event	Date	Year	Magnitude		Epicenter Location	
						Latitude	Longitude
1	Davao del Sur Earthquake	15-Dec	2019	6.9		6.74	125.2
2	Cotabato Earthquake	29-Oct	2019	6.6		6.8	125.1
3	Itbayat, Batanes Earthquake	27-Jul	2019	5.9	Mw[6]	20.8	122.0
4	*Central Luzon Earthquake*	*22-Apr*	*2019*	*6.1*		*15.1*	*120.3*
5	Leyte Earthquake	6-Jul	2017	6.5	Ms[7]	11.07	124.41
6	Surigao de Norte Earthquake	10-Feb	2017	6.7	Ms	9.8	125.35
7	Bohol Earthquake	15-Oct	2013	7.2	Ms	9.88	124.117
8	Masbate Earthquake	6-Feb	2003	6.2	Ms	12.2	123.8
9	Palimbang Earthquake	6-Mar	2002	6.8	Ms	6.1	124
10	Bayugan Earthquake	7-Jun	1999	5.1	Ms	8.6	125.8
11	*Mindoro Earthquake*	*15-Nov*	*1994*	*7.1*	*Ms*	*13.5*	*121.1*
12	*Luzon Earthquake*	*16-Jul*	*1990*	*7.8*		*15.7*	*121.1166*
13	Panay Earthquake	14-Jun	1990	7.1	Ms	11.34	122
14	Laoag Earthquake	17-Aug	1983	7.3	Ms	18.231	120.86
15	Moro Gulf Earthquake	17-Aug	1976	7.9	Ms	6.3	124
16	*Casiguran Earthquake*	*2-Aug*	*1968*	*7*	*Ms*	*16.3*	*122.11*
17	Ragay Gulf Earthquake	17-Mar	1973	7.3	Ms	13.41	122.87

[5] Source: PHIVOLCS, https://www.phivolcs.dost.gov.ph/index.php/earthquake/destructive-earthquake-of-the-philippines
[6] Moment
[7] Surface Wave

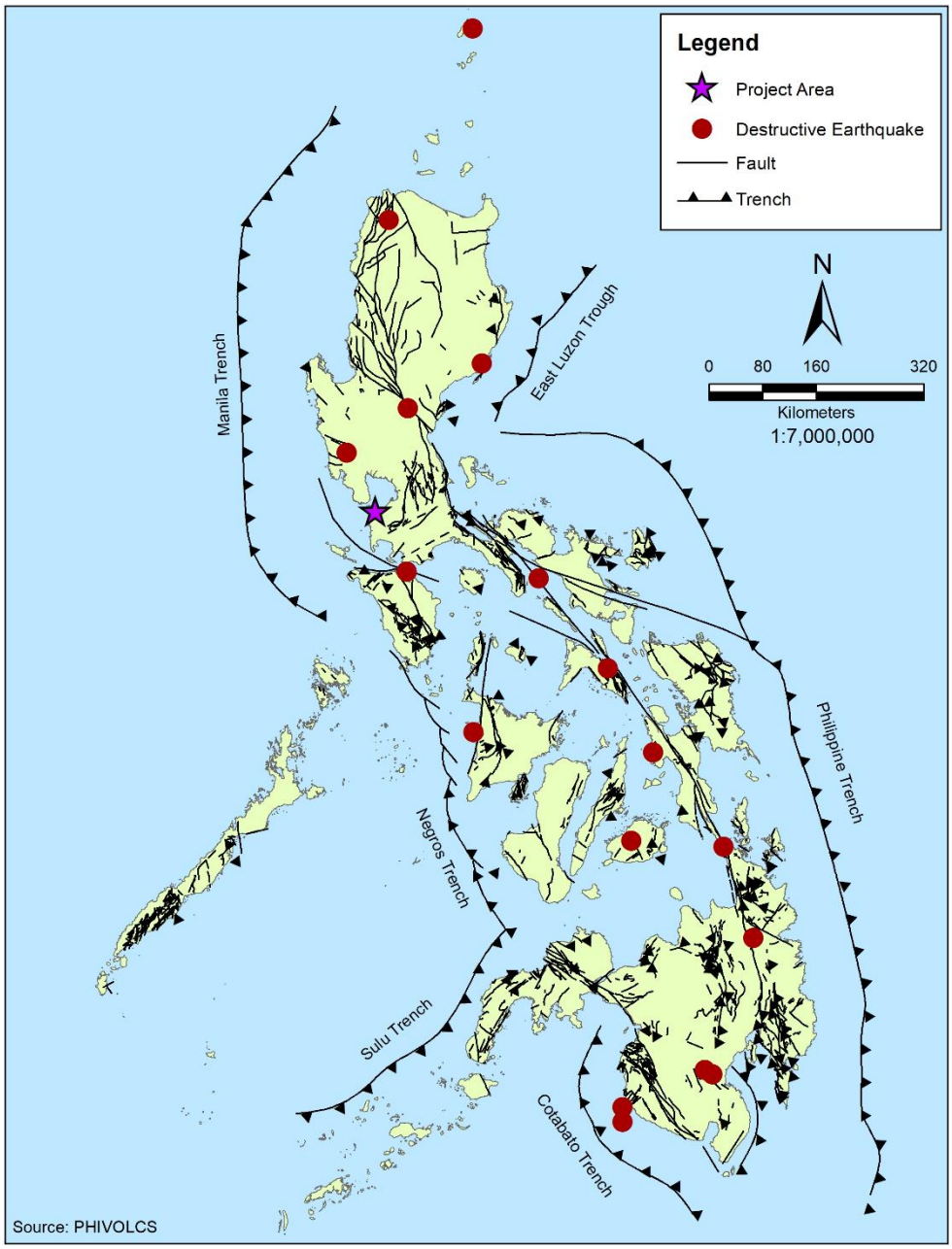


Figure 4-15 Plot of Destructive Earthquakes in the Philippines with respect to the Project Area

4.1.8.2 Ground Rupture

Ground fissure or ruptures occurs when the energy released by the earthquake is strong enough to break the competence of rocks and soil materials. Relative displacements may happen along a fracture or fault line, when the shifting of ground could either be horizontal, vertical or a combination of both. The amount of displacement and length of rupture depends on the earthquake magnitude, distance of the site from the fault/fault zone and ground conditions.

The municipalities of Naic and Ternate are not susceptible to ground rupture. Due to the significant distance of the Project Area away from the major faults in the region, it is not susceptible to ground rupture.

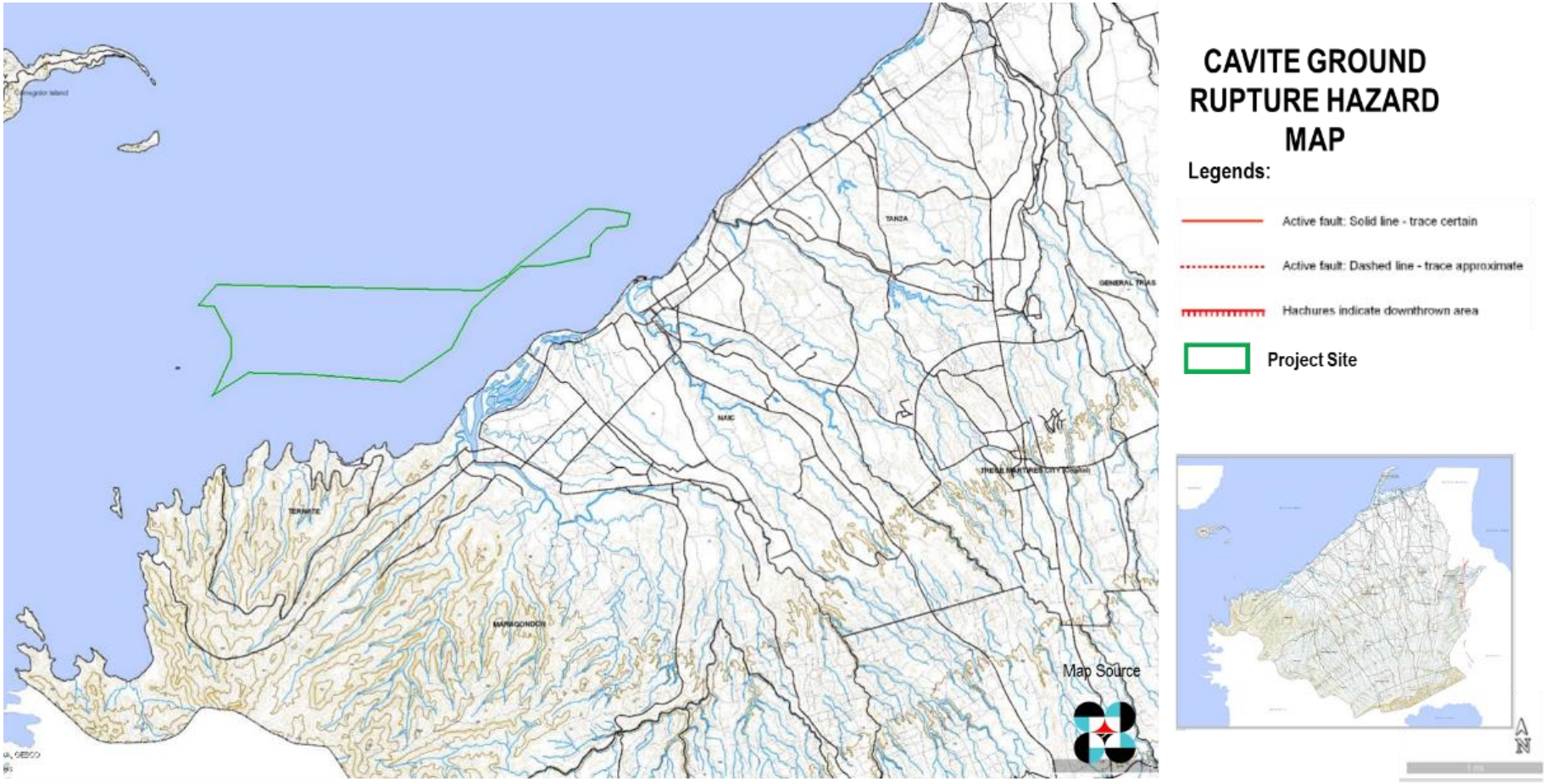


Figure 4-16: Cavite Ground Rupture Hazard Map

4.1.8.3 Ground Shaking

One of the main hazards emanating from an earthquake is ground motion or ground shaking. It is caused by the passage of seismic waves; especially surface waves near the epicenter of the earthquake are responsible for the most damage during and after the earthquake. The intensity of ground shaking depends on local geologic conditions in the area (in general, loose unconsolidated sediment is subject to more intense shaking than solid bedrock); size of the earthquake, the larger the earthquake, the more intense is the shaking and the duration of the shaking and distance from the epicenter (shaking is most severe near the epicenter and drops off away from the epicenter). The distance factor depends on the type of material underlying the area.

In the Municipality of Naic, 3 barangays have high susceptibility to ground shaking while 29 barangays are moderately susceptible. In Ternate, 9 barangays are highly susceptible, and 2 barangays are moderately susceptible. As shown in
Figure 4-17**,** the earthquake intensity in Naic is identified as PEIS Intensity VIII and above which is considered to be very destructive while in Ternate is PEIS Intensity VII which is described to be destructive.

Ground shaking due to earthquakes will affect the project the entire Manila Bay and its coastal rim including the project area. This phenomenon could stir up the partially consolidated sediments or soft soils. The regional peak ground acceleration map of the Philippines prepared by Thenhaus, Hanson and Algermissen of the United States Geological Survey and the Philippine Institute of Volcanology and Seismology (1995) indicate that a value of **0.60 *g*** for the unconsolidated sediments of Manila Bay and the coastal areas (**Figure 4-18**). This ***g*** value has a 10% probability of being exceeded in 50 years.

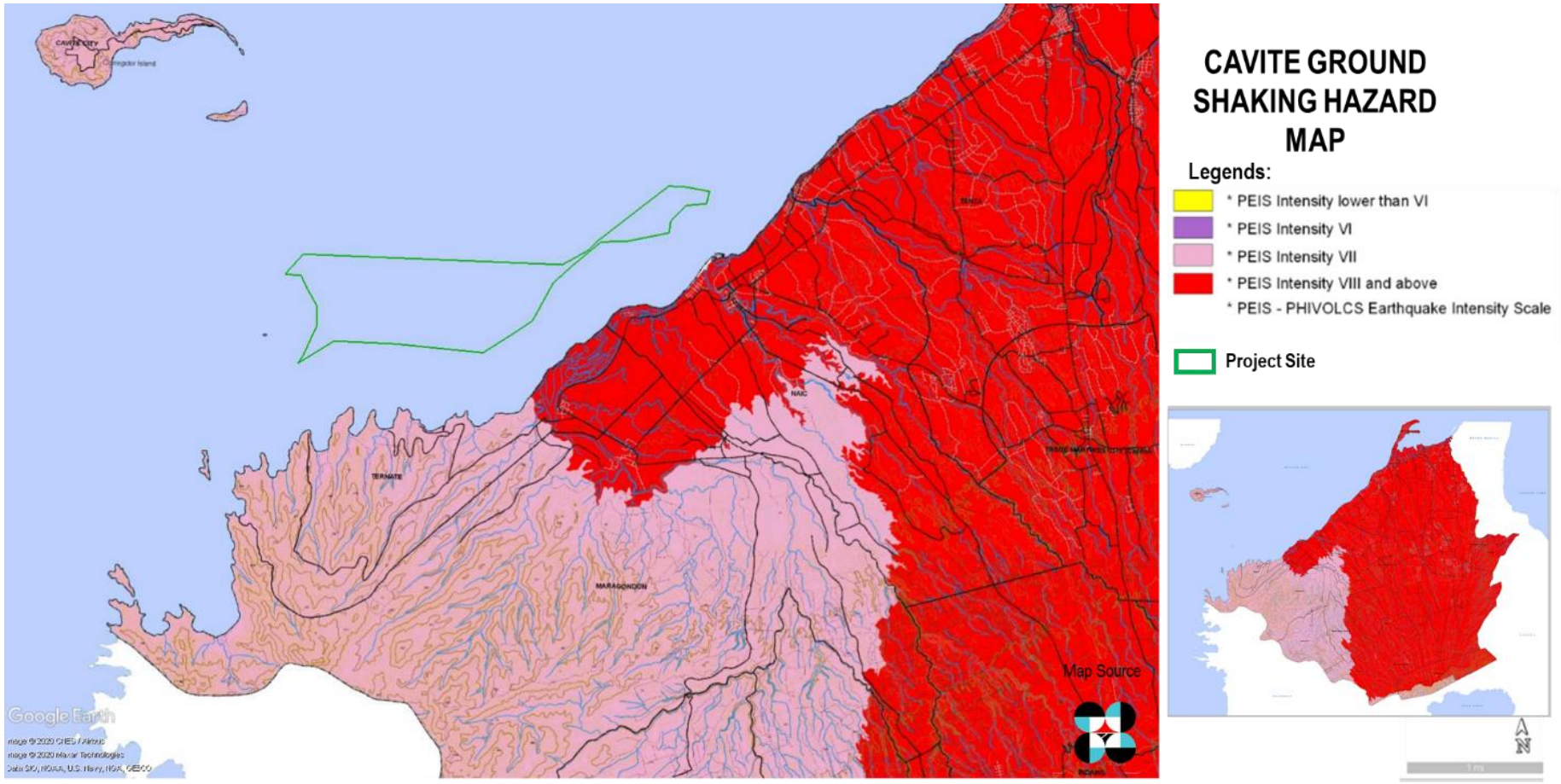


Figure 4-17: Cavite Ground Shaking Hazard Map

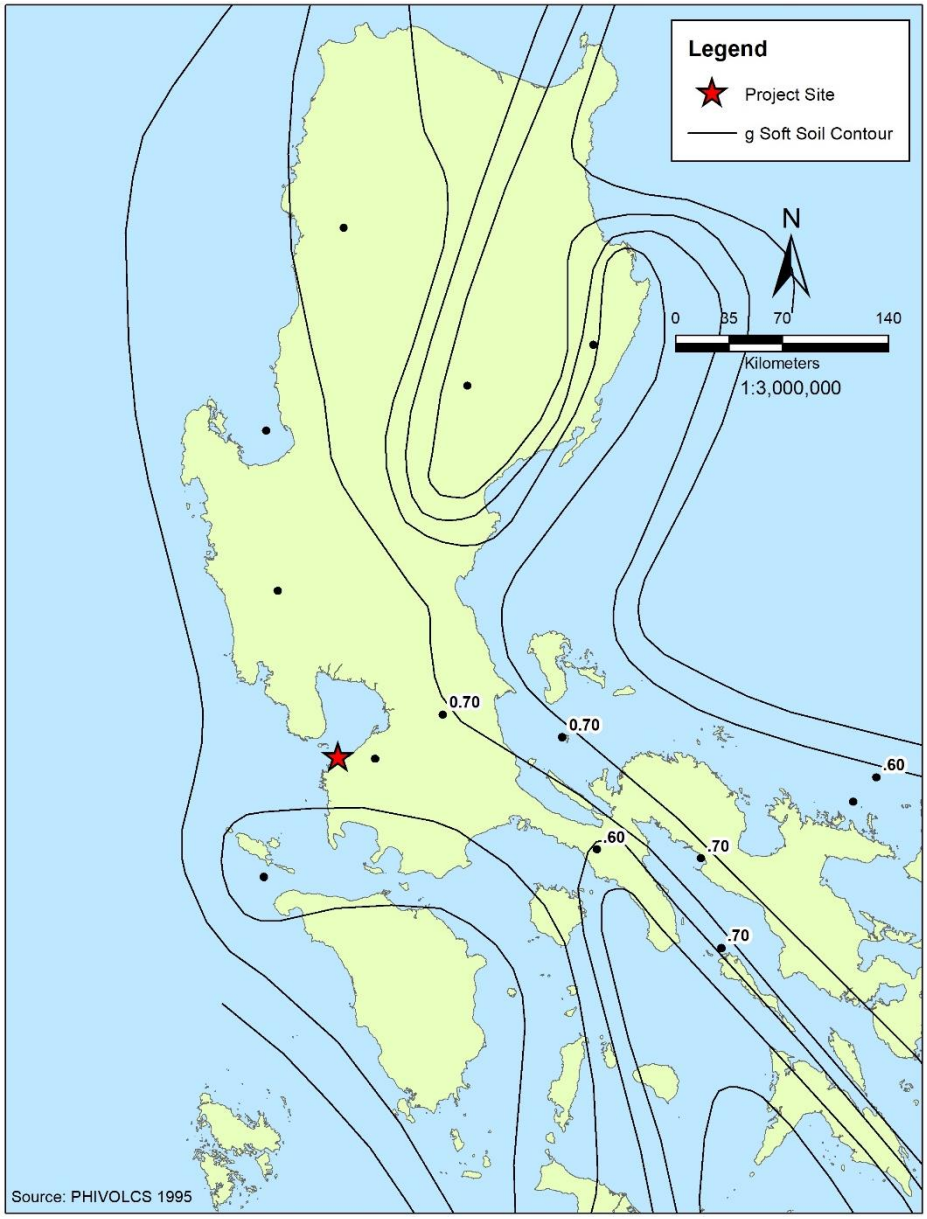


Figure 4-18 g Map for Soft Soils showing the Project Area

4.1.8.4 Earthquake-induced Landslide

Occurrence of earthquake-induced landslides is determined largely by local conditions. Many factors, including geologic and hydrologic conditions, topography, climate, weathering and land use, influence the stability of slopes and the characteristics of landslides.

Both the municipalities of Naic and Ternate are not susceptible to earthquake-induced landslide.

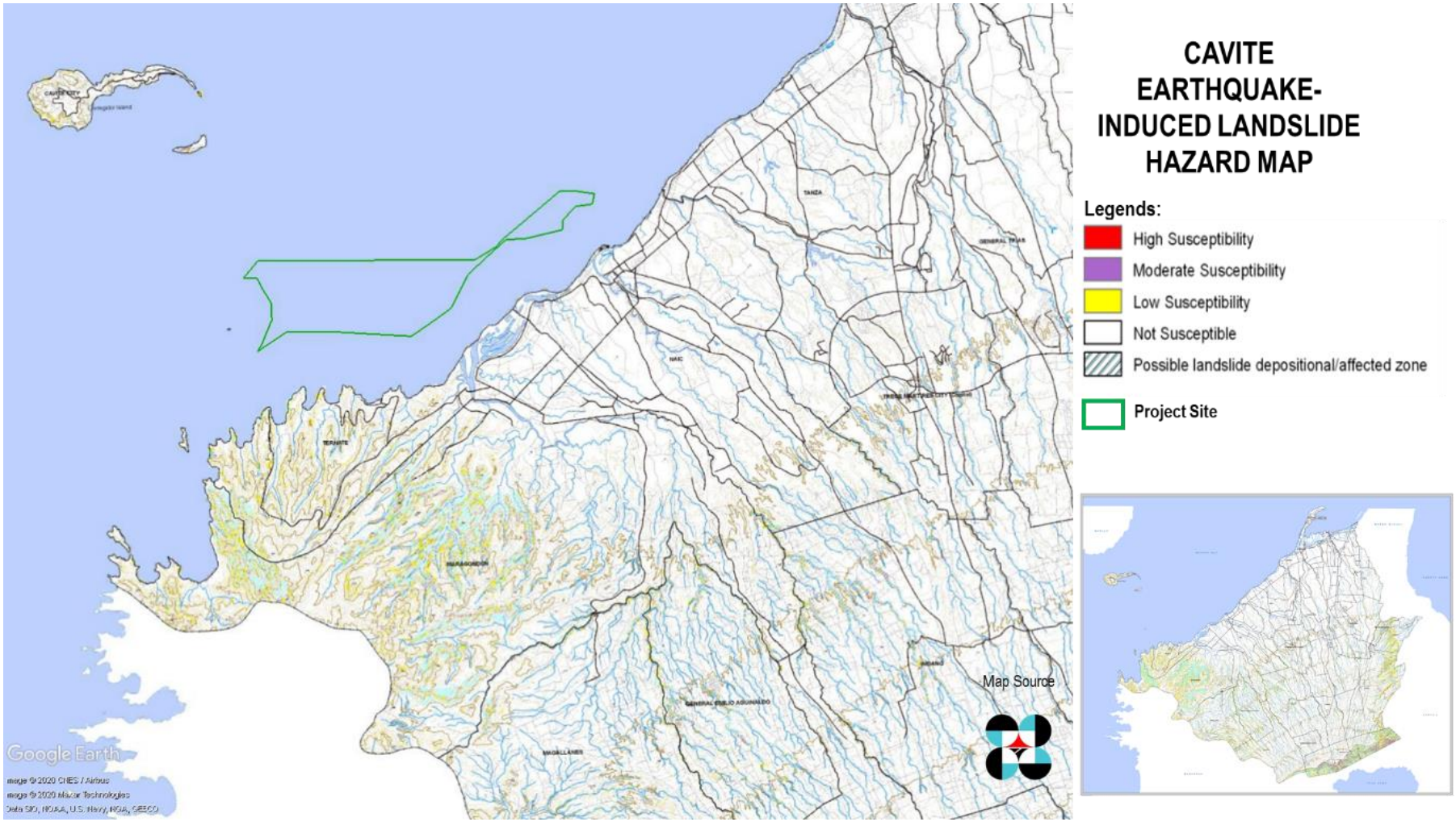


Figure 4-19: Cavite Earthquake-induced Landslide Hazard Map

4.1.8.5 Liquefaction

Liquefaction as a site-specific geo-hazard may be triggered by strong earthquakes, usually magnitude Ms>6.5. It is a condition where the soil formation liquefies, loses its bearing capacity and flows like a liquid towards areas of lesser pressure. Factors affecting liquefaction include the presence of low density fine clean highly permeable sandy materials, water saturation and the occurrence of strong earthquake. Alluvial plains, pyroclastic plains and coastal plains with shallow groundwater and with loose sand and silty to sandy soils are possible areas for liquefaction. Liquefaction occurs when loose soils at or near the ground surface lose their strength due to the strong ground shaking caused by an earthquake. This means that a strong intensity earthquake can cause settling of soil.

In Naic, 16 barangays are susceptible to liquefaction; 9 barangays are highly susceptible while 7 barangays are moderately susceptible. For Ternate, only 1 barangay is not susceptible to liquefaction; 4 barangays are highly susceptible, 4 are moderately susceptible and 1 has low susceptibility.

Ground shaking could bring about liquefaction of the water-saturated, partially consolidated sediments which are present in the coastal plains. Liquefaction will not take place at the offshore and submerged sediments of the Project site or Area

4.1.9 Other Geo-hazards

The flat shoreline which rims Manila Bay are vulnerable to a combination of the following hazards, namely hydrologic, earthquake-related and coastal. These hazards, with the exception of earthquake-generated ground shaking and the passage of tsunamis will have minimal or no effect on the project site or area.

4.1.9.1 Volcanic Hazards

There are 37 volcanoes in the Philippines, of which 18 are still active volcanoes. The closest to the proposed project site is the Taal Volcano which is approximately 43.9 kilometers away. The proposed project site is outside the kilometer radius of Tall Volcano. In terms of volcanic hazards, the proposed project site is safe from ballistic projectiles, base surge and volcanic tsunami.

However, based on previous eruption records, ash spewed from Taal Volcano and even Mt. Pinatubo in the north could reach the Manila Bay Area. Although these airborne deposits could locally and temporarily reduce visibility and safe movement of vehicles, ships and airplanes in the Bay area, these will have no significant impact on the Project Area. Some of the volcanic materials which will fall on the Bay could potentially be deposited on the shoal depending on the combination of wind, waves and currents.

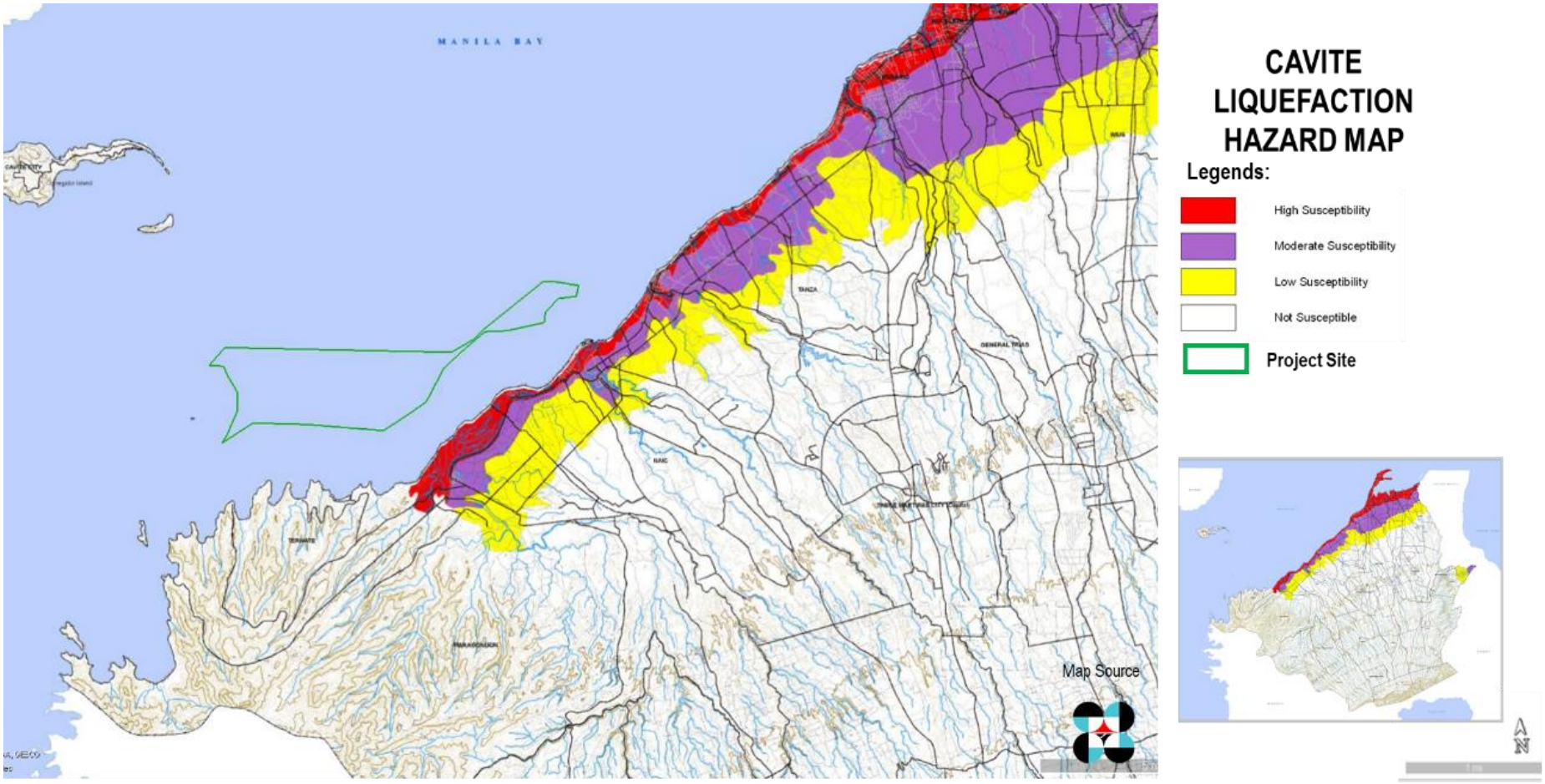


Figure 4-20: Cavite Liquefaction Hazard Map

4.1.9.2 Tsunami

A tsunami is a series of giant waves generated when a body of water, such as lake or ocean, is rapidly displaced on a massive scale. Earthquakes, landslides, volcanic eruptions and large meteorite impacts, all have the potential to generate a tsunami. The effects of a tsunami can range from unnoticeable to devastating. Tsunamis have been historically referred to as tidal waves because they approach land with the characteristics of a violent onrushing tide rather than the sort of cresting waves that are formed by wind action upon the ocean. Areas particularly vulnerable to this hazard are the coastal zones fronting an open sea.

The Manila Trench is a major earthquake generator and is located approximately 200 kilometers west of the City. As shown in **Figure 4-21**, coastal zones fronting the open sea is susceptible to tsunami should major earthquake occurs, and the Manila Trench moves in the future. Seven barangays in Naic have high susceptibility to tsunami while Ternate is not susceptible to tsunami. In the Municipality of Naic, potential inundation of 2 to 4 meters may be observed should a tsunami with wave height of 5.5 meters occur. A small portion of Ternate may also experience a potential inundation of 4 to 5 meters.

Tsunamis generated by major seismic events could potentially damage the coastal areas depending on the wave height and the presence of coastal protection measures. The passage of the tsunamis through the project area can potentially affect the seabed by stirring up the underlying sediments.

4.1.9.1 Storm Surge

Storm surge may be visualized as a raised dome of water, moving with the storm, and centered a few kilometers to the right of its path. The dome height is related to local pressure (i.e., a barometric effect dependent on the intensity of the storm) and to wind stress on the water caused by local winds. Other significant contributing factors are storm speed, direction of approach, bottom topography, and coincidence with astronomical tide.

The coast-lying barangays are susceptible to this kind of hazard. The municipalities of Naic and Ternate are both moderately susceptible to storm surge. Storm surges which are generated by storms could affect the Coastal Plain but will have no effect on the submerged Project site or Area.

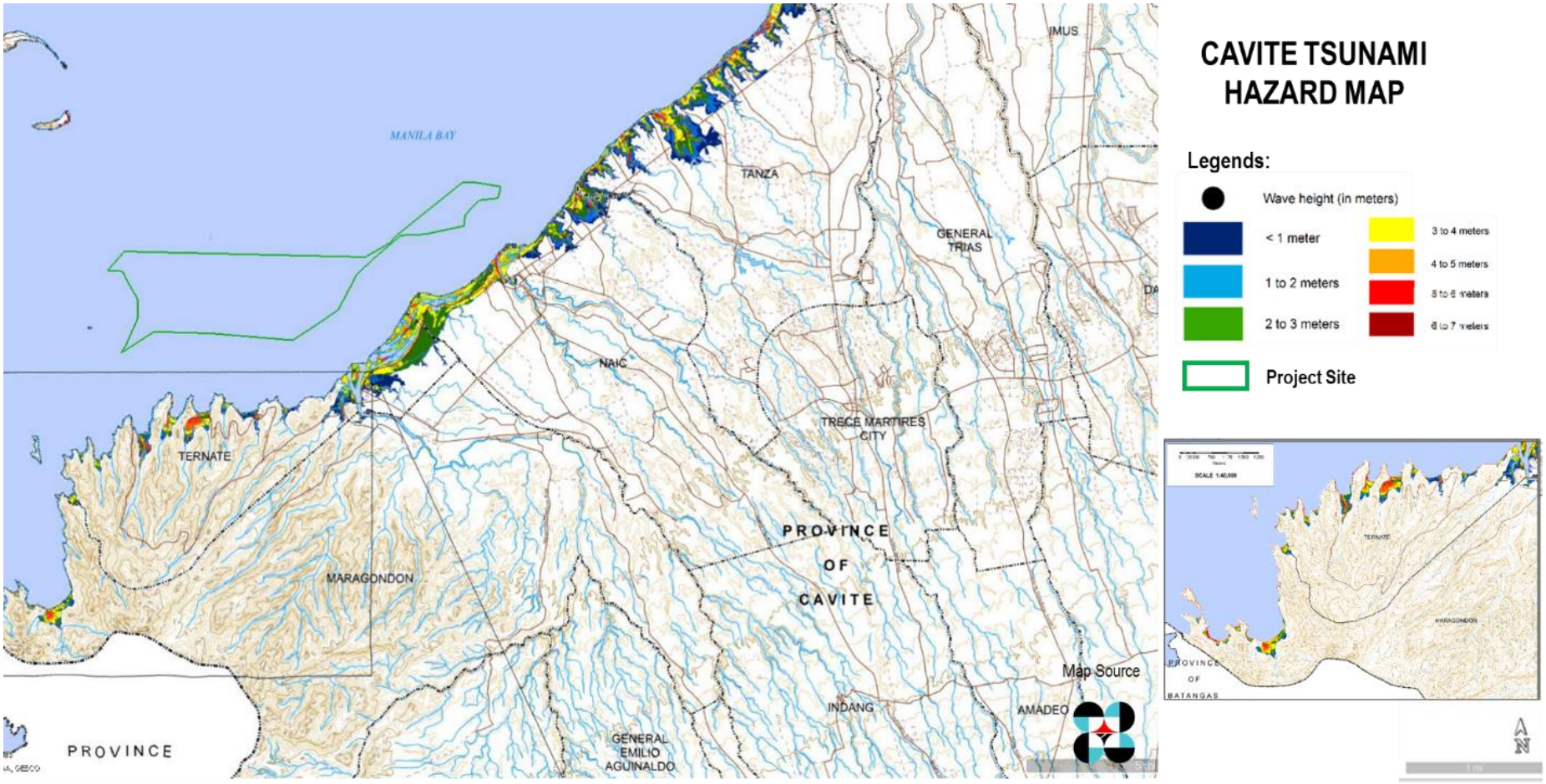


Figure 4-21. Tsunami Hazard Map of the Province of Cavite

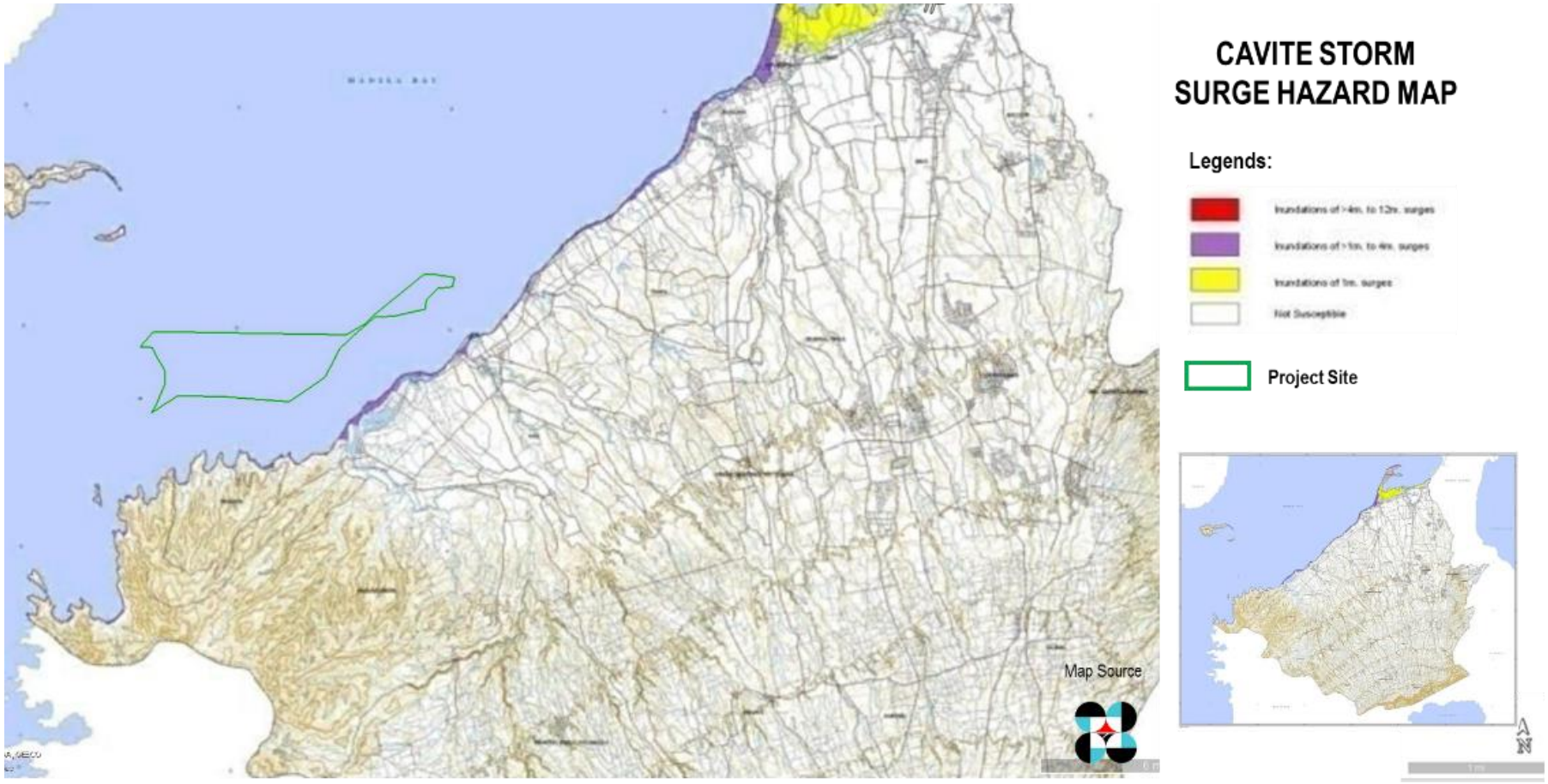


Figure 4-22: Cavite Storm Surge Hazard Map

4.1.9.2 Flooding

Flooding in Cavite may be due to coastal flooding, river overflow or due inadequacy of the drainage facilities in the general area. Coastal flooding occurs when normally dry, low-lying land is flooded by sea water. It can result from a variety of different causes including storm surges created by tropical cyclones, rising sea levels due to climate change, and tsunamis. An increase of sea water level will affect the lower portions of the project site particularly those areas situated along the shoreline.

As shown in **Figure 4-23**, coastal areas have high susceptibility to flooding. In Naic, 8 barangays are highly susceptible while 15 barangays have low susceptible to flooding. In Ternate, 8 barangays also have high susceptibility to landslide while 2 barangays have low susceptibility.

The floods due to runoff could bring sediment-laden waters and contribute to the deposition of sediments into Manila Bay including the Project Area.

Wave action and currents will erode the beaches along the rim of Manila Bay but will not affect the project area. Depending on tidal and wind conditions and the presence of man-made structures, the eroded sediments could potentially be deposited into other parts of the Bay including the Project Area.

4.1.9.1 Rain-induced Landslide

Areas with high risk to landslide are those with steep slopes, high precipitation and highly fractured rocks. As shown in **Figure 4-24,** the some areas in the Municipality of Naic has low susceptibility to rain-induced landslide while the Municipality of Ternate is highly susceptible.

4.1.10 Soil

4.1.10.1 Soil Types

The lowland area of Cavite, including the Municipality of Naic, is generally composed of Guadalupe clay and clay loam. It is characterized as coarse and granular when dry, but sticky and plastic when wet. Its substratum is solid volcanic tuff. The shoreline of Naic is composed of Guadalupe sand.

In Ternate, majority of the soil type is Tagaytay sandy loam with mountain soil undifferentiated. Tagaytay sandy loam is friable and granular. It has a considerable amount of volcanic sand and is underlain by adobe clay. Patungan sand, characterized as pale gray to almost white sand with a substratum of marine conglomerates, is seen along the coastlines of Ternate.

4.1.10.2 Soil Erosion

Both Naic and Ternate, being located along the coastal area of Manila Bay, are susceptible to coastal erosion due to flood and storm surge.

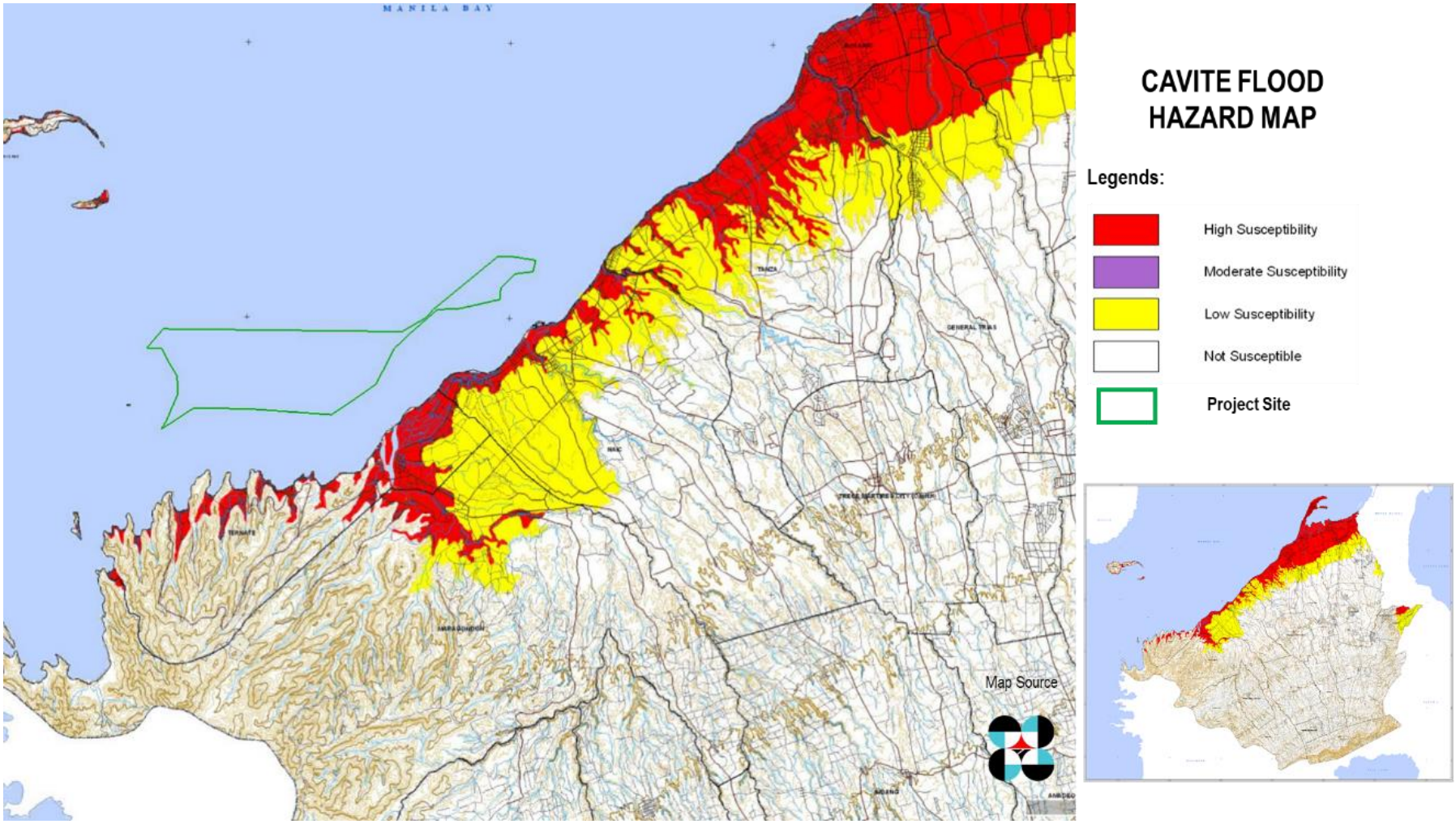


Figure 4-23: Flood Hazard Map of the Province of Cavite

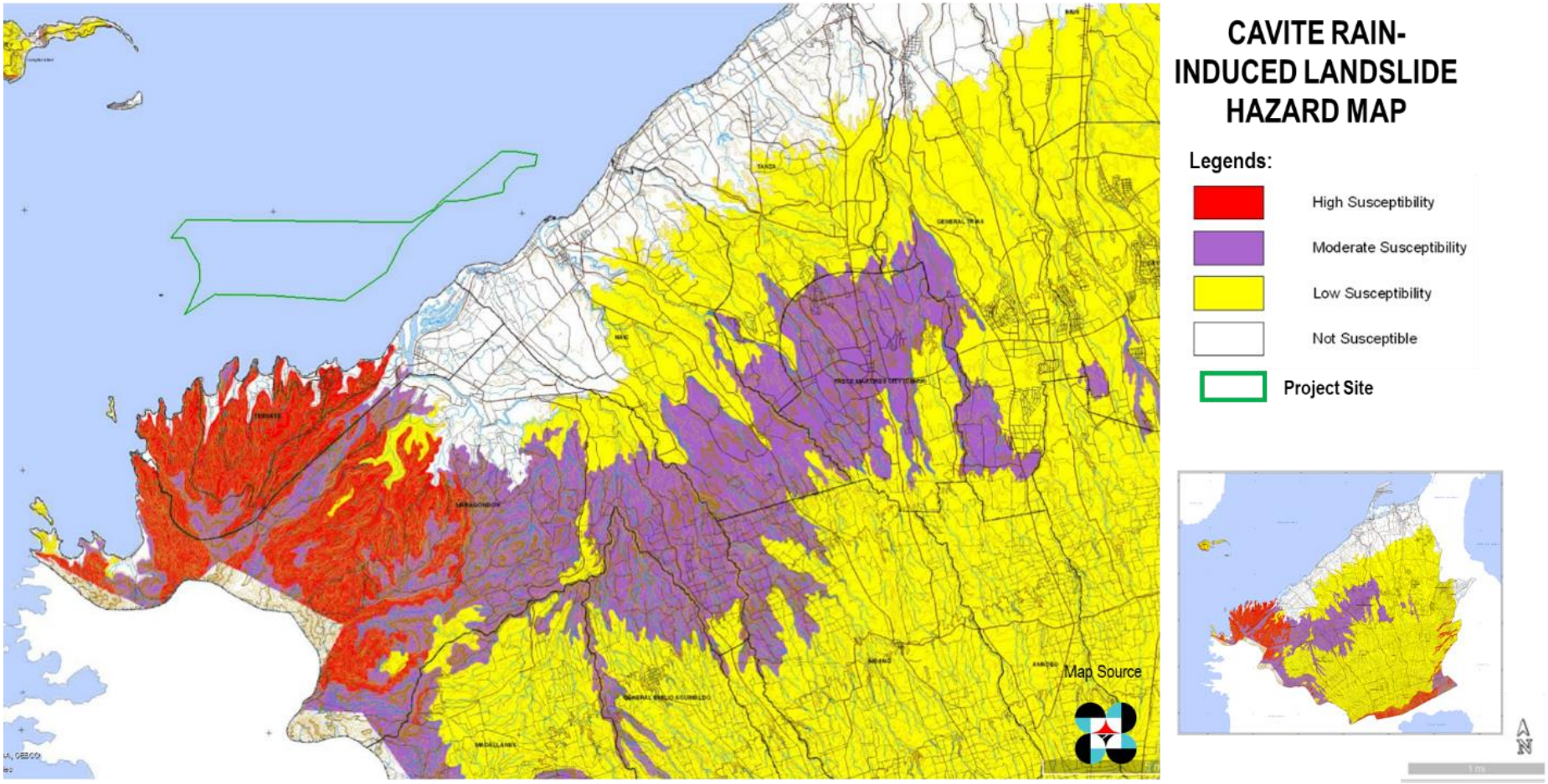


Figure 4-24: Cavite Rain-induced Landslide Hazard Map

4.1.11 Impact Assessment for the Land Environment

The table below details the perceived impacts on land of the proposed dredging project and the recommended management measures:

Table 4-6.Impact Assessment and Management Plan for the Land Environment

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
• **Dredging Phase** Local terrain modification, trenches will be generated on the project area as a result of sediment, silts, sand, etc. extraction; generation of sediment plumes and increase in turbidity of the marine waters within the project area.		**X**	**X**		• Planning of dredging operations via bathymetric surveys, current measurements and plume modeling • Monitoring of dredging operations and volume of extracted materials • Proper handling of dredged materials and transport to the reclamation area • Use of siltation traps to reduce the dispersal of sediments into the adjacent sections of Manila Bay • Water quality monitoring
• **Impact on Beaches and Tourism** Turbidity, while already high off the coast (see water quality report) may further increase which may impact the tourism use of beaches		**X**	**X**		• The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. The ideal deployment is that smaller-capacity TSHD is deployed near the coast, while larger-capacity TSHD should be assigned far offshore. The larger the capacity, the higher it can generate suspended solids and deploying them in deeper waters lessen the concentration due to high mixing potential in those area. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides.

4.2. WATER

4.2.1 Hydrology, Hydrogeology and Hazards

Rivers and streams that originate from upland areas or mountains drain into the coast. The general direction of the flow is from highlands of Tagaytay going to Manila Bay and stretching from the Municipality of Bacoor up to Ternate. The province of Cavite has six major rivers; Maragondon River, Labac River, San Juan River, Bacoor River and Imus River. The Municipality of Ternate is within the Maragondon River Basin while Naic is within the Maragondon River Basin and Labac River Basin as shown in **Figure 4-25.**

The Maragondon River and Labac River are discharging near the proposed project site (see **Figure** 4-26**)**

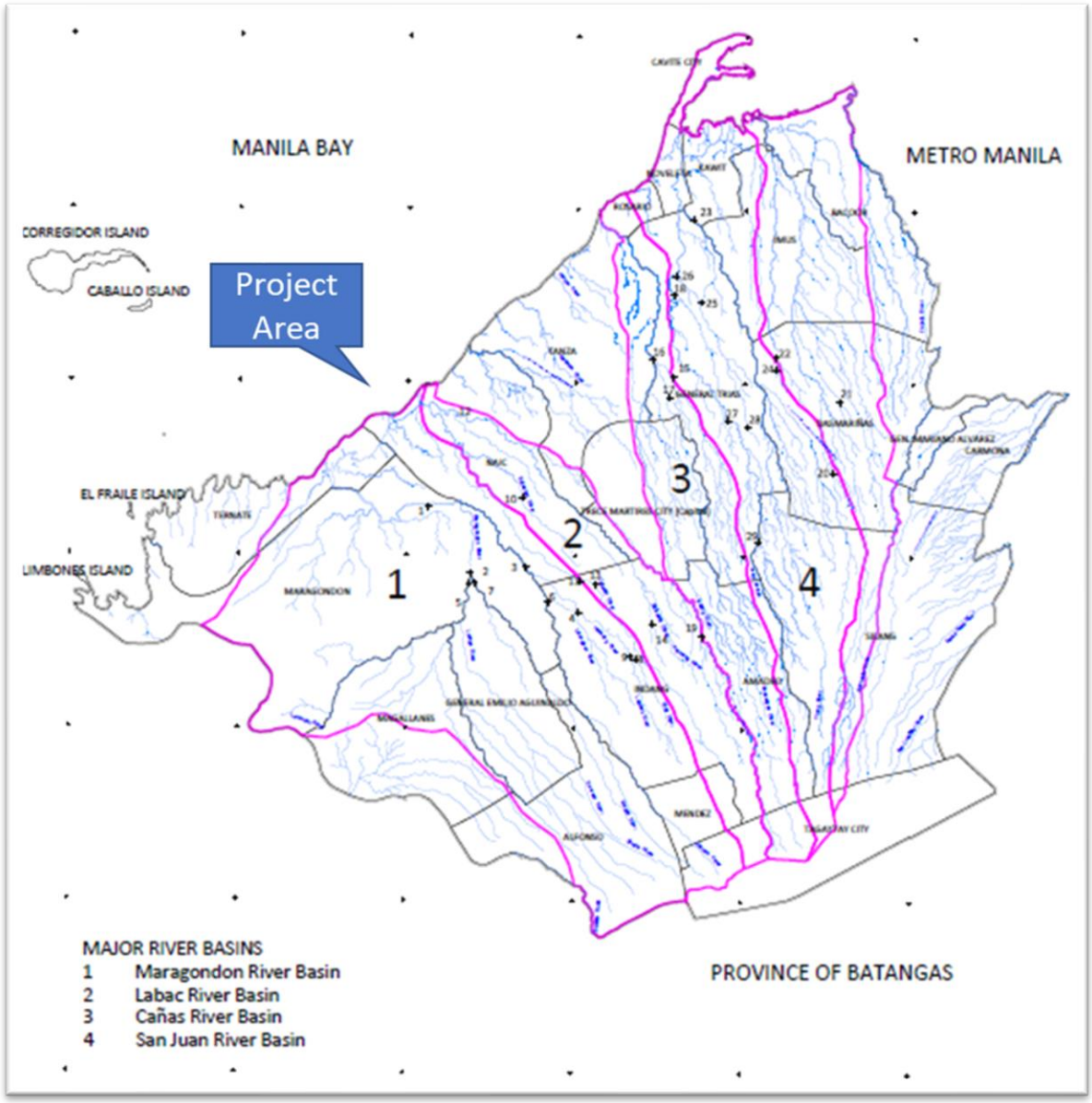


Figure 4-25: River Basin Map of Cavite

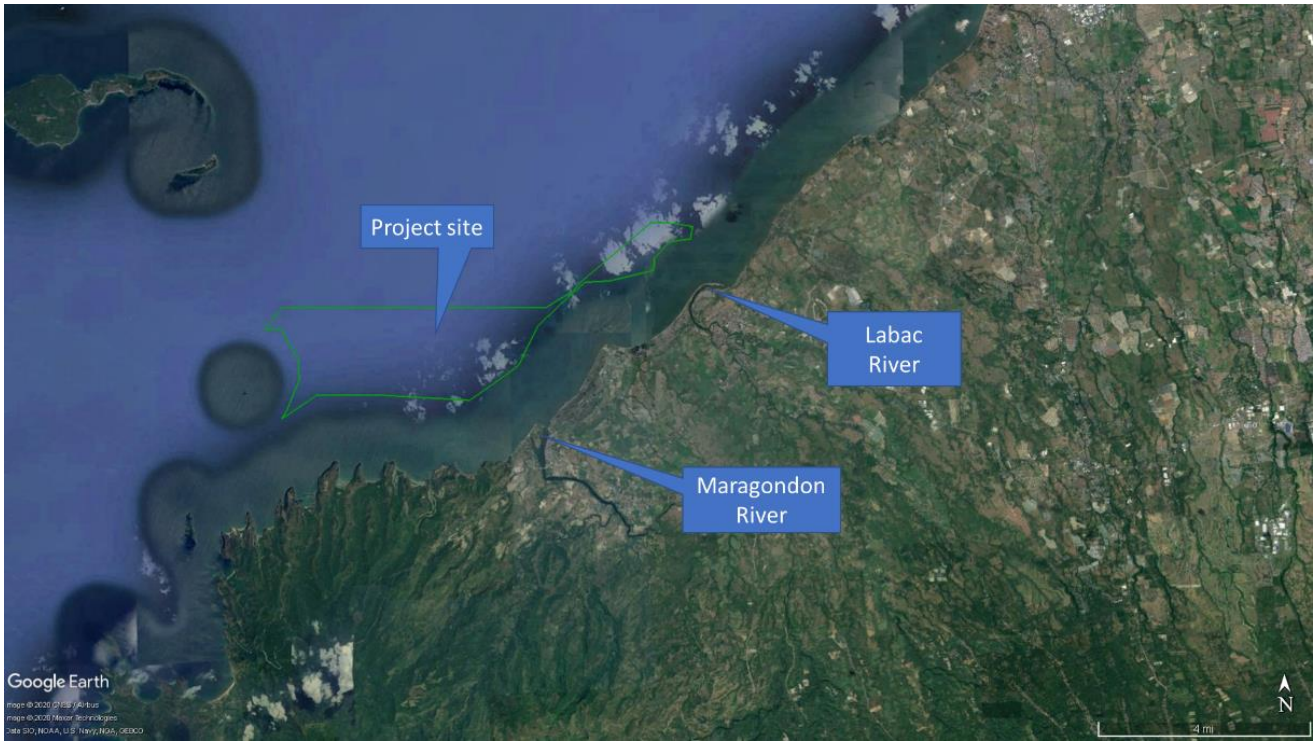


Figure 4-26: Rivers near the Proposed Project Site

4.2.2 Water Quality

Rivers and tributaries in the Manila Bay Area including Laguna Lake and Pasig River are currently being monitored intensively. Time series datasets on nutrients, BOD, and other physical parameters of major river basins have been established since the Manila Bay Mandamus was issued in 2009. These stations are provided in **Figure 4-27.**

The parameters that are being monitored in the Manila Bay Region are divided into five groups, namely; (1) physical - Total suspended solids (TSS), potential hydrogen (pH) -, (2) organic - 5-day biochemical oxygen demand (BOD), minimum-dissolved oxygen, Oil and grease, (3) nutrients - Nitrate, Phosphate, Ammonia, (4) heavy metals - Cadmium, Chromium, Lead, Mercury, Arsenic and (5) microbial - Total and fecal coliform.

Further, information on water quality particularly organic and nutrient loadings of the coastal waster off the bay is actually limited. Except for the regular monitoring of bathing beaches along the coast of Bataan and Cavite, there are limited information on how the Bay is assimilating the increasing organic and nutrient discharges coming from the different sub-basins of the region.

4.2.2.1 Water Quality in Coastal/Bathing Beaches

Coastal waters within Manila Bay are being monitored by the EMB. There are 19 monitoring stations, scattered in the areas of Bataan and Cavite and along the shores fronting the City of Manila. Among other reasons, they are monitored to determine which parts of the Manila Bay are safe for human contact particularly for resorts, tourism, or swimming activities.
All the monitoring stations in NCR have dissolved oxygen below the limit in 2017 and were observed to have low dissolved oxygen since 2011. Stations in Region 3 and Region 4A have DO levels of 6-7 mg/L from 2011 to 2017.

Only the stations in NCR have available data on nutrients. Measured nitrate in NCR stations are below the standard limit for Class SB. This is also true for the measured phosphate concentrations in the stations.

All the coastal beach monitoring stations contain high level of fecal and total coliform exceeding the standard limit. The stations in NCR were observed to have the highest measured coliforms. This indicates that the bathing beaches are not safe for human contact

4.2.2.2Water Quality in Marine Waters

Manila Bay was divided into 9 grids as sampling sites for the monitoring of the water quality in the bay.

pH levels in the monitoring stations in Manila Bay shows an increasing trend. In 2009, the pH range is 7 to 8, while in 2017 the pH range is 7 to 9. The DO concentrations of all the stations increased from 2009 to 2017. There was a decreasing trend on the DO concentration in each station from top to bottom. Only four stations conformed with the minimum DO concentration of 5 mg/L from top to bottom.

In 2014, the measured phosphate concentration in all the stations are above the limit of 0.5 mg/L. Average phosphate concentration in the Manila bay is 1.3 mg/L.

Heavy metals monitored from rivers may indicate discharges from industrial activities. The EMB monitoring showed increasing concentrations of cadmium, chromium and lead in some stations along Pasig River

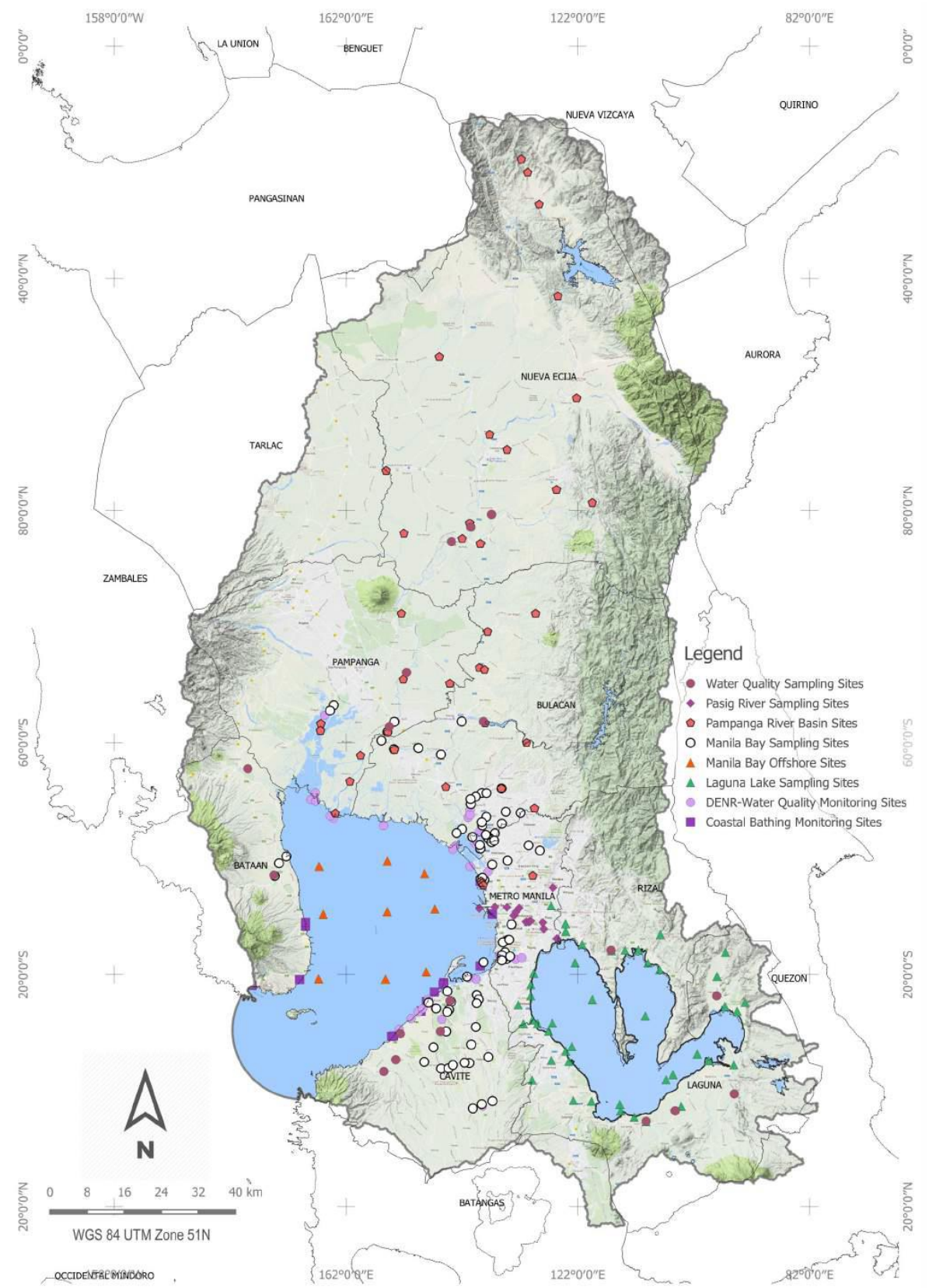


Figure 4-27 Water Quality Monitoring Stations in Manila Bay

4.2.2.3 Pollutant Loading[8]

The growth in population and industrialization within the Manila Bay Area has contributed to the degradation of its water quality. Pollution from households along the coastal zones and waterways and urban areas are common sources of organic as well as inorganic pollutants in Manila Bay due to the absence of sufficient solid waste management and sanitation facilities. Pollution also comes from other sources including surface runoff from agricultural areas that carries nutrients and residues of chemical pesticides. Sediments from soil erosion in upstream areas where improper farming practices and other erosive land use practices are common contributor as well to the pollution of waters in Manila Bay and rivers feeding to the bay. Frequency of oil spills and discharges from ships and maritime activities at the Manila Harbors is also a major pollution concern.

4.2.2.3.1 Increasing Sewage Generation

It is estimated that an average of 80% total domestic water consumption end up as sewage. In the absence of sufficient management facilities, significant proportion of the sewage generated from the MBA is likely to end up in the Bay.

4.2.2.3.2 Commercial and Industrial Wastewater

Wastewater from institutional, commercial and industrial establishments is similar to domestic wastewater. Unfortunately, at present, data on the wastewater generated and discharged (in terms of quality and volume) by these point sources remain with the regional offices of the Environmental Management Bureau (EMB). They seem not fully collated yet and analysed. Thus, it is difficult to have an overview of the extent of pollution loading coming from all these point sources within the Manila Bay Area. This is a gap needs to be addressed.

4.2.2.3.3 Solid Wastes

It was estimated in 2018 that about 20,586 tons per day of solid wastes were generated within MBA and projected to increase to 32,558 tons per day (11.89 million tons per year) by 2050. Pollution brought about by inadequate solid waste management (SWM) is major contributor to the water quality of the creeks, estero, rivers and eventually the Manila Bay. Domestic, commercial, and industrial activities generate solid wastes (i.e., garbage) that enter the Bay directly or via river and drainage systems. Solid wastes impair ecosystems and habitats, deteriorate aesthetics, and pose public health risks. They also aggravate the flooding problem since they clog the pumping stations rendering them inoperable.

4.2.2.3.4 BOD pollutant Loading

The deeper waters of Manila Bay are depleted of dissolved oxygen for most of the year. This is a serious problem for ecosystem health and fisheries. It is caused by the high load of organic materials entering the bay coming from domestic, commercial, industrial and institutional sources, as well as

[8] National Economic Development Authority. Manila Bay Sustainable Development Master Plan - Final Master Plan Report. 2020.

urban and agricultural runoffs. Sea-based activities such as aquaculture and waste release from passenger ships and cargo vessels also contribute to the pollution load.

Biological Oxygen Demand (BOD) is much used parameter representing all oxygen consuming substances in the water of which organic material typically constitutes the biggest part. For BOD, the load generated onshore is believed to have the larger contribution. As DENR routinely monitors BOD concentration in the rivers and river water quality objectives are established for BOD as performance indicator.

The pollutant loading entering Manila Bay in 2015 is 0.346 million tons per year in 2015. The target value is 0.087 million tons per year under the Manila Bay Plan as derived from the Water Load Model and the Water Quality Model. The target value is chosen for reducing the BOD load entering Manila Bay by 75% from the 2015 base case which will substantially reduce the dead zone (oxygen-depleted area).

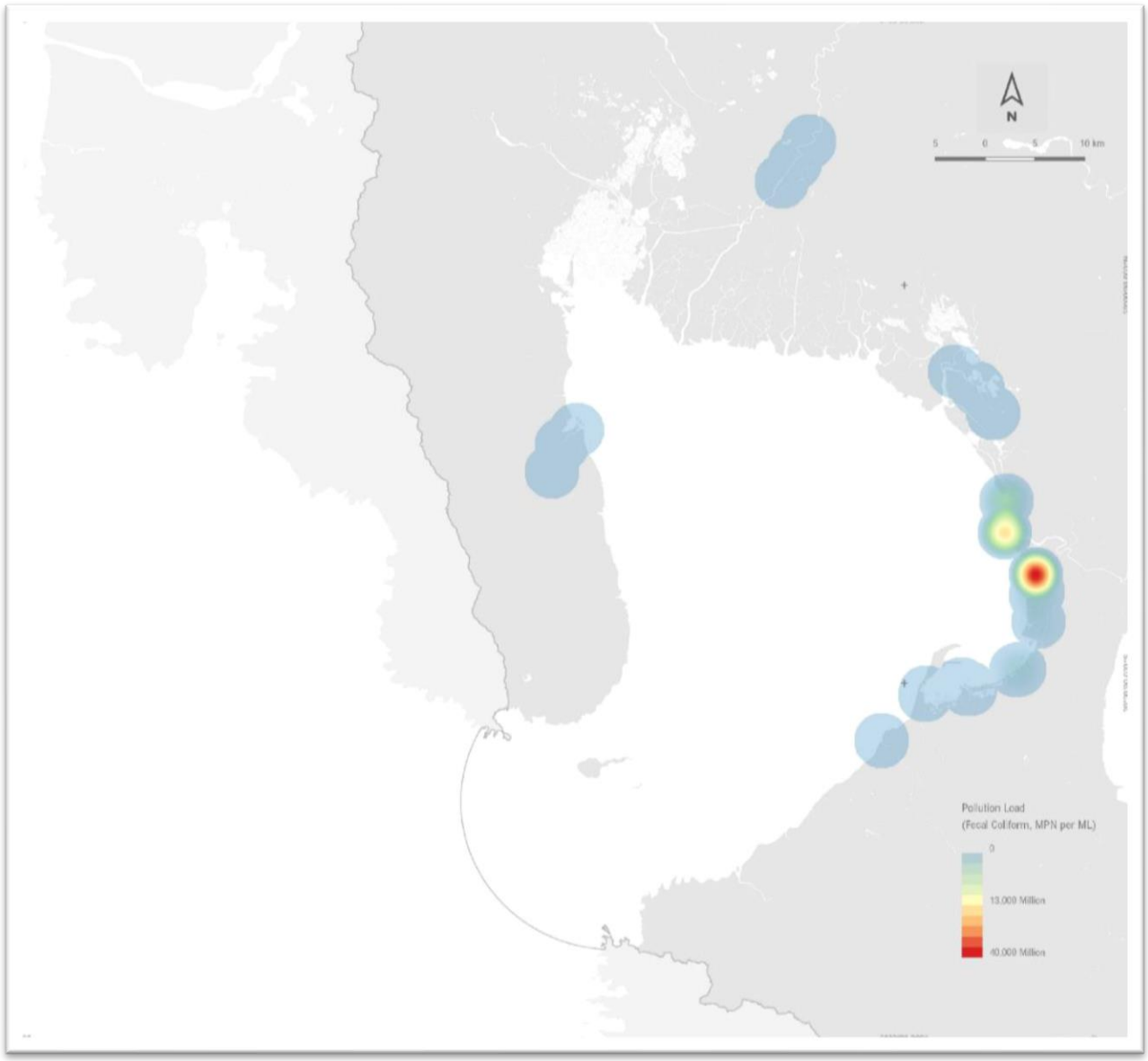


Figure 4-28 Pollutant Load in Manila Bay

4.2.2.4 Water Quality On site

Water Quality Sampling was made on January 27, 2021 with three samples taken at three different barangays onshore perpendicular to the proposed dredging site. Based on results, the waters along the coastal areas relatively near the site have already higher levels of total suspended particulates than allowed for Class SB waters. Fecal coliform is also higher in some areas as provided in the table below.

Table 4-7 Water Sampling Results (January 27, 2021)

Sample ID	***Analysis***	***Unit***	***Results as received***	***WATER QUALITY PARAMETERS FOR CLASS SB***
CW Station 1- Bucana, Temate	True Color	TCU	15.00	50
	pH on-site	pH Units	7.87	7.0-8.5
	Total Suspended Solids	mg/L	66.00	50
	Chloride	mg/L	25,700.00	n/a
	Dissolved Oxygen	mg/L	7.10	6
	Nitrate-Nitrogen	mg/L as N	0.04110	10
	Phosphate	mg/L as P	0.05810	0.5
	BOD	mg/L	ND	*n/a*
	COD	mg/L	815.00	-
	Fecal Coliform	MPN/100mL	49.00	100
	Total Coliform	MPN/100mL	49.00	n/a
	Temperature on-site	°C	28.20	26-30
CW Station 2- San Jose, Temate	True Color	TCU	15.00	50
	pH on-site	pH Units	8.00	7.0-8.5
	Total Suspended Solids	mg/L	96.50	50
	Chloride	mg/L	17,500.00	n/a
	Dissolved Oxygen	mg/L	6.80	6
	Nitrate-Nitrooen	mop_ as N	0.08770	10
	Phosphate	mg/L as P	0.06630	0.5

Sample ID	***Analysis***	***Unit***	***Results as received***	***WATER QUALITY PARAMETERS FOR CLASS SB***
	BOD	mg/L	ND	*n/a*
	COD	mg/L	735.00	-
	Fecal Coliform	MPN/100m 1	130.00	100
	Total Coliform	MPN/100m L	2,300.00	n/a
	Temperature on-site	°C	28.70	26-30
CW Station 3-Labac, Naic	True Color	TCU	20.00	50
	PH on-site	pH Units	8.16	7.0-8.5
	Total Suspended Solids	ma/L	55.50	50
	Chloride	mg/L	17,700.00	n/a
	Dissolved Oxygen	mg/L	7.00	6
	Nitrate-Nitrogen	mg/L as N	0.08770	10
	Phosphate	mg/L as P	0.12500	0.5
	BOD	mg/L	4.78	*n/a*
	COD	mc/L	895.00	-
	Fecal Coliform	MPN/100m 1	4,900.00	100
	Total Coliform	MPN/100m L	22.00	n/a
	Temperature on-site	°C	28.6	26-30

4.2.3 Sediments

The sediments which underlie the dredging or project area and the probably the rest of Manila Bay were transported by river systems. There are about 26 catchments that drain on it. These catchments are bounded on the east by Sierra Madre Mountains, to the north by the Caraballo Mountains, to the northwest by the Zambales Mountain Range and to the west by the Bataan Peninsula.

The biggest river system corresponds to the Pampanga River to the north and the Pasig River to the west. At the Maragondon – Ternate area, the drainage systems which discharge into Manila Bay and in the vicinity of the Project Area, which corresponds to Maragondon River and small streams that drain the Volcanic Mountainous Area. These waterways form their respective deltas at the southeastern edge of Manila Bay.

De Las Alas in 1990[9] (as cited in Siringan and Ringor, 1998) predicted the sedimentation rates in various parts of Manila Bay. The predicted rate at the Project Area is less than 1 cm per year. The movement of the sediments within the bay is due to the combined effects of tidal, fluvial and wind patterns.

Siringan and Ringor (1997) identified the longshore currents which result during the passage of the major winds within the Bay area. As shown in **Figure 4-29**, these wind patterns are the southwesterlies, southeasterlies and northeasterlies. These winds generate longshore currents which transport the sediments to particular sections of the bay.

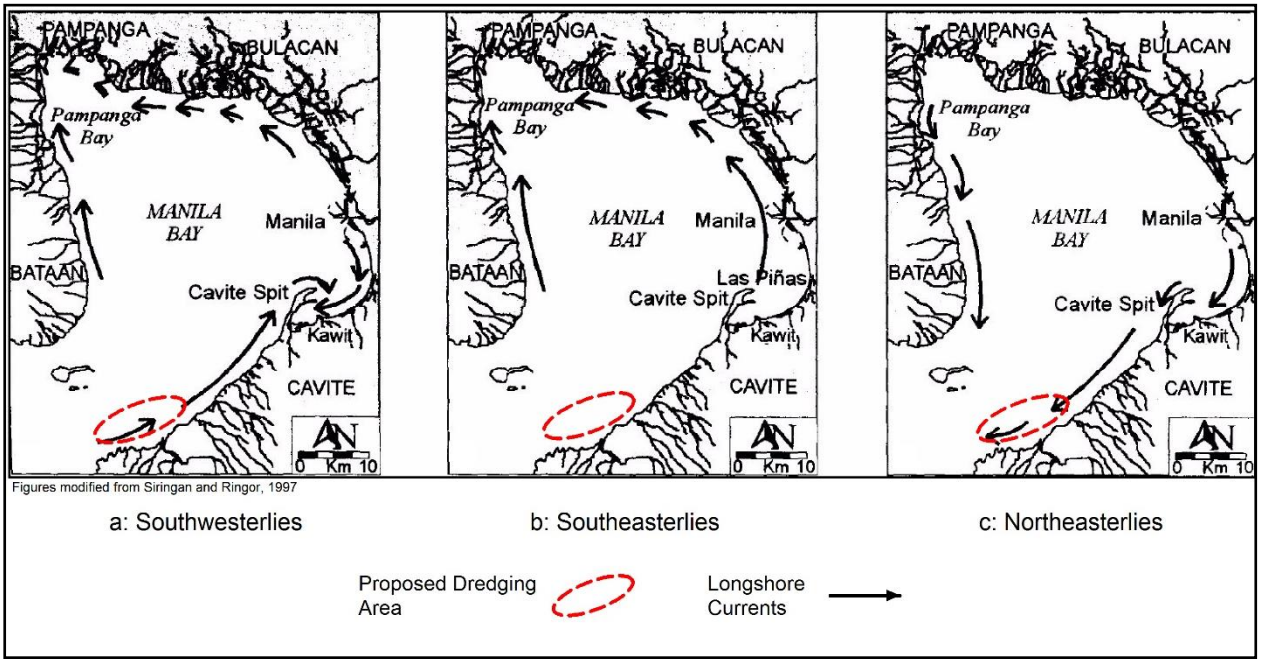


Figure 4-29: Longshore currents of Manila Bay which were generated by major winds

Southwesterlies generate currents that runs northeast and parallel to the coastal section of Cavite and passes through the project area. These winds also produce longshore currents that run northward along the coastal section of the Bataan Peninsula.

The southeasterlies generate currents that runs northwest from the Cavite spit towards Pampanga Bay. The same winds produce currents that run northward along the coastal section of the Bataan Peninsula.

The northeasterlies generate currents which run southwest and parallel to the coastal section of Cavite, and through the project area. The same winds generate currents which run southward along the coast of the Bataan Peninsula.

4.2.4 Marine Ecology

The project dredging site is on the eastern coast of Manila Bay adjacent to Nasugbu Bay. The dredging area is estimated at 2 to 4 kilometers far from Ternate coast. There is no known reef in the area but hard substrates or volcanic origins are known to occur. The proposed dredging area is about 10 to 30 meters in depth (Villanoy and Martin, 1997).

[9] Estimation of sedimentation rate in Manila Bay

4.2.4.1 Methodology

Benthic within the proposed project area was surveyed using modified manta tow (English et al., 1997). An underwater camera was tethered to a stick and immersed in water approximately at least 10 meters from the bottom. The boatman was instructed to run at 10 knots per hour through a continuous 157-meter imaginary transect line within the proposed project area. Based on the actual site reconnaissance, low to very low underwater visibility was documented mostly in the entire project area.

The same method was employed on three (3) points approximately 500 meters from the coast. Spot dive was also done on an area known by the fishermen to have hard substrate. Interviews with fishermen were conducted to determine species composition of fish catch and rough estimate of catch per unit effort in the area.

Available secondary information on heavy metal concentration in water and plankton from previous studies were utilized.

4.2.4.2 Limitations of the Study

The assessment was confined within the project area of Silverquest Mining Resources, Inc. Representative. Generally, the representative areas already characterize the marine environment in the impact area. Low underwater visibility was noted in the entire project area.

4.2.4.3 Results and Discussions

4.2.4.3.1 Study site

The marine study was conducted on October 24, 2020 at three (3) stations described in **Table 4-8** and **Figure 4-30.**

Table 4-8 Sampling points for the Marine Ecology Survey

Code	Coordinates	Description
PAT1	14˚ 19’ 09” N; 120 40’ 47” E to 14 ˚ 18’ 54” N; 120 40’ 06”E	Modified manta tow within the project area
NCA1	14 ˚ 17’ 40.23” N 120 ˚ 42’ 57.35” E	Near Coast Area 1; mouth of Maragondon River
NCA2	14 ˚ 16’ 51”N 120 ˚ 40’ 57” E	Near Coast Area 2; reef area

Much of the study area as described by fishermen interviewed is sandy bottom with sporadic hard bottom of granite origin. Consistently, the marine resource map of Cavite showed that 19.5 hectare of reef is present in Barangay. Sta. Mercedez, Maragondon with 34% hard coral cover (Cavite

Ecological Profile 2017). The municipality of Maragondon is south of Ternate and within the mouth of Manila Bay where reefs occur (Manila Bay Coastal Strategy 2001). Other sites where reefs within Manila Bay occur are in Mariveles and Orion in Bataan.

There are no known reefs in the immediate project area and as per ecological profile of Cavite. Therefore, a Marine Resource Map was not drawn for this study.

4.2.4.3.2 Biological Features

Fish

Underwater visibility within the project area (PAT1) runs only for about a meter in which camera tows did not show any features that indicate biological activity within the project site. Interviews with fishermen, however, indicate pelagic fish species are being sourced from the area. Species caught mostly include species from the Scrombidae and Carangidae like Shortfin scad or *"galunggong" (Decapterus macrosoma),* Frigate tuna *or "tulingan" (Auxis thazard*), *and* Chub mackerel or *"lumahan" (Scomber* sp.*)*.

Benthos

NCA1 is located at the mouth of Ternate River. The site has gravel-sand substrate with thick shells layer overlying the bottom. The study area is known locally to be commercially exploited for *halaan*. At least two (2) species of clams were documented to be harvested from the site: *Katelysia hianta* (Family Veneridae) and *Anadara* sp. (Family Arcidae). *Tahong* (*Mytilus* sp.) also forms part of the benthic harvest but are usually discarded. Interviews with gleaners indicate a catch-per-unit effort of 10 liters for four (4) hours that is being sold at PhP 500.

Photo 4-1. Gleaning for halaan *entails scooping the loose bottom materials and hand-picking the live clams with right size. Left photo shows a woman doing the sorting while right photo is a sampler of the bottom material where clams are handpicked*

Photo 4-2 Handpicked halaan.

Figure 4-30 Sampling stations for the Marine Ecology Rapid Assessment

NCA2 showed sandy substrate with rocks of igneous origin. Spot diving in the area indicated recruitment of sponges, oyster spats, and hard corals. There were no observed large colonies of either sponges or hard corals observed, though. The study site is visited by angler-hobbyists which reportedly can haul various fish species such as *lapulapu* (Serranidae)*, mais-mais* (Luthjanidae and Lethrinidae)*, tulingan* (Scrombidae) and *talakitok* (Carangidae).

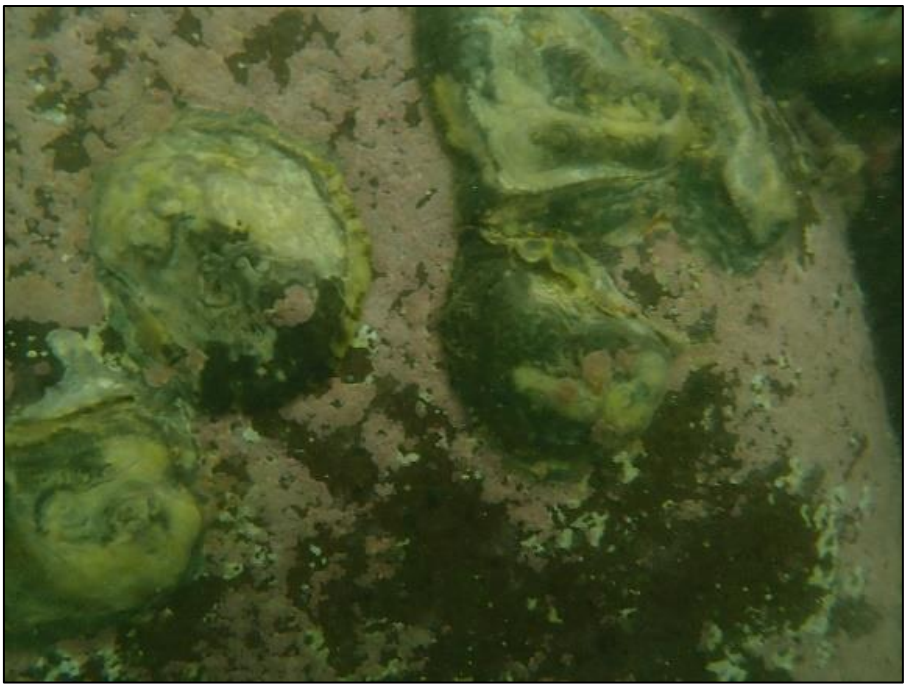


Photo 4-3 Oyster spats on a bolder from NCA2.

Interview with fishermen plying the nearshore area indicated the following catch composition: *sapsap* (Leiognathidae), *mamsa* (Carangaidae)*, mais-mais, tilapyang dagat* (Lethrinidae)*, and sermolete* (Mullidae). Catch-per-unit effort in the area is about 2 kilograms for 2.5 hours.

Photo 4-4 NCA1 Site photo

Photo 4-5 NCA2 Site photo

Photo 4-6 A closer view of coastline of NCA2

Photo 4-7 A closer view of coastline of NCA2 (with a sea urchin)

Seagrass

There was no seagrass community observed in the area. Within Manila Bay, seagrasses are known to occur in Bataan at the northern coast of the bay.

Plankton Concentration

Phytoplankton concentration measured as chlorophyll concentration for Manila Bay as of 2015 indicated the bayhead areas had the highest concentrations in 2015 (Figure 2). Zooplankton concentration, on the other hand, range from 500-2000 individuals per litre of water (Figure 3). Temporal variability over time indicated that the southern points which are within the project area showed high zooplankton concentrations.

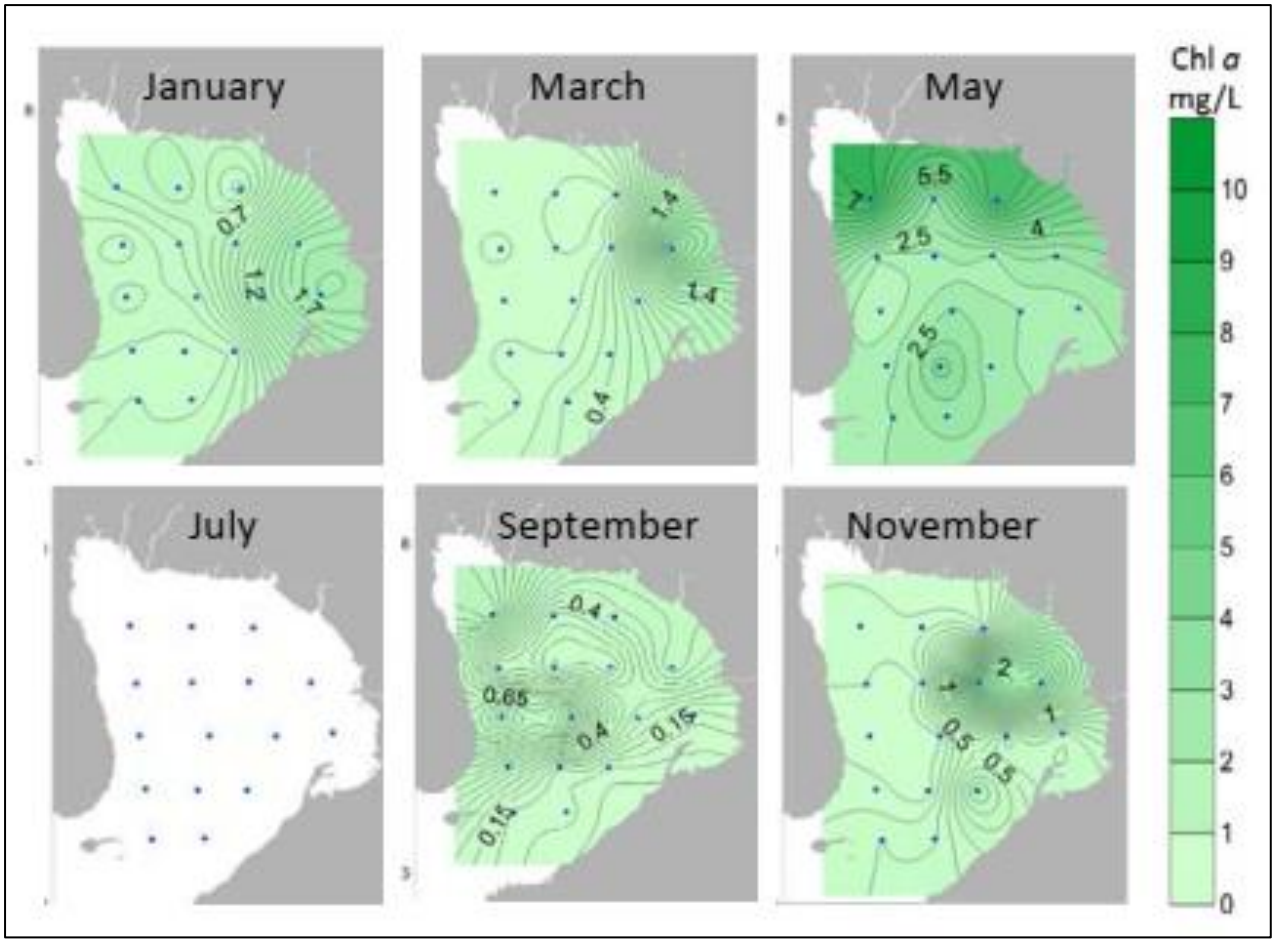


Figure 4-31 Spatio-temporal concentration of chlorophyll in Manila Bay (Source: Jose et al., 2015)

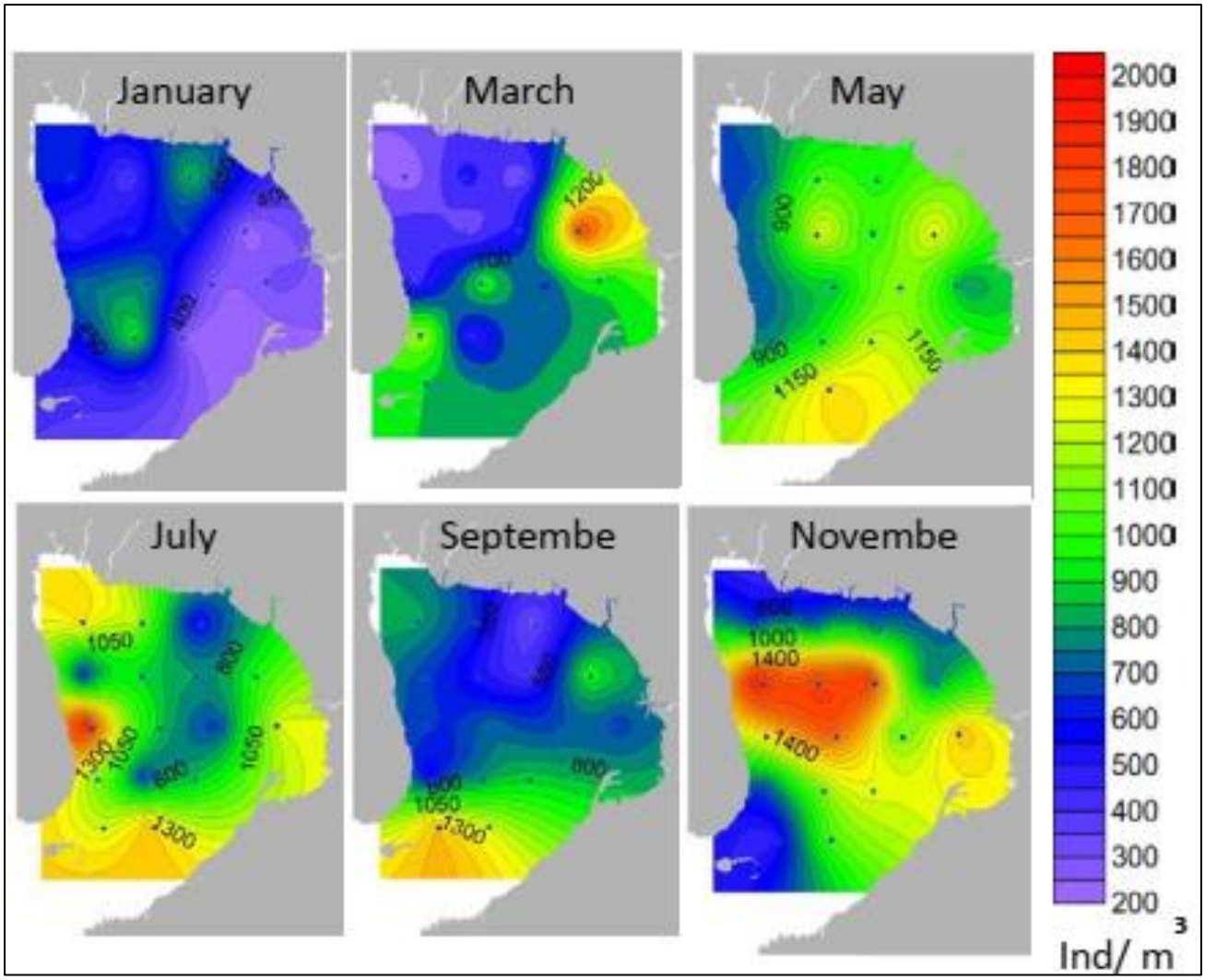


Figure 4-32 Spatio-temporal variation in zooplankton concentration of Manila Bay (Source: Jose et al., 2015)

Ordination plot between environmental parameters and the 10 most abundant zooplankton in the area indicated significant positive correlation between temperature and dissolved oxygen (Jose et al, 2015). Nutrients such as nitrates and phosphates also showed significant positive correlation to a lesser degree.

4.2.4.3.3 Heavy metal concentration

Data on heavy metal concentration was taken from Sy et al., 2017. Average Cadmium and Mercury concentrations were within water quality standards while average Lead concentration is above minimum allowed for surface waters. DAO 34-90 puts a standard of 0.05 mg/L of water as the acceptable level of Class SC waters (Figure 4).

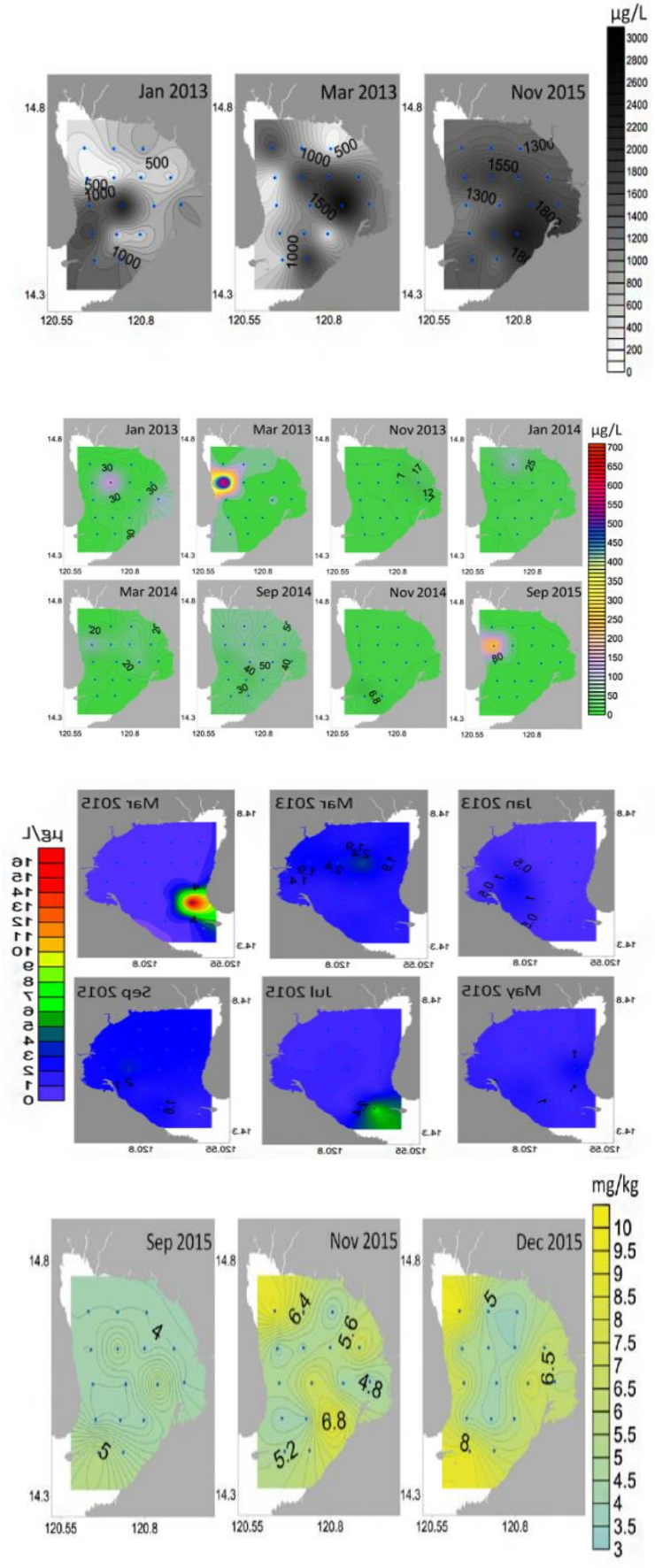


Figure 4-33 (Top to Bottom) Lead, Cadmium, Mercury, and Hydrogen Sulfide concentration in surface water and bottom of Manila Bay, respectively (Source: Sy et al., 2017).

4.2.5 Marine Protected Areas

The project will not impede nor overlap with existing fish sanctuaries (with municipal ordinances) in the province of Cavite but there may be some minor cohesion within the 3 kilometer buffer zone of the said sanctuaries as provided below. The municipality of Ternate however, identified a coastal buffer of 1.5km from the shore.

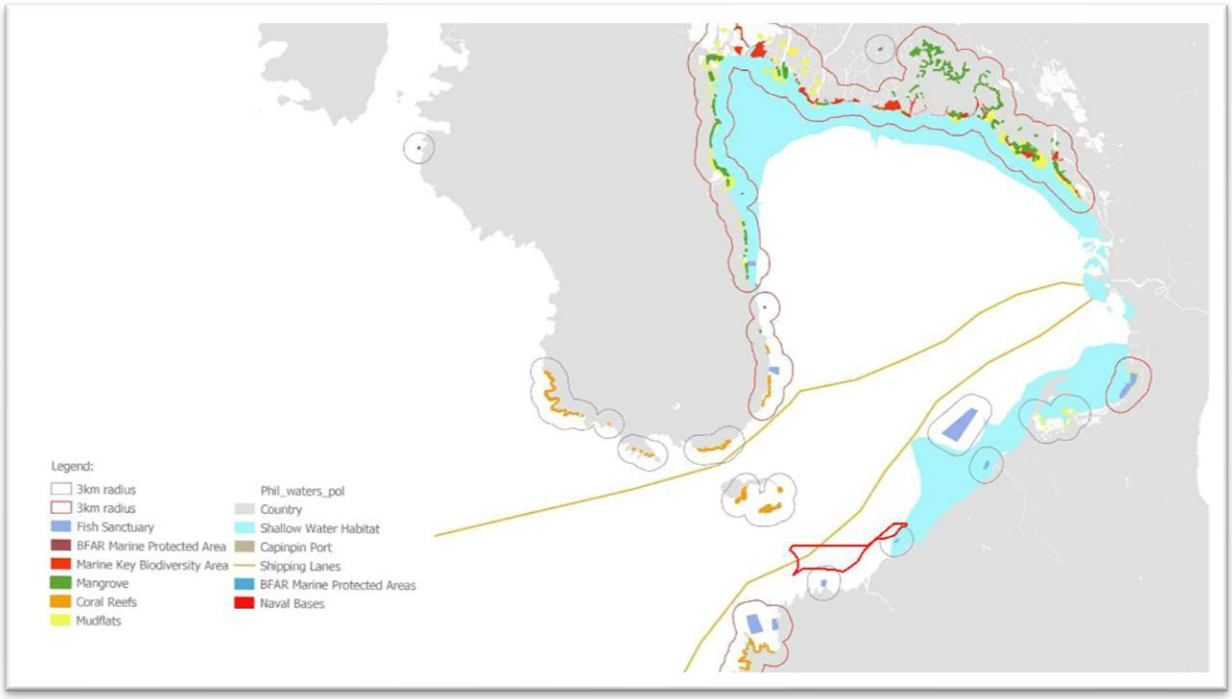


Figure 4-34 Identified Protected Areas near the Project Site

Table 4-9 Fish Sanctuaries in Cavite

Municipality	Ordinancen/resolutiono.	Title
Naic	No. 03 series of 2003	Resolution declaring a portion of the municipal waters of Brgy. Bagong Kalsada as fish sanctuary.
	No. 09 series of 2003	An ordinance declaring, establishing and regulating the Naic fish sanctuary and Naic reserve areas, prescribing the regulatory measures related thereto with fixed fines and penalties in case of violation and granting authority to the Naic Municipal Mayor to enter into a Memorandum of Agreement with an accredited nongovernmental organization for the full implementation and enforcement of this ordinance.
Ternate	No. 04 8-2005	An ordinance declaring, establishing and regulating the Ternate Fish sanctuary and marine reserved areas, prescribing the regulatory measure related thereto with fixed fines and penalties in case of violation.
	No. 17 8-2005	Resolution declaring the creation of Bulaklakin Reef as fish sanctuary and fishery reserve.

4.2.6 Impacts Assessment for the Water Environment

The table below summarizes the Impact Assessment on the water environment and the recommended management measures.

Table 4-10 Summary Impacts on water quality of the SILVERQUEST Project

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Threat to existence and/or loss of important local species Threat to abundance. Frequency and distribution Increase in Turbidity due to Resuspension of Sediments. Possibility of Effects on Maragondon corals		X	X		*No pre-operational and abandonment impact is expected from the Project.* • The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. The ideal deployment is that smaller-capacity TSHD is deployed near the coast, while larger-capacity TSHD is far offshore. The larger the capacity, the higher it can generate suspended solids and deploying them in deeper waters lessen the concentration due to high current mixing potential in the area. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides. • An emergency plan should be put in place in case of oil spills. Provisions on confinement bouys, absorptive materials and siphoning equipment should be on stand-by to address accidental spills. Careful dredging plan will minimally change depth contour of the area to allow the normal water circulation dynamics within the bay.

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
					• To address potential ecosystem loss from possible smothering of corals on precious reefs of Maragondon, SMIR will invest on ecosystem enhancement projects. Hard materials within the coast of Ternate showed potentials of recruiting benthic organisms. Fishermen recounted deployment of fish aggregating devices and artificial reefs within Ternate waters but were not managed well. This possible socio development projects for SMRI will showcase the impact of dredging in the general ecosystem becomes nil.
Increased Possibility of Oil Spills. Garbage Disposal to the sea		**X**	**X**		The dredging equipment should be regularly maintained to ensure that oil and grease leaks will be addressed prior to its actual deployment. Solid waste should not be directly disposed to the sea. Strict protocol on waste disposal should be implemented including provision disposal bins and regular collection right after the operation.

4.3 AIR

4.3.1 Climate

The Philippines is a tropical and maritime climate characterized by relatively high temperature, high humidity and abundant rainfall. The climate in the project site and in the municipalities of Naic and Ternate is classified as Type I under the Modified Corona's Classification System used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Areas under this climate type experiences two pronounced seasons: dry from the months of November to April and wet for the rest of the year. See **Figure 4-37.**

4.3.2 Temperature and Humidity

As shown in the climatological normal provided under **Table 4-11**, April and May are the hottest month of the year with a recorded mean temperature of 31 degrees Celsius (˚C) while January is the coldest month with average temperature of 26 ˚C.

Based on the climatological extremes in **Table 4-12**, the recorded highest temperature was 38.5 ˚C on May 6, 1987 while the lowest temperature of 18 ˚C was recorded on February 1, 1982.

4.3.2.1 Projected Temperature due to Climate Change

The annual mean temperature in the Philippines has risen by 0.68°C which translates to an average rate of increase by about 0.1°C per decade.

Mean temperatures in the whole country are expected to rise by 0.9°C to 1.1°C, and by 1.8°C to 2.2°C in 2020, and 2050, respectively. Consistently, all seasonal mean temperatures in the Manila Bay Area will also increase in similar time slices, with the highest temperature projected in the summer (March April May) season[10].

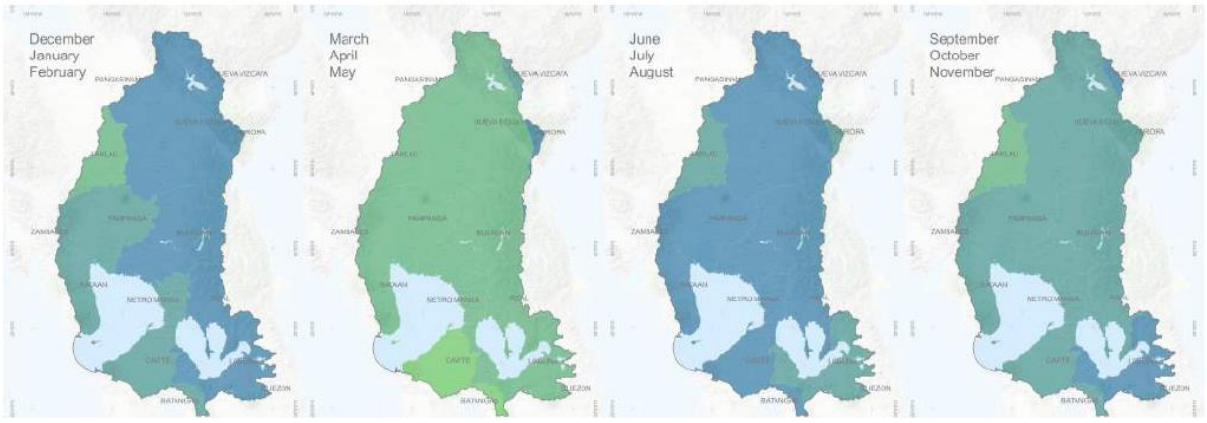


Figure 4-35 Projected Temperature Increase in °C for all seasonal months in 2020

[10] National Economic Development Authority. Manila Bay Area Situation Atlas. December 2018

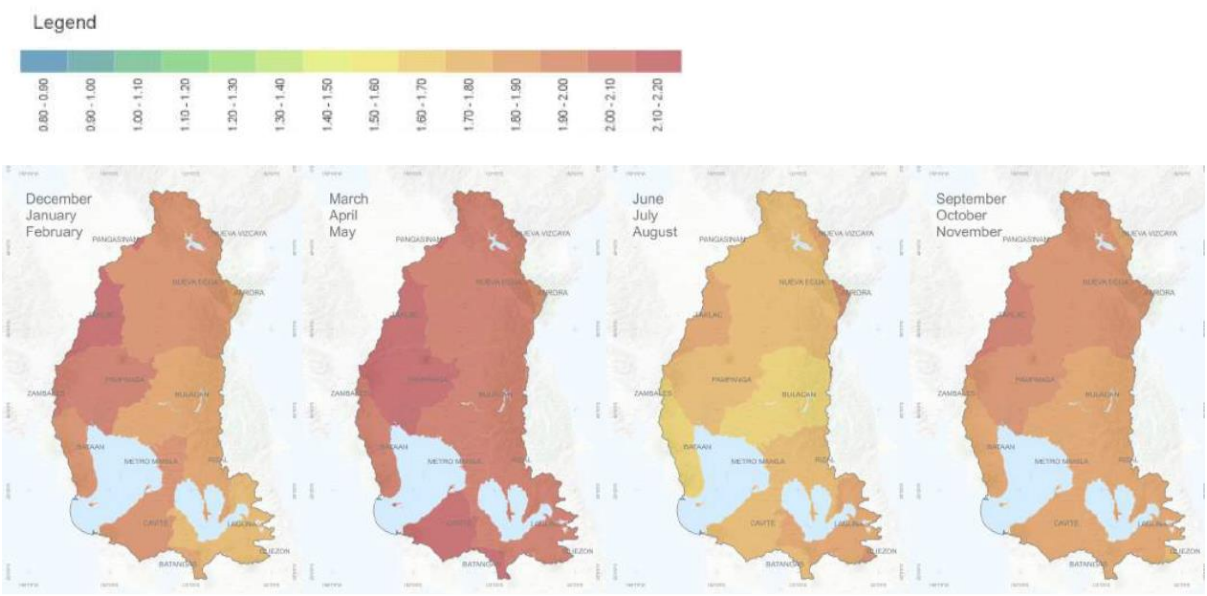


Figure 4-36 Projected Temperature Increase in °C for all seasonal months in 2050

4.3.3 Wind Speed and Direction

Based on the meteorological observations from 1974 to 2012, it showed that the prevailing wind in the area is east-southeast during the northeast monsoon ("Amihan") from October to March and west during the southwest monsoon ("Habagat") from June to September. The average speed of winds is 3.0 meters per second.

In terms of climatological extremes, the strongest wind was recorded on July 13, 2010 with the speed of 54 meters per second with wind direction of east.

4.3.4 Rainfall and Rainfall Intensity

Based on the climatological normals in Sangley Point, Cavite the annual amount of rainfall in the area is about 2,078.4 mm with 127 days of rainfall. The highest rainfall was observed in August with amount of 457.2 mm and lowest in March with 9 mm. The greatest daily rainfall recorded was on August 7, 2012 with amount of 354.2 mm.

A more refined rainfall map is also provided by the Manila Bay Atlas which shows an average rainfall of from 2000 to 3000 mm for the project area (**Figure 4-38**)

4.3.4.1 Tropical Cyclones

The Philippines experiences an average of 20 cyclones annually. Tropical cyclones usually occur in the country from June to December. The province of Cavite experiences an average of one (1) cyclone pass every year as shown in **Figure 4-39**.

Tropical cyclone paths from 1948-2017 show only about 18-20 typhoons and tropical cyclones pass near the area with only one hitting the project area directly (**Figure 4-40**)

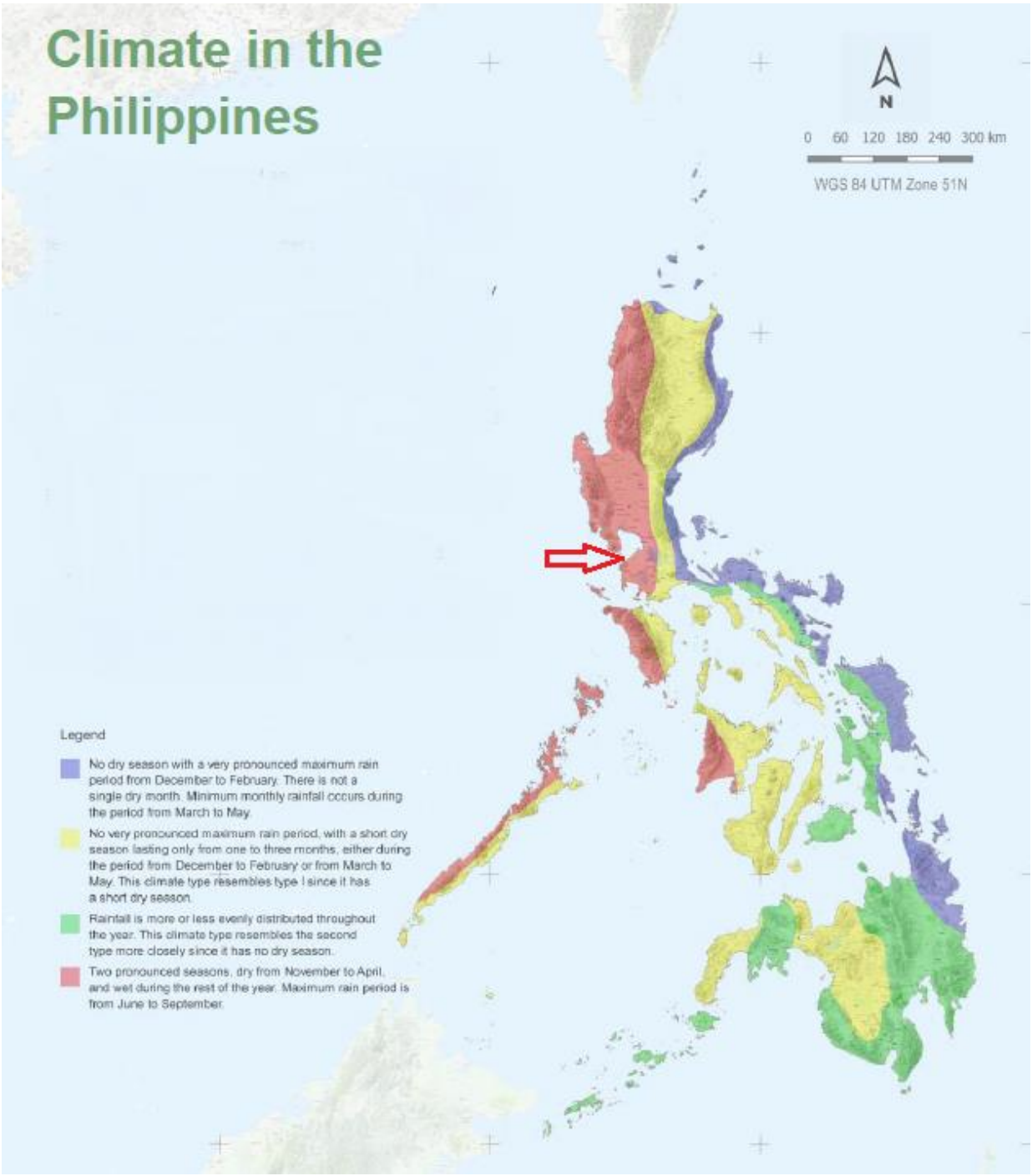


Figure 4-37 Climate Map of the Philippines

Table 4-11: Mean Historical Monthly Temperature and Rainfall Data (1974-2012)

Month	Rainfall		Temperature								Wind				No. of Days	
	Amount (mm)	No. of RD	Max ˚C	Min ˚C	Mean ˚C	Dry Bulb ˚C	Wet Bulb ˚C	Dew Point ˚C	Vapor Press (mbs)	RH (%)	MSLP (mbs)	Dir (16pt)	SPD (mps)	Cloud Amt (okta)	TSTM	LTNG
January	16.9	4	30	23.3	26.6	26.8	23.9	22.8	27.7	79	1012.5	ESE	3	5	0	0
February	11.1	2	30.8	23.6	27.2	27.4	24.1	22.9	27.7	76	1012.7	ESE	3	5	0	0
March	9.4	2	32.7	24.6	28.6	28.7	25	23.7	29.1	74	1012.1	ESE	3	4	1	1
April	18.5	2	34.4	25.9	30.1	30.3	26	24.6	30.6	71	1010.5	ESE	3	4	2	5
May	139.1	9	34.1	26.1	30.1	30.3	26.5	25.3	32	74	1008.8	ESE	3	5	11	16
June	264.5	15	32.8	25.8	29.3	29.5	26.4	25.4	32.3	78	1008.4	ESE	3	6	14	18
July	422.4	20	31.7	25.3	28.5	28.6	26	25.1	31.8	81	1008	W	3	6	16	17
August	457.2	21	31.3	25.2	28.3	28.2	25.8	25	31.5	83	1007.6	SW	3	7	13	14
September	341.8	19	31.4	25.2	28.3	28.4	25.9	25.1	31.7	82	1008.4	W	3	6	15	16
October	224.3	15	31.4	25.3	28.4	28.4	25.8	24.9	31.4	81	1009.3	ESE	3	6	9	14
November	110.5	11	31.1	25	28.1	28.1	25.3	24.3	30.3	80	1010.4	ESE	3	6	4	5
December	62.7	7	30	23.9	27	27.1	24.3	23.3	28.4	79	1011.9	ESE	3	5	1	1
Annual	2078.4	127	31.8	24.9	28.4	28.5	25.4	24.4	30.4	78	1010.1	ESE	3	5	86	107

Station: Sangley Point, Cavite

Table 4-12: Climatological Extremes as of 2012

Month	TEMPERATURE				GREATEST DAILY RAINFALL (mm)		STRONGEST WINDS (mps)			SEA LEVEL PRESSURES (mbs)			
	HIGH	DATE	LOW	DATE	AMOUNT	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
January	34.8	1/25/1999	19	1/3/1982	94	1/12/1977	17	ESE	1/19/2010	1023.4	1/16/1999	1001.9	1/31/2001
February	35.2	2/28/1998	18	2/1/1982	36.5	2/27/2012	15	ESE	2/27/1992	1019.9	2/3/1993	1005.4	2/21/2001
March	36.6	3/29/1981	19.1	3/25/1980	49.5	3/24/2012	24	ESE	3/23/1998	1020.5	3/5/2005	1003.9	3/6/1999
April	37.8	4/7/1983	21.5	4/3/2007	53.9	4/24/1975	16	ESE	4/5/1996	1017.5	4/14/1993	1002	4/30/1988
May	38.5	5/16/1987	22	5/15/1980	237.1	5/26/1997	27	SW	5/22/1976	1015.5	5/25/1983	993.4	5/22/1976
June	38.4	6/4/1987	22	6/16/1981	172.4	6/27/1985	25	SE	6/8/2011	1014.3	6/8/1997	997.6	6/28/2004
July	36.3	7/25/2007	21.2	7/15/1982	231.4	7/20/2002	54	E	7/13/2010	1013.8	7/29/1983	993.8	7/4/2001
August	36.5	8/16/2009	22	8/2/1994	354.2	8/7/2012	30	W	8/18/1990	1014.5	8/13/2005	998.1	8/17/1990
September	35.6	9/2/1996	21	9/16/1979	198.6	9/14/2012	44	NNW	9/28/2006	1015.6	9/18/2005	984.3	9/28/2006
October	35.8	10/8/1996	21	10/24/1988	260.7	10/5/1986	45	NW	10/21/1994	1016.4	10/27/1993	990.3	10/21/1994
November	36.4	11/8/1978	21.5	11/26/1982	171.2	11/2/2000	49	NW	11/3/1995	1017.5	11/30/1989	977	11/3/1995
December	34	12/6/1998	20	12/24/1985	131.3	12/10/2006	22	NNW	12/5/1993	1019.1	12/31/1992	997.9	12/2/2004
Annual	38.5	5/16/1987	18	2/1/1982	354.2	8/7/2012	54	E	7/13/2010	1023.4	1/16/1999	977	11/3/1995
Period of Record	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012	1974-2012

Station: Sangley Point, Cavite

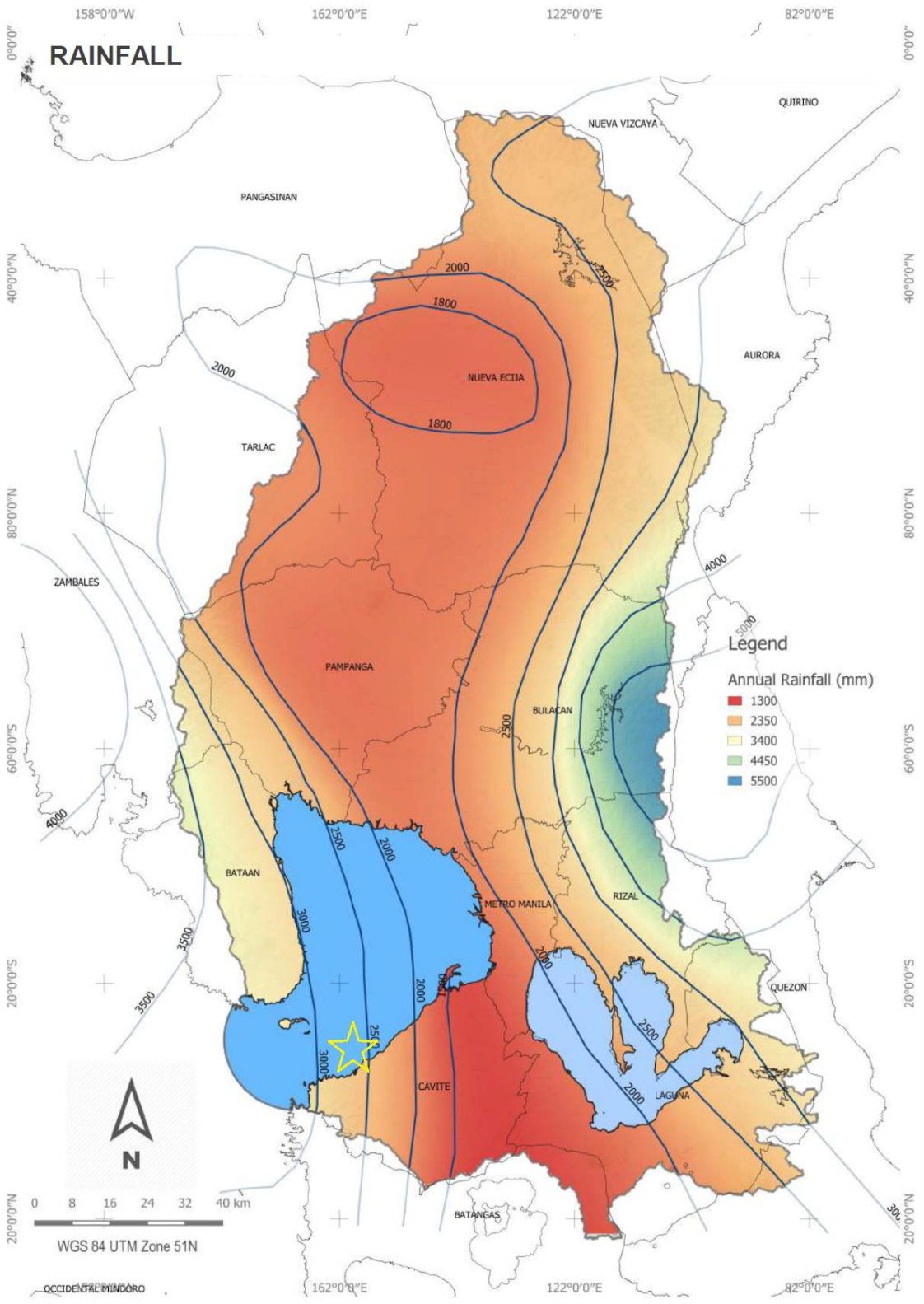


Figure 4-38 Rainfall map of the project area

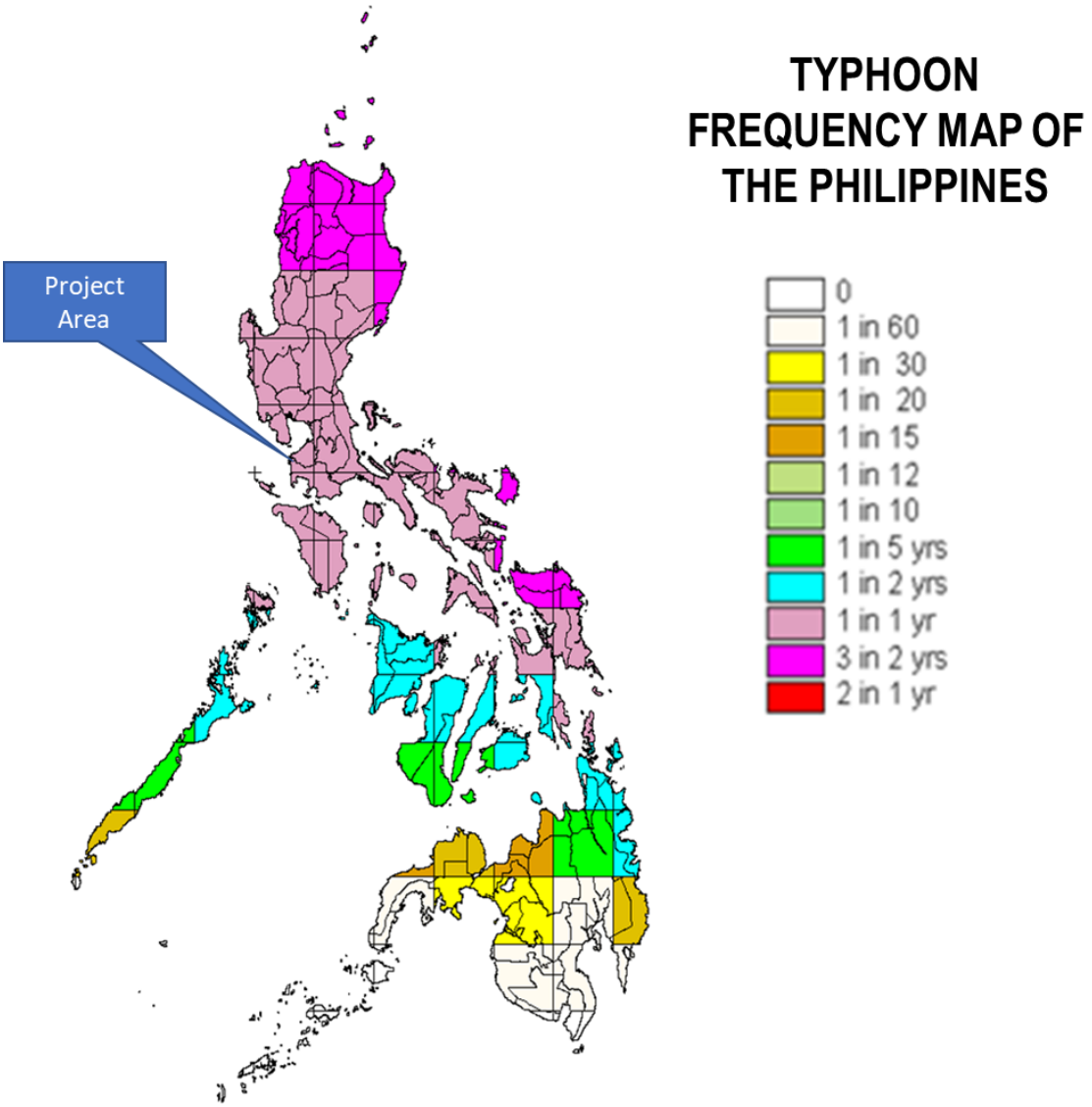


Figure 4-39 Typhoon Frequency Map of the Philippines

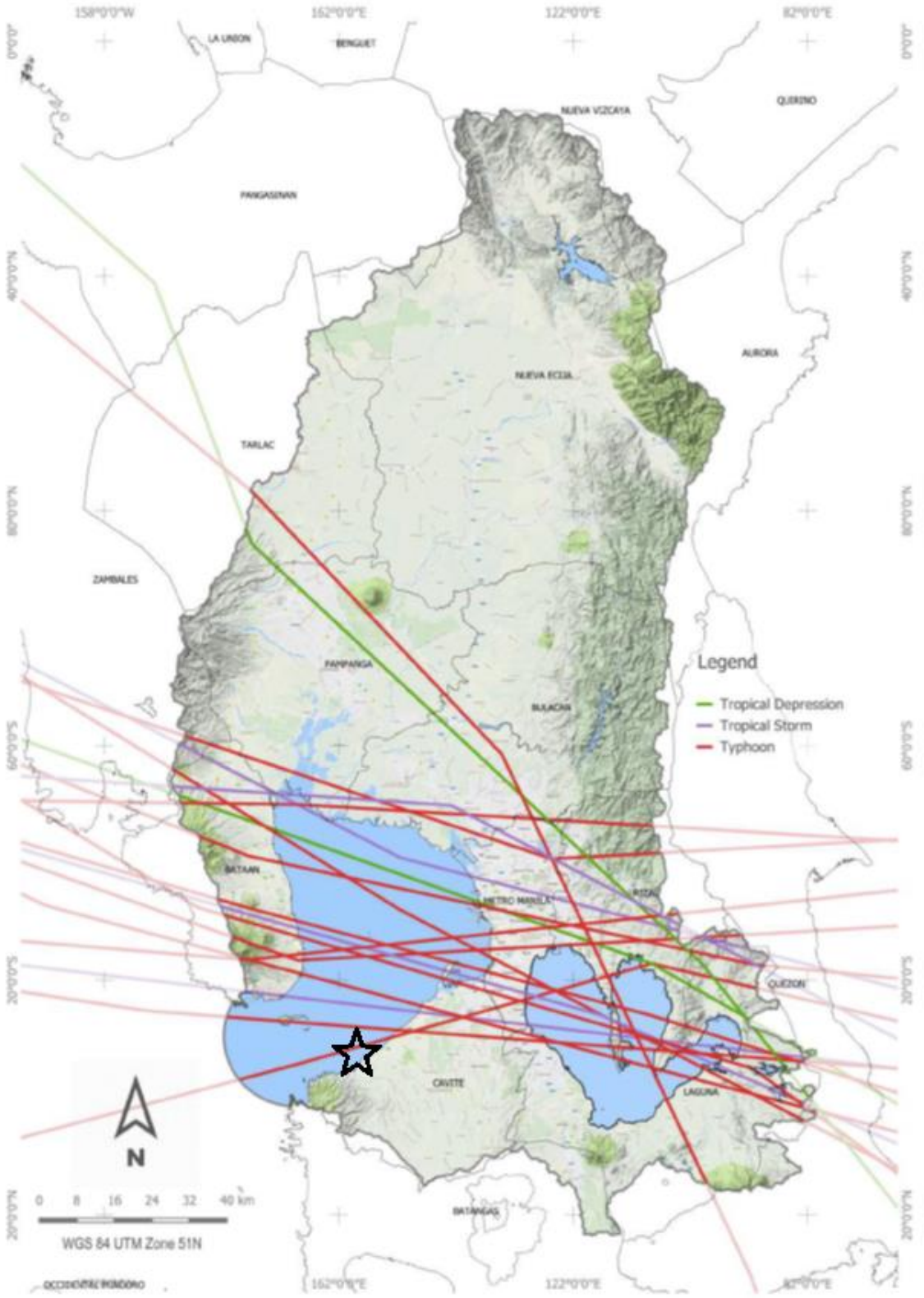


Figure 4-40 Tropical Cyclone Paths 1948-2017

4.3.5 Air Quality and Noise

Ambient air quality in Naic and Ternate is generally very good as the surroundings are mostly devoid of industries and mostly agricultural and residential in use usage. Air quality in the dredging or quarry area where the ships will be deployed has not been measured but is expected to be very good considering the effects of land and sea breezes.

Sea/Land breezes are generated by thermally induced winds due to the different heat capacities of the land and the sea water along coastal lines. The maximum speeds of the sea and land breezes can reach approximately 2.5 m/s and 1.5 m/s, respectively along the coastal line. These sea breezes can penetrate up to 25 kilometers offshore which will suit well as it can easily disperse air pollutants.

4.3.6 Impact Assessment for the Air Environment

The following table summarizes the impacts of dredging operations to the air environment and the recommended management measures.

Table 4-13 Impact Assessment and Management Plan for the Air Environment

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Greenhouse gas emissions and other air emissions Greenhouse gases may increase from the increase due to the operations of the dredging ships both while dredging and sailing to and from the reclamation		X	X		Sea breeze and land breezes will work to quickly to dissipate emissions. SMRI would adhere to the International Maritime Organization's new 0.5% global marine fuel sulfur cap to limit sulfur dioxide emissions. SMRI will endeavor to conduct tree planting

4.4 PEOPLE

4.4.1 Demography

Based on the 2015 Census of the Philippine Statistic Authority, the Province of Cavite had a total population of 3,678,301 of which 3.03% (11,454) is from Naic and only 0.63% (23,157) is from Ternate.

In terms of population density, for every square kilometer, Naic is inhabited by 1,470 people while Ternate by 386 people. The total number of households is Naic is 26,131 with average household size of 4.2 while Ternate has 5,673 with average household size of 4.1.

Table 4-14: 2015 Population in the Municipality of Ternate (PSA)

Barangay	Population
Poblacion I (Barangay I)	1,992
Poblacion II (Barangay II)	1,906
Bucana	855
Poblacion III (Barangay III)	1,861
San Jose	2,038
San Juan I	2,737
Sapang I	7,686
Poblacion I A	1,456
San Juan II	1,490
Sapang II	1,136
Total	23,157

Table 4-15: 2015 Population in the Municipality of Naic (PSA)

Barangay	Population
Bagong Karsada	1,916
Balsahan	381
Bancaan	4,255
Bucana Malaki	1,374
Bucana Sasahan	5,511
Capt. C. Nazareno (Pob.)	801
Calubcob	1,499
Palangue 2 & 3	3,745
Gomez-Zamora (Pob.)	774
Halang	4,953
Humbac	1,018
Ibayo Estacion	4,866
Ibayo Silangan	12,627
Kanluran	1,930

Barangay	Population
Labac	6,167
Latoria	2,242
Mabolo	3,833
Makina	833
Malainen Bago	4,603
Malainen Luma	3,036
Molino	1,832
Munting Mapino	5,822
Muzon	2,422
Palangue 1	4,136
Sabang	9,898
San Roque	4,680
Santulan	708
Sapa	1,206
Timalan Balsahan	9,754
Timalan Concepcion	4,632
Total	**111,454**

4.4.2 Indigenous Peoples

There is no known Ancestral Domain Claim (CADC) covering the project area nor Ancestral Domain Title (CADT) applied or issued within the project area. Figure 4-41 shows the areas with CADT applied or issued near the project area; no indigenous peoples will be affected by the dredging works

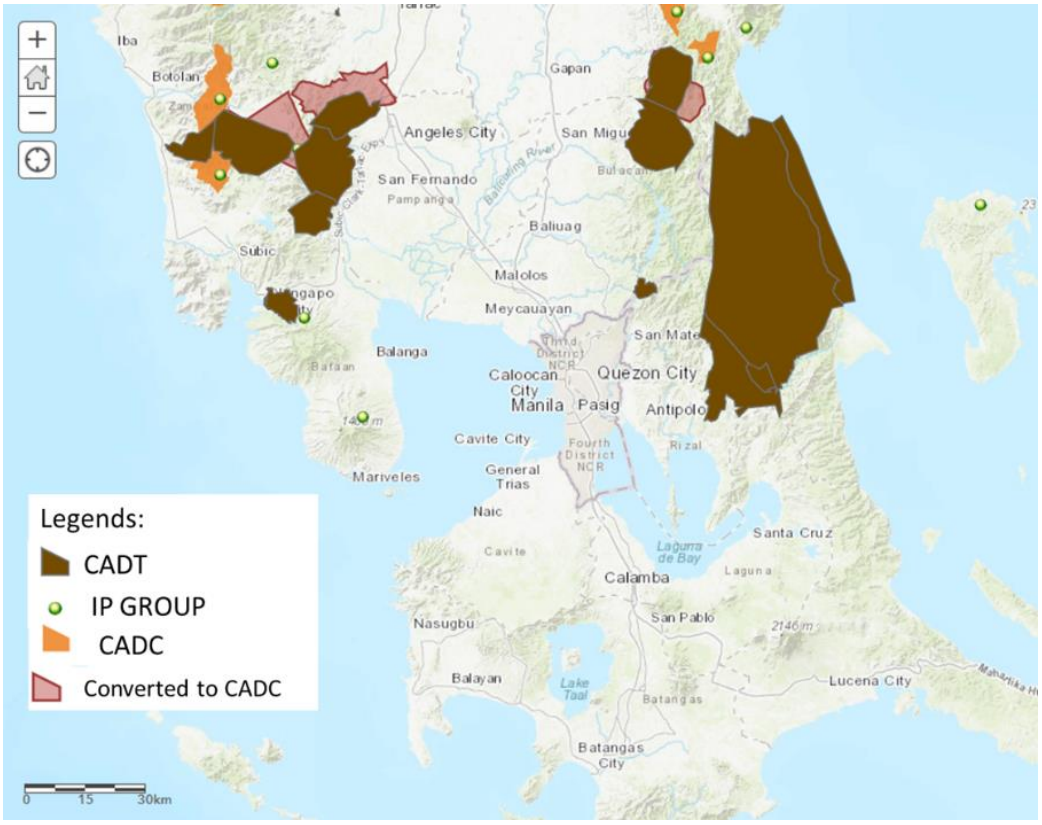


Figure 4-41: IP Areas with CADT and CADC

4.4.3 Literacy Rate/Profile of Educational Attainment

4.4.3.1. Municipality of Naic

In 2015, the literacy rate of Naic in terms of its household population of 10 years old and above is 99.4%. The percentage of people who are in schooling age (5 to 24 years old) that was attending school in 2015 was 68.49%. In terms of highest educational attainment, majority (30%) of the population were able to graduate in high school and about 11% were academic degree holder.

The Municipality of Naic has a total of 53 school institutions wherein 30 are public institutions while 23 are private.

4.4.3.2Municipality of Ternate

For Ternate, the literacy rate is 99.7% and about 67.3% of the population were attending school in 2015. The highest education attainment of the Municipality was high school graduate with 30% of the population followed by high school undergraduate with 15%. Only 8% were academic degree holder.

There are 11 school institutions in the Municipality of Ternate; 9 public institutions and 2 are private.

Table 4-16: Highest education completed by people in Municipality of Naic and Ternate 2015.

Highest Grade/Year Completed	Naic	Ternate
No Grade Completed	2,152	347
Pre-School	2,755	513
Special Education	19	7
Elementary	28,716	6,462
1st - 4th Grade	14,411	3,226
5th - 6th Grade	5,455	1,337
Graduate	8,850	1,899
High School	43,343	9,315
Undergraduate	13,516	3,025
Graduate	29,827	6,290
Post-Secondary	2,583	542
Undergraduate	127	44
Graduate	2,456	498
College Undergraduate	9,567	1,916
Academic Degree Holder	10,785	1,710
Post Baccalaureate	53	8
Not Stated	50	6
Total	**100,023**	**20,826**

4.4.4 Economy and Income

According to the 2015 Family Income and Expenditure Survey (FIES), the average annual family income in Region 4A at current (2015) prices was at 312,000. For all income class, majority (60%) reported wage/salaries as their main source of income. Only 15.7% reported entrepreneurial activities while 24.3% cited other sources of income.

In Naic, there are a total of 42,795 gainful workers who are 15 years old and above. Of the major occupation groups covered in the 2015 Census of Population, the largest number of gainful workers 15 years were found to be engaged as Service and Sales Workers. For Ternate, the total gainful workers who are 15 years old and above is 8,810 in which majority were also engaged as Service and Sales Workers.

Table 4-17: Gainful Workers 15 Years Old and Over in Naic and Ternate by Major Occupation Group, Age Group, and Sex, 2015

Major Occupation Group	Naic	Ternate
Managers	3,039	453
Professionals	2,449	466
Technicians and Associate Professionals	5,675	733
Clerical Support Workers	2,499	376
Service and Sales Workers	6,957	1,694
Skilled Agricultural Forestry and Fishery Workers	4,125	1,142
Craft and Related Trades Workers	4,764	1,232

Major Occupation Group	Naic	Ternate
Plant and Machine Operators and Assemblers	6,278	1,209
Elementary Occupations	6,561	1,465
Armed Forces Occupations	375	33
Other Occupation Not Elsewhere Classified	-	-
Not Reported	73	7
Total	42,795	8,810

4.4.5 Industry

The main sources of income in the Municipality of Naic and Ternate are from agriculture and fishery.

4.4.5.1 Municipality of Naic

About 46% of the land area in Naic is used as agricultural area. As of 2018, there are 8,529 farmers in Naic and Ternate and about 14,938 MT of crops were harvested. These crops include rice, corn, vegetables and mango. Of all the crops harvested, majority (78%) is rice.

Farmers are also engaged in backyard and commercial livestock and poultry production. In 2018, it was observed that cattle raising with the population of 595 heads was the top backyard livestock activity, followed by swine and goats with 581 and 326 heads, respectively. With regards to backyard poultry activities, chicken raising was the highest with 4,600 heads. For the commercial livestock and poultry, there are 19,675 swine heads and 240,000 breeder heads produced in 2018.

As shown in **Table 4-18**, aquaculture fisheries is also observed in Naic. Furthermore, Naic has 3,791 registered municipal fisher folks and 178 registered commercial fisherfolks.

Table 4-18: Aquaculture Fisheries in Naic (2018)

	Area (has)	Production (Metric Tons)	Number of Operators	Species cultures
Fresh Water Fishpond	9.62	35.32	96	Tilapia
Brackish Water Fishpond	3.38	4.08	7	Bangus
Mariculture Production	0.16	80	70	Oyster (kulot)

In terms of industry, Naic has one operating economic zones/industrial estates and 2 are for development.

4.4.5.2Municipality of Ternate

In Ternate, only 12% of the land area is used for agriculture and only 312 farmers were recorded in 2018. About 4,420.82 MT of crops were produced which consists of rice, vegetables, root crops, coffee, banana, mango and papaya. More than half of the crop produced was rice.

Backyard and commercial livestock and poultry production were also present in Ternate. In terms of backyard livestock, mostly were swine with 540 population, goat with 210 population and cattle with 157.

For background poultry, chicken population reached 4,325 in 2018. Furthermore, there were 10,130 hogs from commercial livestock.

Aquaculture fisheries in the municipality were mostly in brackish water fishpond (**Table 4-19**). There are also 3,000 municipal fisher folks registered in the municipality.

Table 4-19: Aquaculture Fisheries in Ternate (2018)

	Area (has)	Production (Metric Tons)	Number of Operators	Species cultures
Fresh Water Fishpond	5.02	10.86	13	Tilapia
Brackish Water Fishpond	52.0	38.72	58	Bangus and Tilapia
Mariculture Production	0.50	80	6	Oyster (spat)

4.4.6 Roads

The province has a total road length of 2,204 kilometers which are mostly (60%) paved with concrete. Of the total road in the province, almost half is classified as barangay road (see **Table 4-20**).

Table 4-20: Total Road Length in Cavite Province

Road classification	Length					
	Total	Concrete	Asphalt	Gravel	Earth fill	Asphalted Concrete
National	428.997	160.55	268.44			
Provincial	379.394	238.19	9.26	27.64		57.77
City/Municipality	309.4242	250.73	47.67	0.047	10.65	
Barangay	1,086.7879	695.56	21.64	101.18	268.99	
Total	2,204.6031	1,345.95	347	128.87	279.65	57.77

4.4.7 Water Supply

The water supply in Municipality of Naic is served by the Naic Water Supply Corporation. In 2018, there are 8,495 households and 348 commercial establishments connected to Naic Water Supply Corp. The minimum residential water rate is Php 120 for first 10 m^3.

For the Municipality of Ternate, water is supplied by Western Cavite Water Supply and Service Corporation. There were 1,545 residential service connections in 2018 with minimum residential rate of Php 144 for first 10 m^3.

4.4.8 Electricity.

The electric power supply in both municipalities is serviced by the Manila Electric Company (MERALCO). In 2017, there were 27,858 and 3,577 customers of MERALCO in Naic and Ternate, respectively. About 90% of the households in Naic and Ternate are served by MERALCO.

4.4.9 Tourism.

In terms of tourism, Ternate is included in Metro Tagaytay which is famous for natural tourist attractions and conducive for meditation, sight-seeing, picnicking and other activities. Another tourism point in the province is the Tente-Corregidor-Naic-Maragondon area which is known for the presence of world-class beach resorts. There are also two major historical attractions in Naic, the Battle of Naik Site and the Recollect State House. For natural attractions, Ternate has the Mts. Palay Palay and Mataas na Gulod National Park.

In 2018, there were no recorded tourist arrivals in Naic and Ternate.

4.4.9.1 Beach resorts near the project

Beach resorts near the project are the shown in **Table 4-21.**

Table 4-21: Beach Resorts near the Project Site

Ternate	Naic
• Caylabne Bay Resort • Back's Beach Island • Khyline Jaz Beach • Caysubic Beach Resort • Puerto Azul Clubhouse • Casa Las Brisas • Kamandag Beach • Blacklisted Beach Resort • Ternate Beach Resort • Dalaroy Beach Resort • Bucana Beach Resort • Ranrich Resort • Queens Private Resort	• Tropical Garden Resort • Roberto's Resort • Seaside Beach Resort • Villa Manda Resort • Sweet Paradise Beach Resort • Naic Healing Beach Resort • Aroma Beach Resort

4.4.10 Solid Waste Management.

Solid wastes in the municipalities were being collected and disposed to a sanitary land fill. The LGU are responsible for the collection of the wastes in the households. In Naic, the frequency of collection is once or twice a week while in Ternate is daily. The disposal of the collected solid wastes is by a third party contractor with sanitary landfill located at San Pedro, Laguna.

4.4.11 Security and Protection.

The Municipality of Naic has a police to population ratio of 1:2,055 while in Ternate, the police to population ration is 1:714.

4.4.12 Health.

There are two private hospitals and one government-owned hospital in Naic with a total bed capacity of 90 however, there are no hospitals in Ternate. Furthermore, there are 1 RHU, 34 barangay health stations in Naic and 1 RHU and 2 barangay health stations in Ternate.

4.4.13 Perception Survey

4.4.13.1 Respondents' Information

4.4.13.1.1 Position in the family

The respondents in the survey done for the affected barangays of Ternate were mostly the fathers or heads of families as shown in Table__. This finding was true in Bucana, 53.66%, Poblacion III, 53.6% and San Jose, 50%. On the other hand, there were only 28.6% in San Juan I and 40.7% in Sapang I whose respondents were the fathers. On the whole, there were seventy (70) or 43% of the respondents who were the heads of the family while seventy-three (73) or 45% of the respondents were the mothers of the family. There were a few respondents who identified themselves as the son, 4%, daughter, 6%, sister of the head of the family, 1.2% and cousin, 0.6%.

Table 4-22 Perception Survey: Position in the family

Position in the family	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	Number	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	
Father	*15*	*53.6*	*8*	*53.3*	*8*	*50.0*	*6*	*28.6*	*33*	*40.7*	*70*	*43*
Mother	*13*	*46.4*	*5*	*33.3*	*6*	*37.5*	*15*	*71.4*	*34*	*42.0*	*73*	*45*
Son	*0*		*1*	*6.7*	*2*	*12.5*	*0*		*3*	*3.7*	*6*	*4*
Daughter	*0*		*1*	*6.7*	*0*		*0*		*8*	*9.9*	*9*	*6*
Cousin	*0*		*0*		*0*		*0*		*1*	*1.2*	*1*	*0.6*
Sister	*0*		*0*		*0*		*0*		*2*	*2.5*	*2*	*1.2*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.1.2 Age

Table 4-23 shows that majority or 67% of the respondents, was from the age group 31-60 years. The younger respondents, belonging to the 21-30 years old classification, comprised only 22% or about one fifth of the total number of interviewees. There were also seniors, 61-75 years old, who participated as respondents in the household survey conducted.

Table 4-23 Perception Survey: Age of Respondents

Age	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	%
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	
21-25					3	18.8			13	16.1	16	10
26-30	4	14.3	2	13.3	1	6.3			13	16.1	20	12
31-35	3	10.7	4	26.7	0	0			7	8.6	14	9
36-40	3	10.7	2	13.3	0		2	9.5	11	13.6	18	11
41-45	3	10.7	1	6.67	2	12.5	3	14.3	11	13.6	20	12
46-50	4	14.3	2	13.3	1	6.3	2	9.5	16	19.8	25	15
51-55	3	10.7	1	6.67	6	37.5	5	23.8	7	8.6	22	14
56-60	4	14.3	1	6.67	1	6.3	3	14.3	0	0	9	6
61-65	2	7.14	1	6.67	1	6.3	3	14.3	1	1	8	5
66-70	0	0	1	6.67	1	6.3	2	9.5	2	2.5	6	4
71-75	2	7.17					1	4.8	0	0	3	2
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.1.3 Gender

As can be inferred from the respondents' position in the family, majority or 53% of the respondents was classified as female while the remaining 47% was male. However, on a per barangay basis, Bucana, Poblacion III and San Jose respondents were mostly male.

Table 4-24 Perception Survey: Gender of Respondents

Gender	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	%
	Number	%	Number	%	Number	%	Number	%	Number	%		
Male	15	53.6	9	60	10	63	6	29	36	44.4	76	47
Female	13	46.4	6	40	6	37	15	71	45	55.6	85	53
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.1.4 Civil Status

Majority of the respondents in all the barangays were married – Bucana (16 or 57.1%), Poblacion III (9 or 60%), San Jose (12 or 75%), San Juan I (15 or 71.4%) and Sapang I (43 or 53.1%) as seen in **Table 4-25**. There was only twenty-six (26) or 16% of the total respondents who were single. On the other hand, there were nine (9) or 6% widowed, eight (8) or 5% separated and twenty-three (23) or 14% in a live-in arrangement. The respondents from Poblacion III were either single (40%) or married (60%).

Table 4-25 Perception Survey: Civil Status of Respondents

Civil Status	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Single	1	3.8	6	40.0	2	12.4	3	14.3	14	17.3	26	16
Married	16	57.1	9	60.0	12	75.0	15	71.4	43	53.1	95	59

Civil Status	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Widow/er	1	3.8	0	0	1	6.3	2	9.5	5	6.2	9	6
Separated	6	21.4	0	0	0	0		0	2	2.5	8	5
Live-in	4	14.3	0	0	1	6.3	1	4.8	17	20.9	23	14
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.1.5 Respondents' Dwelling Classification

Majority of the respondents (89.3%) interviewed in barangay Bucana considered themselves as informal settlers while on the other hand, 100% of the respondents from barangay San Jose were owners of the houses they reside in. It is worthy to note that majority of the people who were interviewed in Poblacion III (73.3%) and San Juan I (85.7%) own their abodes. On the whole, there were eighty- three (83) or 52% who had legal ownership of their houses while eleven (11) or 7% were renters and fifty-seven (57) or 35% were informal settler families. There were ten (10) or 6% of the respondents who reported to be caretakers of the houses they reside in.

The migrants or informal settler families (ISFs) settling along the banks and near the mouth of the Maragondon River stated that they came from the different parts of Visayas, Mindanao and some parts of Luzon. Initially, the number of ISF houses were few but increased through time. The members of the ISFs got married and established their temporary houses in the area aside from the new settlers through the years.

According to the respondents in Brgy. Sapang 1, the Municipal government of Ternate had proposed that each of the informal settler family (ISF) will be allocated a total of 30 square meters where they could establish their place of residence. A loan in the amount of PhP80,000.00 will be granted per ISF and proceeds of which will be used as payment to the private landowners where they squatted on. Through the Community Mortgage Program (CMP), the said loan will be paid to the bank on a monthly basis.

Table 4-26 Perception Survey: Respondents' dwelling classification

Ownership	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Owner	2	7.1	11	73.3	15	100	18	85.7	37	45.7	83	52
Renter	1	3.8	1	6.7	0	0	1	4.8	8	9.9	11	7
Informal settler	25*	89.3	0	0	0	0	0	0	32*	39.5	57	35
Care taker	0	0	3	0	1	0	2	0	4	4.9	10	6
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.1.6 Occupation of Respondents

The predominant occupation of the respondents was fishing aas shown in **Table 4-27**. This corresponds to 50% from Bucana, 68.8% from San Jose and 66.7% from San Juan I. On the other hand, there was 46.7% of the respondents from Poblacion III who indicated that they were housewives who takes care of their children and manage their home. The other sources of income mentioned by the respondents include

sari-sari/ fish vending (12%), self-employment (4%), government employment (4%), private employment (4%), construction work (3%), to name a few.

Table 4-27 Perception Survey: Occupation of respondents

Occupation	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Govt. Emp.	3	10.7	1	6.7	0	0	1	4.8	2	2.5	7	4
AFP/PNP	0	0	0	0	0	0	0	0	0	0	0	0
Pvt. Emp.	1	3.6	0	0	0	0	2	9.5	4	4.9	7	4
Fisherman	14	50.0	4	26.7	11	68.8	14	66.7	29	35.8	72	45
Self Emp.	1	3.6	0	0	1	6.3	2	9.5	2	2.5	6	4
Businessman	0	0	0	0	0	0	0	0	1	1.2	1	0.6
Sari-Sari/fish Vendor	3	10.7	0	0	2	12.5	2	9.5	11	13.6	18	12
Housewife	5	17.9	7	46.7	2	12.5	0	0	15	18.5	29	18
OFW	1	3.6	0	0	0	0	0	0	1	1.2	2	1
Pensioner	0	0	0	0	0	0	0	0	0	0	0	0
Student	0	0	0	0	0	0	0	0	5	6.2	5	3
Construction	0	0	3	20.0	0	0	0	0	2	2.5	5	3
Driver	0	0	0	0	0	0	0	0	4	4.9	4	2
Bus conductor	0	0	0	0	0	0	0	0	1	1.2	1	0.6
Online selling	0	0	0	0	0	0	0	0	2	2.5	2	1
Junk shop	0	0	0	0	0	0	0	0	2	2.5	2	1
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.1.7 Secondary sources of income

The other or secondary sources of income include online selling, employment in the local government as a barangay health worker or other available barangay positions, fish paste ("alamang") making, beautician, yema/candy making, pilot of fishing boat, massage therapist, fitness coach and fishing.

4.4.13.1.8 Educational Attainment

Of the total respondents from all the barangays, about 50% have either reached or graduated from high school. There were twenty-nine (29) or 18% who attended elementary level while twenty-eight (28) or 17% completed elementary education. There were sixteen (16) or 10% who attended some years in college while only two (2) or 1% graduated from college. The college graduates were from Poblacion III and Sapang I. Five (5) or 3% of the respondents finished vocational courses.

Table 4-28 Perception Survey: Educational attainment of Respondents

Level of Education	Impact barangays in ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Elementary	4	14.3	3	20.0	5	31.3	4	19.1	13	16.1	29	18
Elem. Grad.	4	14.3	2	13.3	2	12.5	5	23.8	15	18.5	28	17
HS Level	10	35.7	2	13.3	3	18.8	9	42.9	8	9.9	32	20
HS Grad	8	28.6	5	33.3	4	25.0	2	9.5	30	37.0	49	30
College Level	1	3.6	1	6.7	1	6.3	0	0	13	16.1	16	10
College Grad	0	0	1	6.7	0	0	0	0	1	1.2	2	1

Level of Education	*Impact barangays in ternate*											
	Bucana		*Población III*		*San Jose*		*San Juan I*		*Sapang I*		*Total*	
	Number	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
Vocational	*1*	*3.6*	*1*	*6.7*	*1*	*6.3*	*1*	*4.8*	*1*	*1.2*	*5*	*3*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.1.9 Place of Birth

Table 4-29 shows that fifty-seven (57) or 35% of the respondents were born in Ternate while 4% were born in the nearby municipality of Naic while 8% were born in the other towns of Cavite. The other places of birth mentioned by 6% of the respondents include the National Capital Region (NCR), other provinces in Luzon (20%), Visayas (14%) and Mindanao (12%).

Table 4-29 Perception Survey: Place of Birth of Respondents

Birth Place	*Impact barangays in Ternate*											
	Bucana		*Población III*		*San Jose*		*San Juan I*		*Sapang I*		*Total*	
	Number	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
Ternate	*10*	*35.7*	*9*	*60.0*	*11*	*68.8*	*7*	*33.3*	*20*	*24.7*	*57*	*35*
Naic	*2*	*7.2*	*0*	*0*	*1*	*6.3*	*1*	*4.8*	*2*	*2.5*	*6*	*4*
NCR	*2*	*7.2*	*2*	*13.3*	*1*	*6.3*	*0*	*0*	*5*	*6.2*	*10*	*6*
Other Cavite Towns	*3*	*10.7*	*0*	*0*	*2*	*12.5*	*4*	*19.0*	*4*	*5.0*	*13*	*8*
Luzon	*2*	*7.2*	*2*	*13.3*	*0*	*0*	*2*	*9.5*	*26*	*32.1*	*32*	*20*
Mindanao	*5*	*17.9*	*2*	*13.3*	*1*	*6.3*	*4*	*19.0*	*8*	*9.9*	*20*	*12*
Visayas	*4*	*14.3*	*0*		*0*	*0*	*3*	*14.4*	*16*	*19.8*	*23*	*14*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.1.10 Original residence

Only respondents from Poblacion III had a majority of (60%) who indicated that they were originally from the barangay while a fifty-fifty response was given by the respondents from San Jose. Majority of the interviewees from barangays Bucana (60.7%), San Juan I (80.9%) and Sapang I (93.8%) indicated that they were not originally from the respective barangays they presently reside. On the whole, there was 77% of the respondents who did not originate from the barangay.

Table 4-30 Perception Survey: Original Residence of Respondents

Originally from the barangay?	**Impact Barangays of Ternate**											
	Bucana		**Poblacion 3**		**San Jose**		**San Juan 1**		**Sapang 1**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Yes	11	39.3	9	60.0	8	50.0	4	19.1	5	6.2	37	23
No	17	60.7	6	40.0	8	50.0	17	80.9	76	93.8	124	77
Total	28	100	15	100	16	100.0	21	100.0	81	100	161	100

4.4.13.1.11 Length of Stay in the Barangay

For the respondents who were not born in the respective barangays, their length of stay differed. **Table 4-31** shows that about one fourth of the respondents have been living in the locality for about 20-29 years. It can also be gleaned from the table that majority or more than 80% of the interviewees resided in their respective barangays for more than 10 years. The findings imply that even if majority of the respondents are migrants, they have continuously stayed in their barangays or dwelling places for many years.

Table 4-31 Perception Survey: Length of Stay in the Barangay of Respondents

Length of stay in the barangay	Impact Barangays of Ternate										Total	%
	Bucana		Poblacion 3		San Jose		San Juan 1		Sapang 1			
	No	%	No	%	No	%	No	%	No	%		
Since birth	11	39	9	60	8	50	4	19	5	6	37	23
1-9	2	7.1	1	6.7	3	18.8	0	0	20	24.7	26	16.2
10-19	4	14.3	1	6.7	2	12.5	1	4.8	19	23.5	27	16.8
20-29	4	17.9	4	40.0	0	6.3	1	4.8	22	30.9	38	23.6
30-39	2	14.3	0	33.3	0	6.3	2	9.5	10	14.8	24	15.0
40-49	3	21.4	0	6.7	1	25.0	4	19.1	3	3.7	18	11.2
50-59	2	17.9	0	0	2	31.3	4	28.6	1	1.2	17	10.5
60-69	0	3.6	0	6.7	0	0	4	28.6	1	1.2	9	5.6
70-79 +	0	3.6	0	0	0	0	1	4.8	0	0	2	1.2
Total	28	100.0	15	100.0	16	100.0	21	100.0	81	100.0	161	100.0

4.4.13.2 Household information

4.4.13.2.1 Number of Family Members Per Household

Table 4-32 shows that about one fourth (26%) of the respondents have four (4) household members while about one fifth (22%) had three (3) and another one fifth (19%) had five (5). There were three (3) or 2% of the respondents who stated to have ten (10) or more members living in their household while six (6) or 4% had nine (9) household members. The average household size of Ternate stated by the 2015 Philippine Statistics Authority was four (4) household members.

Table 4-32 Perception Survey: Number of family members per household

Number of Family Members	*Impact Barangays in Ternate*											
	Bucana		*Población III*		*San Jose*		*San Juan I*		*Sapang I*		*Total*	
	Number	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
1	*1*	*3.6*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0.6*
2	*0*	*0*	*0*	*0*	*1*	*6.3*	*1*	*4.8*	*3*	*3.7*	*5*	*3*
3	*7*	*25.0*	*4*	*26.7*	*6*	*37.5*	*6*	*28.6*	*12*	*14.8*	*35*	*22*
4	*10*	*35.7*	*4*	*26.7*	*2*	*12.5*	*6*	*28.6*	*20*	*24.7*	*42*	*26*
5	*5*	*17.9*	*3*	*20.0*	*3*	*18.8*	*2*	*9.5*	*17*	*21.0*	*30*	*19*
6	*2*	*7.1*	*3*	*20.0*	*2*	*12.5*	*2*	*9.5*	*8*	*10.0*	*17*	*11*
7	*2*	*7.1*	*1*	*6.7*	*2*	*12.5*	*3*	*14.3*	*12*	*14.8*	*20*	*12*
8	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*2.5*	*2*	*1*
9	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*6*	*7.4*	*6*	*4*
10 & above	*1*	*3.6*	*0*	*0*	*0*	*0*	*1*	*4.8*	*1*	*1.2*	*3*	*2*

Number of Family Members	***Impact Barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	Number	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.2.2 Family type

Table 4-33 shows that majority, one hundred twenty-three (123) or 76%, of the respondents had a nuclear or one-family type compared to thirty-five (35) or 22% who reported to have an extended family type. This classification has more than one family living in the household. These findings were observed in all the barangays. There were only three (3) or 2% of the respondents who indicated that they were living alone.

Table 4-33 Perception Survey: Family Type

Type of Family	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	Number	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***
Nuclear (one family)	*20*	*71.4*	*12*	*80.0*	*13*	*81.3*	*14*	*66.7*	*64*	*79.0*	*123*	*76*
Extended (more than one family in the household)	*7*	*25.0*	*3*	*20.0*	*3*	*18.7*	*6*	*28.6*	*16*	*19.8*	*35*	*22*
Living Alone	*1*	*3.6*	*0*	*0*	*0*	*0*	*1*	*4.8*	*1*	*1.2*	*3*	*2*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.2.3 Main Use of the Bay to the respondents' family

The bay, to majority of the respondents in all the barangays – Bucana (79.3%), Poblacion III (70.6%), San Jose (81.3%), San Juan I (90.5%), and Sapang I (82.7%) – was for fishing and a source of livelihood. Fishing is the main source of food and income to many locals. The bay is also an accessible source of food to those who are not solely engaged in fishing but also to residents along the bay. During this time of the COVID-19 pandemic when many service industries have ceased their operation, fishing became an alternative source of income.

There were fifteen (15) or 9% of the respondents who depended on the bay for tourism or tourism-related activities. These respondents were either waiters in resorts/ restaurants or tourist guides during island hopping/recreational activities.

Picking of non-returnable bottles and other plastic containers among the trash washed up in the sand beaches is carried out by some of the respondents to obtain additional income after selling these to junkshops.

Table 4-34 Perception Survey: Main use of the bay to the family

Use of the Bay to Family	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Quarrying	0	0	0	0	0	0	0	0	0	0	0	0
Fishing	23	79.3	12	70.6	13	81.3	19	90.5	67	82.7	134	82
Tourism	5	17.2	3	17.6	2	12.5	1	4.8	4	5.0	15	9
Plastic waste picking	1	3.5	2	11.8	1	6.3	1	4.8	10	12.3	15	9
Total	29	100	17	100	16	100	21	100	81	100	164	100

4.4.13.2.4 Occurrence of Turbidity in the Bay

All or one hundred percent (100%) of the respondents stated that they experience turbidity of the bay. (**Table 4-35**) This problem happens during a typhoon that hits the area or when the southwest monsoon (habagat)season prevails. In addition, turbidity is experienced when the Pasig River and Laguna de Bay swell due to floodwaters from the Sierra Madre Mountains. The floodwaters coming from these bodies of water include water hyacinth and other garbage which increases the severity of the already turbid bay.

Maragondon River in the province contributes to the same problem. According to the respondents and informants, the rushing waters from this river especially during typhoon and prolonged strong rains loosen the soil and result to erosion and further siltation of the bay. The strong current likewise progressively erodes the Balut Island and its coastline adding more soil particles into the turbid bay.

Table 4-35 Perception Survey: Occurrence of turbidity in the bay

Experienced Turbidity	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Yes	28	100	15	100	16	100	21	100	81	100	161	100
No	0		0		0		0		0	0	0	0
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.2.5 Help and Assistance from the LGU

The LGU helps the barangays in various ways especially during calamities. With the assistance of the Philippine Army and the members of the police force, pre-emptive evacuation of residents residing along the coastlines is done during typhoons and strong persistent rainfall, even before actual flooding of the area occurs. Relief goods to tide over the needs of the evacuees are also provided by the LGU.

A weekly clean-up was reported to be conducted by the LGU officials and the community to maintain the coastline,

4.4.13.2.6 Methods of Garbage Disposal

Collection of garbage is done by the LGU garbage trucks for residences located along the barangay roads (102 or 663%). For those located in the inner areas like Bucana Barangay Proper, garbage is disposed in garbage pits (37 or23%). There were twenty (20) or 13% of the respondents who reported that they resort to burning their garbage as a last alternative when their solid waste is not collected on time. It is worthy to note that materials not totally burned in the process, are washed into the river or bay, especially during rainy season.

Table 4-36 Perception Survey: Methods of garbage disposal

Methods of Disposal	Impact barangays in Ternate											
	Bucana		Poblacio III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
Thru LGU Collection Service	4	14.3	12	80.0	13	81.3	9	42.9	64	79.0	102	63
Backyard Garbage Pit	21	75.0	3	20.0	3	18.8	6	28.6	4	4.9	37	23
Burning	3	10.7	0	0	0	0	6	28.6	11	13.6	20	13
No answer	0	0	0	0	0	0	0	0	2	2.5	2	1
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.2.7 Availability of toilets

There is a majority of respondents in all the barangays who have indicated having their own toilets (120 or 74%). There were twenty-two (22) or 14% who use public toilets to relieve themselves while ten (10) or 6% share toilets with their neighbors. There were nine (9) or 6% who had no toilets at all. This response came from three (3), two (2), one (1), and three (3) interviewees of barangays Poblacion III, San Jose, San Juan I and Sapang I, respectively.

Table 4-37 Perception Survey: Availability of toilets

Toilet Availability	Impact barangays in Ternate											
	Bucana		Poblacion III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
Has own toilet	22	78.6	9	60.0	13	81.3	13	61.9	63	77.8	120	74
Public Toilet	5	17.9	0	0	1	6.3	6	28.6	10	12.3	22	14
Share with neighbors	1	3.6	3	20.0	O	0	1	4.8	5	6.2	10	6
No toilet at all	0	0	3	20.0	2	12.5	1	4.8	3	3.7	9	6
Total	28	100	15	100	16	100	21	100	81	100	161	100

Photo 4-8 This part of the bay used to be a land owned by the family of Mr. Augusto Catipon (seen in the picture). Hundreds of hectares were eroded since the early 1980's. The bay has remained turbid. The sea floor is perceived to be built up soil/sediments which has caused turbidity at all times.

4.4.13.3 BARANGAY PROBLEMS

4.4.13.3.1 Most serious problems experienced in the Barangays

The respondents mentioned of several serious problems in their respective barangays. Foremost of these is the occurrence of trash/garbage. According to them, garbage is normally observed as being disposed in the river and shorelines. Furthermore, there seems to be a shortage of garbage trucks which results to the irregular and untimely collection of garbage from the communities. It was also alleged that there is no designated disposal facility which results to improper waste disposal. In addition, a seemingly disregard for the environment was observed because domestic/human waste without treatment is directly discharged to the river and bay.

Another problem experienced is the occurrence of flood waters coming from the Maragondon River. The rushing flood waters during strong rains and typhoon carry not only garbage but also silt, gravel and sand. This contributes to the siltation and shallowing of the river mouth which eventually caused the closure of one of the channels of the said river. The obstruction has resulted to barangay Bucana's being susceptible to flooding.

According to the respondents, the strong waters of Maragondon River during typhoons and heavy rains, has now eroded almost 50% of the original area of Balut Island.

Fishing is the main source of income by majority of the respondents and harsh weather conditions extremely affect their source of income since there are no fishes to sell by the vendors. The source of food for those directly dependent on the sea is likewise drastically affected. Illegal fishing, which utilizes harmful chemicals/dynamite and trolling (gears destroy the corals) add to the burden of the fishermen from the barangays.

The lack of job opportunities has been the predicament of seventeen (17) or 6% of the respondents. Also, shallow wells have allegedly disappeared, damaged and eroded. There is an acute problem as to where to source water for domestic use in the area. Water is fetched from distant sources since all the wells nearby were all reported to have been damaged by big waves.

Furthermore, the insufficient annual barangay budget was forwarded by two (2) of the respondents from Sapang I. The inadequacy poses as a problem because it results to the lack or insufficiency of important resources during emergencies. These resources identified as rescue boats and vehicles which are badly needed during emergency evacuations.

Table 4-38 Perception Survey: Most serious problems experienced in the barangay

Serious Problems of the Barangays	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	No.	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***Number***	***%***
Trashes/Garbage	*21*	*39.6*	*5*	*21.7*	*11*	*26.8*	*9*	*13*	*54*	*52.4*	*100*	*35*
Flood and storm surge	*15*	*28.3*	*4*	*17.4*	*15*	*36.6*	*21*	*31*	*17*	*16.5*	*72*	*25*
Erosion	*8*	*15.1*	*0*	*0*	*0*	*0*	*16*	*23*	*8*	*7.8*	*32*	*11*
Typhoons	*3*	*5.7*	*2*	*8.7*	*15*	*36.6*	*12*	*18*	*12*	*11.7*	*44*	*15*
Illegal fishing	*4*	*7.5*	*3*	*13.0*	*0*	*0*	*4*	*6*	*1*	*1.0*	*12*	*4*
Far from Hospital	*2*	*3.8*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*0.6*
No job opportunity	*0*	*0*	*9*	*39.1*	*0*	*0*	*3*	*4*	*5*	*4.9*	*17*	*6*
Water supply	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*4*	*2*	*1.9*	*5*	*2*
Insufficient budget	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*1.9*	*2*	*0.6*
Peace and order	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*1.9*	*2*	*0.6*
	53	*100*	*23*	*100*	*41*	*100*	*68*	*100*	*103*	*100*	*288*	*100*

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* 	*Photo 4-9 Household Perception survey conducted in the shorelines of San Juan 1. Shoreline erosion is constantly experienced inland. Fishponds owned by the Morales family and other locals are gradually being claimed by the bay. Some portions of the fishpond areas are not operational anymore. Seen in the photo are residents with makeshift shanties as emergency refuge of the families which were recently affected by massive erosion in the barangay after typhoons Quinta, Rolly and Ulysses.*

4.4.13.3.2 Environmental Problems Experienced in the Barangays

The serious barangay problems stated in the previous discussion and the environmental problems experienced by the respondents appeared to be on a similar dimension. Polluted bay (16%), garbage woes (32%), unsafe water for domestic use (5%), flooding (19%), erosion (3%), typhoons and earthquake (10%), siltation and shallowing of the bay caused by the on rushing waters of the Maragondon river (1%), big waves (7%), and dwindling of fish population (5%) have been mentioned in the preceding discussion.

One of the respondents in San Juan I used to own 21 hectares. This area has been reduced to only three (3) hectares because the other eighteen (18) hectares have already been claimed by the sea through time due to erosion.

The continuous degradation of the water quality of the Maragondon River is perceived to be due to floating garbage and the direct discharge of sewer water to the river and bay. Many toilets that are not equipped with proper sanitary septic tanks are inclined to overflow directly to water bodies. This is a widespread complaint against residences situated near and along the riverbanks and coastlines.

The respondents reported that there had been quarrying activities in the past which aggravated shoreline erosion and subsequently affected land and infrastructure.

It was expressed by the respondents that garbage in their barangays originated not only from Ternate but from areas around Manila Bay. Low lying locations suffer the most because during extreme flooding, solid waste enter the residences carrying with them different pollutants detrimental to the health of the people.

Residential communities situated along the shorelines and riverbanks are very prone to flood, storm surges or tsunamis. Situations like these can be dangerously aggravated by earthquakes. The area is near the Manila Trench.

Table 4-39 Perception Survey: Environmental problems experienced in the barangays

Serious Problems of the Barangays	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	No.	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***
Polluted Bay	*5*	*8.9*	*14*	*93.3*	*13*	*24.1*	*6*	*9.4*	*10*	*10*	*48*	*16*
Garbage	*10*	*17.9*	*0*	*0*	*13*	*24.1*	*12*	*18.8*	*60*	*58*	*95*	*32*
Unsafe Water for domestic use	*5*	*8.9*	*0*	*0*	*5*	*9.3*	*5*	*7.8*	*0*	*0*	*15*	*5*
Flooding	*19*	*33.9*	*1*	*6.7*	*11*	*20.1*	*16*	*25.0*	*9*	*9*	*56*	*19*
Erosion	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*6.3*	*5*	*5*	*9*	*3*
Typhoon and earthquake	*14*	*25.0*	*0*	*0*	*0*	*0*	*3*	*4.7*	*12*	*11*	*29*	*10*
Siltation and shallowing of Maragondon River	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*3*	*3*	*1*
Big Waves	*3*	*5.4*	*0*	*0*	*10*	*19.6*	*7*	*10.9*	*0*	*0*	*20*	*7*
No answers	*0*	*0*	*0*	*0*	*2*	*3.7*	*2*	*3.1*	*0*	*0*	*4*	*1*
None	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Dwindling of fish population	*0*	*0*	*0*	*0*	*0*	*0*	*9*	*14.1*	*5*	*5*	*14*	*5*
	56	*100*	*15*	*100*	*54*	*100*	*64*	*100*	*104*	*100*	*293*	*100*

Photo 4-10 These are temporary shelters/dwelling places of families displaced by erosion caused by floods and big waves during the recent typhoons. (coastline of San Juan 1)

4.4.13.3.3 Problems encountered with regard to Government Services

There were forty-one (41) responses stating no problems with their local government and its services. However, there were problems faced by the other respondents. Foremost of these was the slow action on the Social Amelioration Program in connection with the assistance provided by the national government during the COVID-19 pandemic.

Another problem on government services is the irregular schedule of garbage collection which results to additional pollution. It also exacerbates the quality of the air since undisposed garbage emits foul odor.

Barangay Bucana respondents indicated that they have no health center. When they need medical attention, they still have to go to the municipal health Office or to the Sapang I health center.

It was also mentioned that there is a need for quicker response by the local government and give more consideration to those residents near the bay and riverbanks. Rescue efforts are slow. Giving of food reliefs and other forms of assistance are delayed as experienced during the recent typhoons.

Table 4-40 Perception Survey: Problems encountered with regard to government services

Government Services	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	Number	%
Failure to do road repair	0	0	0	0	0	0	0	0	1	1.2	1	0.5
Failure to avert illegal fishing	0	0	0	0	0	0	0	0	2	2.4	2	1
Failure to prevent further erosion	0	0	0	0	0	0	0	0	4	4.9	4	2
Relocation areas for shoreline residences affected by severe erosion	0	0	0	0	0	0	6	27.3	0	0	6	3
Street light	0	0	1	6.3	3	17.6	0	00	0	0	4	2
No Health Ctr	12	26.7	0	0	0	0	0	0	0	0	12	7
SLOW AYUDA (SAP)from national government	4	8.9	0	0	0	0	0	0	35	43.2	39	22
Waste disposal problems	0		0	0	0	0	6	27.3	19	23.5	25	14
Non-stop weekly coastal clean-up	8	17.8	0	0	0	0	0	0	0	0	8	4
No Answer	3	6.7	0	0	0	0	0	0	11	13.6	14	7
Failure to act on alive puppies being disposed in the area, Posing danger to the locals due to dog bites.	0		0	0	0	0	2	9.1	0	0	2	1
No problems, LGU is supportive	6	13.3	12	75.0	11	64.7	8	36.4	4	4.9	41	23
It is just alright	12	26.7	3	18.8	3	17.6	0	0	5	6.2	23	13
Total	45	100	16	100	17	100	22	100	81	100	181	100

4.4.13.3.4 Problems related to employment/livelihood opportunities

The respondents in the various barangays were faced with difficulties in relation to employment or livelihood opportunities. The most predominant drawback is the lack of job opportunities in their respective localities. Since fishing is their major source of income for most of the respondents, whenever their fishing gears get broken or worn-out, the respondents lack or have no sufficient funds to have these repaired. For those who do not have their own fishing tools, they rely on the boat owners to provide these, for them to go fishing. The incidence of the recent COVID-19 pandemic which has gravely affected the health and economic status of the population and has put work stoppage and/or labor cutback has

detrimentally put a burden on the respondents. The present polluted state of the bay has further exacerbated fish catch subsequently affecting the fishermen's income and food source. The practice of illegal fishing by unscrupulous people has likewise put a strain on the bay's ability to provide adequate fish catch.

There were only ten (10) respondents who stated no job – related problem while eleven (11) did not provide any response.

Table 4-41 Perception Survey: Problems related to employment/livelihood opportunities in the barangays

Employment Problems of the Barangays	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	Number	%
No work if "lambat" of boat owner is damaged.	0	0		0	8	38.9	0	0	8	9.8	16	9
No budget to repair fishing gears	0	0		0	0	0	3	10.3	7	8.6	10	16
Illegal fishing deprives smaller fishermen	0	0		0	2	9.5	3	10.3		0	5	3
Undergraduates hard to get employment	0	0		0	0	0	0	0	5	6.2	5	3
Not much job opportunity in the locality	26	86.7	15	100	0	0	15	51.7	17	21.0	73	41
Age discrimination	0	0		0	0	0	0	0		0	0	0
Pandemic -work stoppage	4	13.3		0	2	9.5	3	10.3	1	1.2	10	6
Low wage not provincial rate	0	0		0	0	0	0	0	7	8.6	7	4
Badly polluted affects employment with boat-owner	0	0		0	0	0	3	10.3	8	9.8	11	6
Bad weather limits fishing	0	0		0	0	0	2	7.0	6	7.4	8	4
Cost of transport this pandemic is very high	0	0		0	0	0	0	0	7	8.6	7	4
Too harsh BFAR and Coast Guard restrictions	0	0		0	0	0	0	0	3	3.7	3	2
No Problem	0	0		0	3	14.3	0	0	7	8.6	10	6
No answer	0	0		0	6	28.5	0	0	5	6.2	11	6
Total	30	100	15	100	21	100	29	100	81	100	176	100

4.4.13.4 Women, Youth, and the Elderly

The women, youth and elderly residing along the shoreline communities have stated common problems such as coastal pollution which has a big impact on families who are very dependent on fishing and fish vending. The women sector is reported to have no secondary or alternative source of income. When sources of income become scarce or deprived from them, the families' budget, mostly managed by women or mothers of the household, fall short to provide the basic needs such as food, clothing, shelter and others. Given the situation of low fish catch, the household budget would not be enough to afford the basic necessities and other needs on education and health.

Women, youth and elderly respondents expressed an urgent concern with regard to the uncollected garbage and the presence of water hyacinth and moss in the bodies of water. In the long-run, these trash items would impede the smooth flow of the river and bay waters. In addition, uncollected and improper disposal of garbage subsequently emits foul or undesirable odor affecting mostly the aged, young children and people with pre-existing morbidity factors.

4.4.13.5 Respondents' suggested projects that may be implemented to improve the environmental situation in the barangay

The respondents provided some suggestions on how the environmental situation in the barangays may somehow be enhanced. These include the construction of communal septic tanks with the capacity to treat the waste before final disposal to the bodies of water, establishment of an enclosed or concrete garbage cubicle as a garbage collection area at designated sites to prevent trash and other debris to be washed towards the bay, strict implementation of a regular coastal clean-up and the construction of a fish port by the local government to ensure better income to the fishermen. It was also forwarded that the relocation of families living near and along the coastlines must be actively and seriously pursued by the local and national governments.

4.4.13.6 Perception of the Project

4.4.13.6.1 Idea or Knowledge About the Proposed Project

It is worthy to note that majority (Sapang I – 80.2%), if not all (Poblacion III – 100%), of the respondents have no idea or knowledge about the proposed project. On the other hand, majority of the respondents from Bucana, twenty (20) or 71.4%, San Jose, nine (9) or 56.2%, and San Juan I, twelve (12) or 57.1%, expressed knowledge about the seabed dredging project. Those who have knowledge about the proposed project obtained their information from the barangay and municipal staff/officials and the Bantay Dagat representatives.

Table ___ Idea or knowledge about the proposed project

Knowledge of the Proposed Project	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	Number	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***
Yes	*20*	*71.4*	*0*	*0*	*9*	*56.2*	*12*	*57.1*	*16*	*19.8*	*57*	*35*
No	*8*	*28.6*	*15*	*100*	*7*	*43.8*	*9*	*42.9*	*65*	*80.2*	*104*	*65*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.6.2 Willingness to learn more details about the proposed project

Table 4-42 shows the willingness of the majority of the respondents to know more about the project. There were only fifty (50) or 31% who indicated non-interest while nine (9) or 6% provided no response.

Those who were willing to know more about the proposed project wanted to learn of the benefits of dredging, if any. They also desired to be enlightened on the possible effects on the fishermen and resort

operators, fish sanctuaries and coral reefs. Employment opportunities with the project was also an item that the respondents wanted to be briefed on. The destination of the dredged materials and for what purpose will this be used for were likewise clarifications the respondents wanted to be informed on. Another detail which needs to be expounded on are the main objectives of the project. The interviewees also preferred to have an elaboration on the negative impacts such as soil erosion, disappearance of land where communities were before, and the measures needed to be carried out to address these.

For those who were not amenable to learn more about the project, disinterest, objection to the project and aversion to take part in quarrying projects in the community were some of the reasons for giving a negative response.

Table 4-42 Perception Survey: Willingness to learn more details about the proposed project

Know details of the proposed project	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	Number	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***	***Number***	***%***
Yes	*24*	*86*	*11*	*73*	*11*	*69*	*15*	*71*	*41*	*51*	*102*	*63*
No	*4*	*14*	*4*	*27*	*4*	*25*	*6*	*29*	*32*	*40*	*50*	*31*
No answer	*0*		*0*		*1*	*6*	*0*		*8*	*9*	*9*	*6*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.13.6.3 Opinion about dredging

When asked about their opinion on dredging, there was a different trend observed on a per barangay basis. Majority of the respondents in barangays Bucana (75%), San Juan I (71.4%) and Sapang I (70.4%) had a negative outlook about dredging. While a smaller percentage of the respondents in the given barangays indicated a positive perception on dredging, there was a majority of the respondents in Poblacion III who was not sure of their perspective towards dredging. On the whole, there was 64.0% of the total respondents who had a thumbs down for dredging while 26.1% had a positive outlook on dredging. Over-all, there was only 10% of the interviewed residents who was not sure about dredging activities implying that they need more information to make a conclusive response.

The respondents who replied in the negative, gave reasons such as the destruction of fish sanctuaries including the coral reefs which consequently will drive fishes away. Given this situation, a negative impact will be experienced on their source of livelihood. Furthermore, dredging according to them cause erosion which will make shoreline communities “disappear”. In addition, erosion cause blockage of the waterways exacerbating flooding in the area. The respondents stated a negative perception of dredging because they are oblivious of any positive effect or benefit of the said activity.

Those who stated a positive perception towards dredging mentioned of various reasons for their response. One reason is the improvement/clean-up of the shoreline together with the prevention and control of floods. Furthermore, fishing in the Manila Bay area will be improved and restored. They also indicated that for as long as the corals and fish sanctuaries are protected and not part of the dredging area, they approve of dredging. The respondents with a positive opinion on dredging see the activity as the removal of silt and other waste materials that will promote the growth of crabs, lobsters, seagrasses, corals and fishes which are essential resources to obtain income. With dredging, they foresee the

construction of seawall and breakwater infrastructures which are perceived to be their last line of defense to protect and save their remaining piece of land from being eroded into the bay.

Table 4-43 Perception Survey: **Opinion about dredging**

Opinion	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Yes	7	25.0	1	6.7	10	62.5	6	28.6	18	22.2	42	26.1
No	21	75.0	4	26.7	6	37.5	15	71.4	57	70.4	103	64.0
Not Sure	0	0	10	66.7	0	0	0	0	6	7.4	16	10.0
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.6.4 Perceived benefits of the proposed dredging project in the community

The proposed dredging project was seen by forty-two (42) or 20% of the total respondents as a catalyst for a cleaner Manila Bay. It was also perceived to control floods and a means to prevent destructive erosion. Flood control and erosion prevention infrastructures are perceived to be a component of the proposed project. There was 10% of the respondents who perceived to be provided with more job opportunities while 9% foresee that there will be additional revenues to the local government as a result of the proposed project.

Table 4-44 Perception Survey: Perceived benefits of dredging in the community

Benefits of Dredging	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cleaner Bay	3	10.3	0	0	6	37.5	5	19.2	28	22	42	20
Serves as flood control and to prevent destructive erosion*	0	0	1	6.7	0	0	18	69.2	19	15	38	18
Improved quality and quantity of catch	1	3.4	0	0	5	31.3	1	3.8	0	0	7	3
Job opportunity	3	10.3	4	26.7	0	0	1	3.8	12	10	20	10
Additional IRA for the Brgy from taxes	2	6.9	0	0	0	0	0	0	17	14	19	9
Tricycle drivers to increase earnings	0	0	0	0	0	0	1	3.8	0	0	1	0.4
Reduction of floating garbage	0	0	0	0	0	0	0	0	7	6	7	3
Compliments other dev'ts	0	0	0	0	0	0	0	0	5	4	5	2
No answer/no idea	0	0	0	0	0	0	0	0	13	11	13	6
No benefits to us, just worsen flood & erosion if the seawall and breakwater along the shoreline and riverbanks will not be pursued	0	0	0	0	0	0	0	0	22	18	22	10
No benefits	12	41.4	0	0	2	12.5	0	0	0	0	14	7
No answer/Don't know	6	20.7	2	13.3	3	18.8	0	0	0	0	11	5
Not sure	2	6.9	8	53.3	0	0	0	0	0	0	10	5
Total	29	100	15	100	16	100	26	100	123	100	209	100

4.4.13.6.5 Perceived Negative Impacts of the Proposed Dredging Project in the Community

The perceived negative impacts of the proposed dredging project are listed in **Table 4-45**. As previously mentioned in the negative impacts of dredging, the proposed Silverquest Mining Resources Inc. (SMRI) dredging project was seen as a reason for the fishes and other marine resources to be driven out of their fish sanctuaries and breeding places (18%), more flooding due to erosion and blockage of natural spillways (16%), will contribute to more turbidity (11%) and lost income for fishermen (8%). About one third (31%) of the total respondents felt that the proposed project will trigger more erosion to cause washing out of houses and other properties into the bay.

However, it should be considered that coastline erosion should not be completely blamed on quarrying activities since erosion also occurs with the constant beating of storm waves during typhoons and the surging of water from the Maragondon river during heavy rains and powerful typhoons.

Table 4-45 Perception Survey: Perceived negative impacts of proposed dredging project

Negative Impacts	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	No.	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No***	***%***
More flooding due to erosion	*2*	*6.5*	*2*	*13.3*	*8*	*32.0*	*14**	*45.2*	*4*	*4.4*	*30*	*16*
Bay becomes turbid	*12*	*38.7*	*1*	*6.7*	*0*	*0*	*0*	*0*	*9*	*10.0*	*22*	*11*
Drives away fishes, destroys fish sanctuaries	*7*	*22.6*	*8*	*53.3*	*7*	*28.0*	*4*	*12.9*	*9*	*10.0*	*35*	*18*
Fishermen's lost income	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*6.5*	*14*	*15.4*	*16*	*8*
Triggers more erosion-erodes houses along the bay if seawall and breakwaters are not established	*10*	*32.3*	*0*	*0*	*5*	*20.0*	*10*	*32.3*	*34*	*37.4*	*59*	*31*
Damages marine ecosystem	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*3.2*	*12*	*13.2*	*13*	*7*
Troll's chance for a more illegal fishing	*0*	*0*	*0*	*0*	*1*	*4.0*	*0*	*0*	*0*	*0*	*1*	*0.5*
Not sure	*0*	*0*	*4*	*26.7*	*0*	*0*	*0*	*0*	*2*	*2.2*	*6*	*3*
No answer	*0*	*0*	*0*	*0*	*3*	*12.0*	*0*	*0*	*3*	*3.3*	*6*	*3*
No Negative effects	*0*		*0*	*0*	*1*	*4.0*	*0*	*0*	*4*	*4.3*	*5*	*3*
Total	*31*	*100*	*15*	*100*	*25*	*100*	*31*	*100*	*91*	*100*	*193*	*100*

4.4.13.6.6 Possible Solutions to Address the Negative Impacts of Dredging

It can be seen from **Table 4-46** that one third or 30% of the respondents thought that one way to address the negative impacts of the project is to put a halt to the project while 12% felt that there is no known remedy at all with regard to the adverse impacts. On the other hand, some constructive suggestions were forwarded. One of these is for the proponent to show honesty and transparency in all phases of the project (9%).

It must be noted that the residents in the communities have been "burned" or gravely affected with several quarry projects implemented in the past. They have been exposed to emotional stress and subjected to various questioning and investigations of alleged graft and corruption of local government officials.

Another recommended approach to mitigate the negative impacts is for the proponent to establish an effective coordination with the LGU, communities and other stakeholders. Furthermore, a strict and enhanced coastal clean-up drive should be done on a regular basis with the participation of all stakeholders. There was also a suggestion that the dredged materials be used to bring back the eroded portions of the Ternate shores and not dump these in other areas outside of the municipality or province.

Table 4-46 Perception Survey: Possible solutions to address the negative impacts of dredging

Solutions	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
Effective coordination among the proponent, the LGU's and other stakeholders	0	0	0	0	5	26.3	0	0	0	0	5	3
Enhanced clean up drive	0	0	0	0	5	26.3	0	0	4	4.9	9	5
Construction of breakwaters and seawall	1	3.3		0	0	0	4	14.3	0	0	5	3
Project implementations must be planned well and the proponent is assumed to know the remedies	0	0	4	26.7	0	0	0	0	5	6.1	9	5
Proponent must present project with honesty and transparency. Past quarries had caused so much damage due to erosion.	5	16.7	0	0	0	0	2	7.1	9	11.0	16	9
Bantay Dagat must be more vigilant during duration of the project.	1	3.3	0	0	2	10.5	0	0	0	0	3	2
Quarrying near the coastline must be prohibited	0	0	0	0	0	0	3	10.7	0	0	3	2
Dredged materials should be used to reclaimed back eroded shoreline. Why use it to other projects outside Ternate?	0	0	0	0	0	0	6	21.4	0	0	6	3
Provide fisherfolks jobs	0	0	0	0	0	0	12	42.8	2	2.4	14	8
Avoid the fish sanctuaries	0	0	0	0	0	0	0	0	10	12.2	10	6
Stop the Project	20	66.7	0	0	3	15.8	0	0	30	36.6	53	30
No remedies at all	3	10.0	0	0	3	15.8	0	0	15	18.3	21	12
NO idea	0	0	3	20.0	1	5.3	0	0	7	8.5	11	6
Not sure	0	0	8	53.3	0	0	1	3.6	0	0	9	5
Total	**30**	**100**	**15**	**100**	**19**	**100**	**28**	**100**	**82**	**100**	**174**	**100**

4.4.13.6.7 Potential Benefits that the Family of the Respondent may Derive from the Proposed Project

About one third (32%) of the respondents had the perception that their families will benefit from the proposed project. The benefits anticipated include a less polluted bay area resulting to a better fish catch (17%), safe place to swim and do recreational activities (6%), improved health conditions (10%), employment (9%), flood control structures (8%), increase in income in some of the service sectors such as tricycle drivers/operators (4%) and complementation of the proposed project with other development projects beneficial to all (1%).

The other responses given were particularly pertaining to the respondents' opposition to the project. There were twenty-one (21) or 12% of the respondents who felt that their families will not benefit from the project. In fact, they stated that their families are better off even without the project. Furthermore, being fishing families, they contended that they will not get any benefit from the proposed project (14%). There was 5% of the total respondents who stated their uncertainty while 13% had no idea on how to respond since the project is not clear to them.

Table 4-47 Perception Survey: Potential benefits that the family may derive

Respondents' Family Benefits	***Impact barangays in Ternate***											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		***Total***	
	No.	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No.***	***%***	***No***	***%***
Cleaner bay for fish sanctuary for better catch	*6*	*21.4*	*0*	*0*	*8*	*30.8*	*6*	*27.3*	*10*	*12.3*	*30*	*17*
Safer place to swim	*2*	*7.1*	*0*	*0*	*8*	*30.8*	*0*	*0*	*0*	*0*	*10*	*6*
May improve health	*0*	*0*	*0*	*0*	*4*	*15.4*	*6*	*27.3*	*8*	*9.9*	*18*	*10*
Employment	*4*	*14.2*	*4*	*23.5*	*0*	*0*	*4*	*18.2*	*3*	*3.7*	*15*	*9*
Flood control-house is near the bay	*0*	*0*	*3*	*17.6*	*0*	*0*	*6*	*27.3*	*5*	*6.2*	*14*	*8*
Increase of income to tricycle drivers/operators	*0*	*0*	*3*	*17.6*	*0*	*0*	*0*	*0*	*5*	*6.2*	*8*	*4*
The project will compliment other development projects beneficial to all	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*2*	*2.5*	*2*	*1*
None, families are better off if project won't be implemented	*15*	*53.6*	*0*	*0*	*6*	*23.1*	*0*	*0*	*0*	*0*	*21*	*12*
My family, as fisherman, will NOT benefit from the project	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*24*	*29.6*	*24*	*14*
Not yet sure	*1*	*3.6*	*7*	*41.2*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*5*
No idea, project not clear to us	*0*	*0*	*0*	*0*		*0*	*0*	*0*	*22*	*26.8*	*22*	*13*
No answer	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*2.5*	*2*	*1*
Total	*28*	*100*	*17*	*100*	*26*	*100*	*22*	*100*	*81*	*100*	*174*	*100*

4.4.13.6.8 Willingness to Attend Meetings, Public Consultations and Seminars to be Called by the Barangay with Regards to the Proposed Project

Table 4-48 shows that there were one hundred sixteen (116) or 72% of the respondents who expressed willingness to attend meetings, public consultations and seminars called by the barangay officials in relation to the proposed project. Their reasons for the positive response include the quest for more knowledge about the project – its purpose/objectives, beneficial and /or destructive effects, mitigating measures to address negative impacts. They also wanted to attend to these fora to voice out their objection or support to the project and be cleared of any doubts and reservations about the project.

For the respondents who were not willing to attend meetings, seminars and consultations regarding the proposed project, the reasons forwarded include their disinterest, no time to spare due to various activities, opposition to dredging and busy/hectic work schedule.

Table 4-48 Perception Survey: Willingness to attend meetings, public consultations and seminars about the proposed project

Willingness to Attend	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%		
Yes	20	71.4	11	73.3	14	87.5	17	80.1	54	66.7	116	72
No	7	25.0	3	20.0	1	6.3	0	0	25	30.8	36	22
Not Sure	1	3.6	1	6.7	1	6.3	4	19.0	2	2.5	9	6
Total	28	100	15	100	16	100	21	100	81	100	161	100

4.4.13.6.9 Additional Suggestions and Recommendations About the Project

The respondents provided additional suggestions and recommendations about the project. One is the active participation of the LGU, through its competent representatives in planning and coordinating the project activities devoid of personal interests. In addition, there should be strict compliance on project implementation with the end view of not affecting the livelihood of the residents. There should be an effective information campaign about the project for proper enlightenment about its positive and negative impacts. Prioritization of locals in the provision of benefits such as employment and livelihood opportunities.

Some of the respondents who disagreed with the project still recommended that the project should not be pursued and implemented because of the negative effects it will entail.

Table 4-49 Perception Survey: Additional suggestions and recommendations about the project

Suggestions and Recommendations	Impact barangays in Ternate											
	Bucana		Población III		San Jose		San Juan I		Sapang I		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
LGU, thru its competent technical representatives must actively participate in planning the project without any personal interests.	2	6.7	0	0	8	50.0	3	13.6	8	7.2	21	11
Strict compliance on the project implementation is a must and should not affect livelihood of the residents	5	16.7	0	0	2	12.5	2	9.1	4	3.6	13	7
Effective information dissemination about the project so the communities and other stakeholders will know the positive and negative effects it may bring about	3	10.0	10	66.7	0	0	8	36.4	16	14.4	37	19
The government must be transparent about this project.	0	0	0	0	0	0	0	0	2	1.8	2	1
Serious consideration must be made to protect people dependent on the bay. They should be given the first priority in providing jobs and livelihood opportunities.	0	0	0	0	3	18.8	9	40.9	5	4.5	17	9
Find other alternative area for the project	0	0	0	0	0	0	0	0	4	3.6	4	2
Better not continue with the project before worse effects will take place like the occurrence of more floods	20	66.7	0	0	3	18.8	0	0	16	14.4	39	20
No idea, project not clear to us	0	0	0	0	0	0	0	0	22	19.8	22	11
Cannot suggest/recommend	0	0	4	26.7	0	0	0	0	32	28.8	36	19
No answer	0	0	1	6.7	0	0	0	0	2	1.8	3	1
Total	30	100	15	100	16	100	22	100	111	100	194	100

4.4.13.6.10 Overall Perception of the Project

The respondents' overall perception toward the proposed dredging project were classified into three categories. There were thirty-one (31) or 19% who accepted the project while seventy-two (72) or 44.7% opposed. It must be noted that there were fifty-eight (58) or 36% of the respondents who were still undecided.

For those who accepted the proposed project, removal of contaminated sediments through desilting and dredging was seen to improve the ecosystem in the bay area. An improved ecosystem will result to better fishing grounds and higher fish population. Because of the project, sea walls and breakwaters are expected to be built along the shorelines of the affected barangays. Because of these infrastructures, erosion will be prevented/controlled. There will also be more employment and livelihood opportunities not to mention other environmental benefits.

For the respondents who deemed the proposed project as unacceptable, it was mentioned that dredging the area will aggravate soil erosion. They opined that this was experienced in previous quarry activities. In addition, they alleged that the displaced water from the area that will be reclaimed by the dredged materials shall intensify sea level rise which would consequently make the coastline area more susceptible to flooding. This situation was reportedly observed during and after the reclamation of the now Mall of Asia (MOA) complex.

The undecided lacked information to make a stand with regard to the proposed project.

Table 4-50 Perception Survey: Overall perception of the project

Overall Perception	*Impact barangays in Ternate*											
	Bucana		***Población III***		***San Jose***		***San Juan I***		***Sapang I***		*Total*	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No*	*%*
Acceptable	*3*	*10.7*	*1*	*6.7*	*9*	*56.3*	*5*	*23.8*	*13*	*16.0*	*31*	*19.3*
Unacceptable	*17*	*60.7*	*3*	*20.0*	*5*	*31.3*	*8*	*38.1*	*39*	*48.2*	*72*	*44.7*
Undecided	*8*	*28.6*	*11*	*73.3*	*2*	*12.5*	*8*	*38.1*	*29*	*35.8*	*58*	*36.0*
Total	*28*	*100*	*15*	*100*	*16*	*100*	*21*	*100*	*81*	*100*	*161*	*100*

4.4.14 Impact Assessment for the Social and Health Environment

The following table summarizes the Impacts of the dredging project to the socio-economic and health environment in Ternate and Naic and the recommended management measures.

Table 4-51 Impact Assessment and Management Plan for the Social and Health Environment

List of Key Impacts	**Phase Occurrence**	**Options for Prevention or Mitigation or Enhancement**

	Pre-[illegible]	Construction	Operation	Abandonment	
Reduced INCOME for Fishermen Increased prevalence of Turbidity may cause diminished fish catch for the residents who are fishermen or rely on selling fish for a living		**X**	**X**		Provide Livelihood opportunities in the meantime.
Impact to Tourism due to Turbidity		**X**	**X**		• The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides.

SECTION 5.0 EMERGENCY RESPONSE PLAN / ENVIRONMENTAL RISK ASSESSMENT

5.1 Scope and Coverage

Originally, the Environmental Risk Assessment module in the EIS was meant to assesses and mitigate the potential hazard related to handling, storage, disposal of hazardous materials and wastes. Because of the nature of this project, which does not include processing of hazardous materials, this ERA report discusses all hazard that may be brought about by the proposed project to humans, properties and to the environment, including those that may be brought about by accidents and natural disasters. As such, this section will discuss whether the proposed project poses a significant risk to its surrounding environment and, determine if such environment presents substantial threats to the project.

5.1.1 Methodology

The guidelines and outline for an ERA preparation are prescribed in Annex 2-7e of DAO 2003-03 which focuses on the risks and hazards posed by activities and/or manufacturing methods involving chemical storage, processing, and use. While some aspects mentioned are appropriate to the proposed project, this shall only form part of the overall ERA. Major environmental risks such as natural hazards were identified and assessed for the proposed project.

By virtue of DENR-EMB Memorandum Circular 2001 – 005, Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) are streamlined to the Philippine EIS System (PEISS) as provided for in DENR MC 2010-14 with the following objectives:

- To provide enhanced standards for the preparation of EIA Reports that are customized for specific industry types as required under the PEISS; and
- To provide guidance for project proponents in integrating DRR and CCA concerns in the project planning stage through the EIA Process in order to facilitate review and implementation of projects by incorporating international best practices.

5.1.24.1.2 Risk Screening Level

Risk screening level exercise pertains to specific facilities or the use of certain processes that has the potential to pose significant risks to people and its surrounding environment. **Table 5-1** depicts the risk screening level exercise as stipulated in Annex 2-7e of DAO 2003-03. As shown, None of the Risk Levels were applicable to the proposed project.

Accordingly, the proposed project entails risk that are natural, man-made, or a combination of both, which is under the DENR MC 2001-005. Natural risks are hazards caused by phenomena such as earthquakes,

geological instability, and typhoons, On the other hand, man-made risk include accidents such as fires, structural/equipment failure, chemical spillages, and human error. Furthermore, Man-made risks could also be aggravated as a direct consequence of natural risks. **Table 5-2** provides the ERA screening exercise for Mining Projects under the DENR MC 2001-005 concluding the risks the proposed project covers.

Table 5-1 Risk Screening Matrix

Activities Requiring Screening Exercise	ERA Applicability to the Proposed Project
1. Facilities for the production or processing of organic/inorganic chemicals using: ▪ Alkylation ▪ Amination ▪ Carbonylation ▪ Condesation ▪ Dehydrogenation ▪ Esterification ▪ Halogenation and manufacturing of halogens ▪ Hydrogenation ▪ Hydrolysis ▪ Oxidation ▪ Polymerization ▪ Sulphonation ▪ Desulphurization, manufacture and transformation of sulphur-containing compounds ▪ Nitration and manufacture of nitrogen-containing compounds ▪ Manufacture of phosphorus-containing compounds ▪ Formulation of pesticides and of pharmaceutical products ▪ Distillation ▪ Extraction ▪ Solvation	**NOT APPLICABLE**
2. Installation for distillation, refining, and other processing of petroleum products	**NOT APPLICABLE**
3. Installation for total or partial disposal of solid or liquid substances by incineration or chemical decomposition	**NOT APPLICABLE**
4. Installations for the production or processing of energy gases (e.g., LPG, LNG, SNG)	**NOT APPLICABLE**
5. Installations for the dry distillation of coal or lignite	**NOT APPLICABLE**
6. Installations for the production of metals and non-metals by wet process or electrical energy	**NOT APPLICABLE**
7. Installations for the loading and unloading of hazardous materials as defined by RA 6969 (or DAO 29)	**NOT APPLICABLE**

Table 5-2 Risk Screening for Mining Projects

Type of Risks	ERA Applicability to the Proposed Project	COVERAGE
1. Safety Risks Type: ▪ Fire ▪ Explosion ▪ Release of toxic substances, oil spill	APPLICABLE	- Description of conditions, events and circumstances which could be significant in bringing about identified safety risks - Description and assessment of the possible accident scenarios posing risk to the environment - Description of the hazards, both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the release of toxic substances, as applicable - The safety policy and guidelines shall be consistent with the Mines and geosciences Bureau (MGB) requirements. Emergency Preparedness should also consider natural hazards to the infrastructures and facilities.
2. Physical Risks (failure of structure which could endanger life, property and/or the environment)	APPLICABLE	- Description of conditions, events and "trigger" which could be significant in bringing about identified physical risks - Description and assessment of the possible accident scenarios posing risk to the environment - Description of the hazards both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the failure of structure, as applicable

5.2 Hazard Analysis

5.2.1 Geologic Hazards

Earthquakes result to damages through the following hazards: ground shaking, liquefaction, landslide, surface rupturing, and tsunami. Ground shaking, liquefaction and surface rupture are hazards that are directly related to actual ground movements while landslides and tsunami are mainly due to the indirect effects of the earthquake shocks.

Earthquakes result from the sudden shifting of the earth's crust below or at the surface, causing ground vibrations and shocks. There are two main kind of earthquakes experienced in the Philippines, tectonic and volcanic. A tectonic earthquake is a sudden shift of the earth's crust along active faults, A volcanic earthquake on the other hand happens near volcanoes when hot rocks or magma moves from deep within the earth.

A major tectonic feature in the country is the Philippine Fault Zone (PFZ) that transects the whole archipelago along a general strike from northwestern Luzon to southern Mindanao. Its subsidiary fault, the West Valley Fault (WVF) is capable of magnitude 6-7 events occurring on average 200-300 years and has yet to rupture in over 200 years. The WVF runs from the Sierra Madre Mountains ranges to Sta. Rosa, laguna through Bulacan, Rodriguez, Rizal, Quezon City, the eastern side of Metro Manila including Pasig, Taguig, Muntinlupa, San Pedro, Laguna and Carmona, Cavite. Because of this, the Japan International Cooperation Agency (JICA), in its Metro Manila Earthquake Impact Reduction Study (MMEIRS) suggests a 7.2 earthquake in Metro Manila and adjacent areas, including Cavite where the proposed project is located.

5.2.1.1 Ground Shaking

Most of the damages incurred during earthquakes mainly result from strong ground vibrations that are caused by the passage of seismic waves from the earthquake source to the ground surface. The intensity of ground shaking depends on the magnitude of the earthquake, distance of the site from the earthquake generator, and the modifying effects of subsoil conditions (i.e., loose unconsolidated sediment is subject

to more intense shaking than solid bedrock).

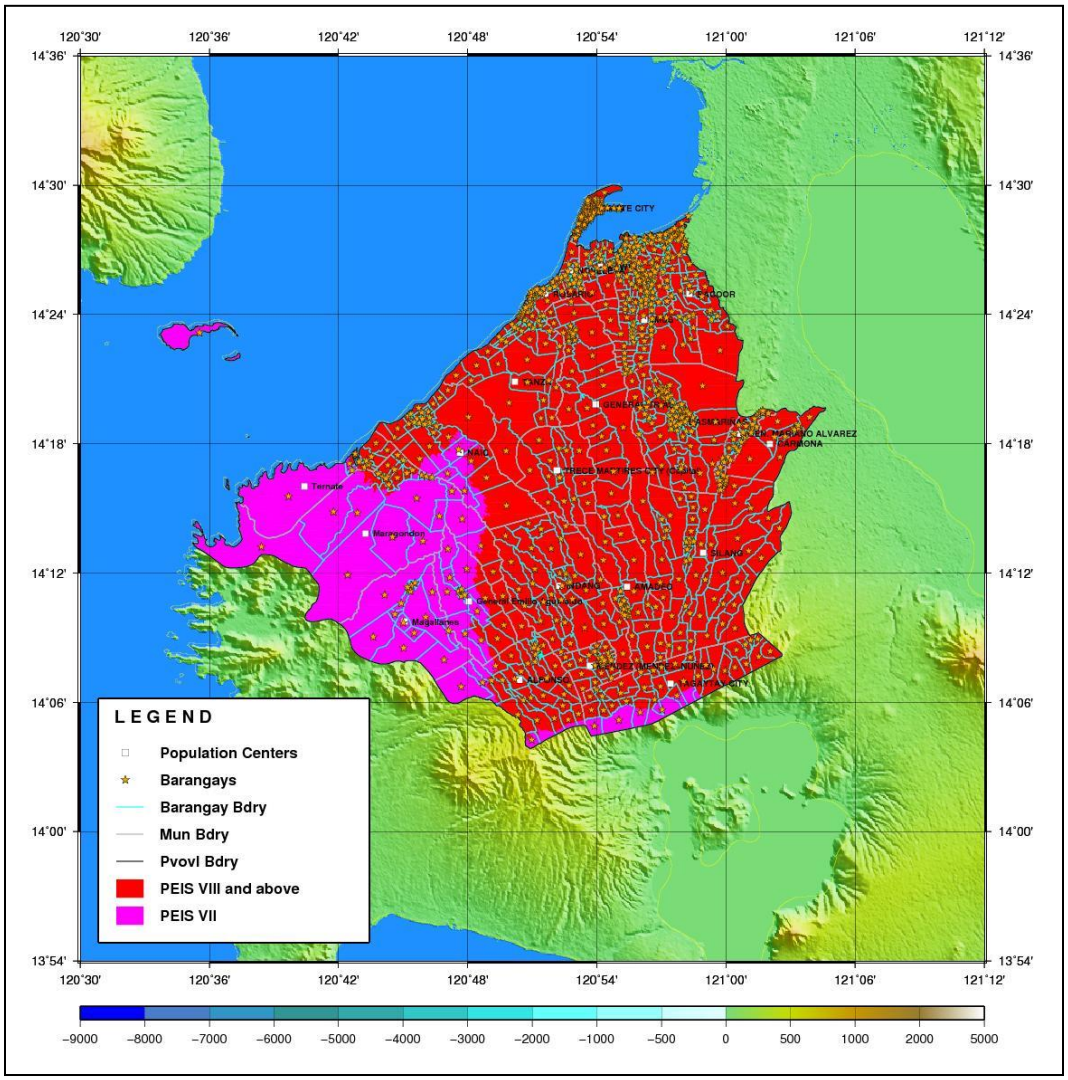


Figure 5-1 Ground Shaking Hazard Map of Cavite

Depicted in **Figure 5-1** is the Ground Shaking Map of the Province of Cavite wherein the whole province is vulnerable to ground shaking with PEIS Intensity VIII and above. In terms of land area, about 88% (125,756 ha) of the Province's total land area is susceptible to ground shaking with 65.95% (94,152.74 ha of the total land area of 142,760 ha) considered highly susceptible while 22.13% (31,603.257 ha) are moderately susceptible. Accordingly, the Municipalities of Ternate and Naic have 9 and 3 Barangays with high susceptibility and 2 and 29 Barangays with moderate susceptibility, respectively (Cavite Province Provincial disaster Risk Reduction and Management Plan 2011-2016).

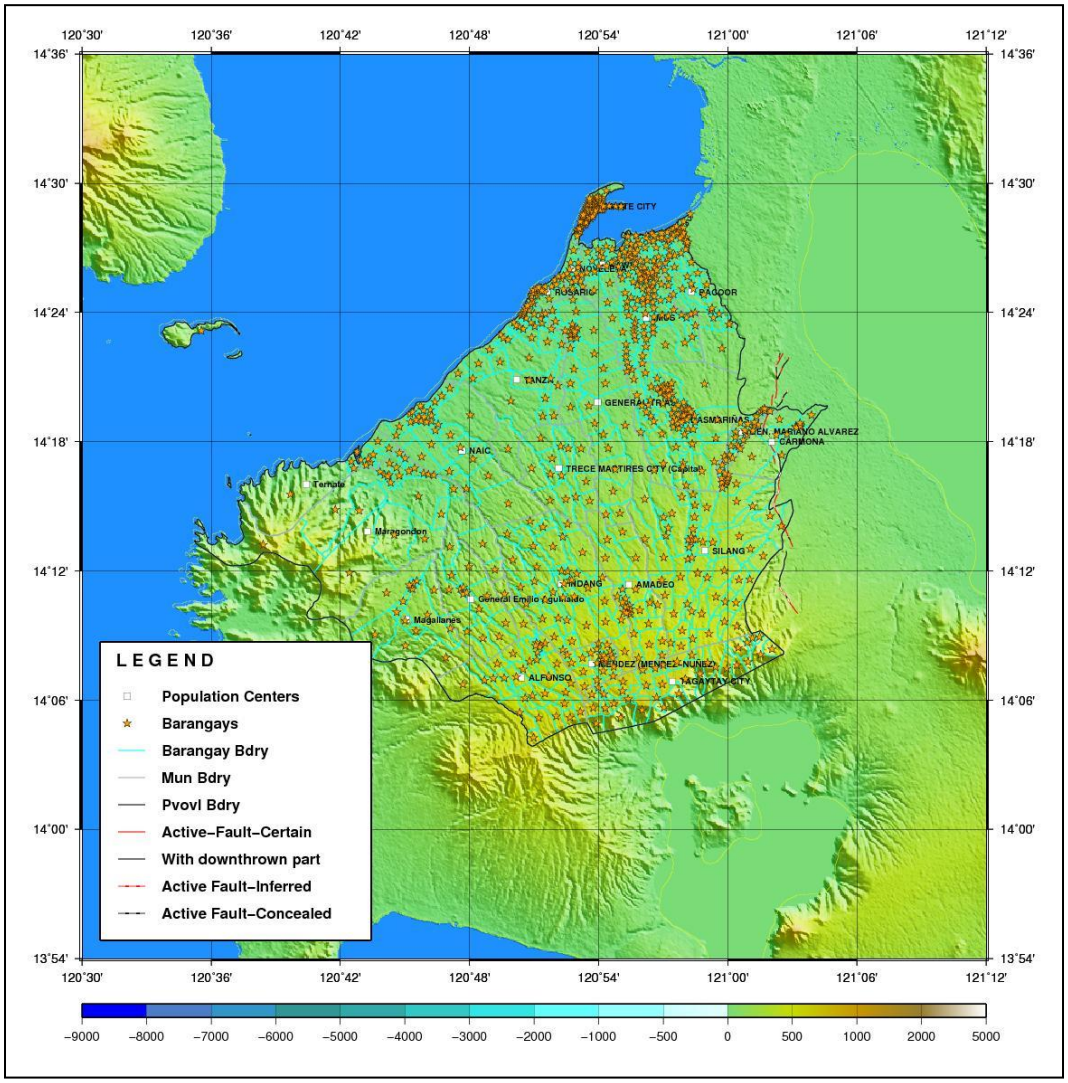


Figure 5-2 Ground Rupture Hazard Map of Cavite

5.2.1.2 Ground Rupture

Ground rupturing occurs along the fault zone that moves during the earthquake. Damage can be severe for structures directly straddling and located within a narrow zone of the active fault traces. Based on **Figure 5-2** that shows the Ground Rupture Map of the Province of Cavite, there is no active fault within the proposed project area, the closest of which is the WVF which is about 36 kilometers away.

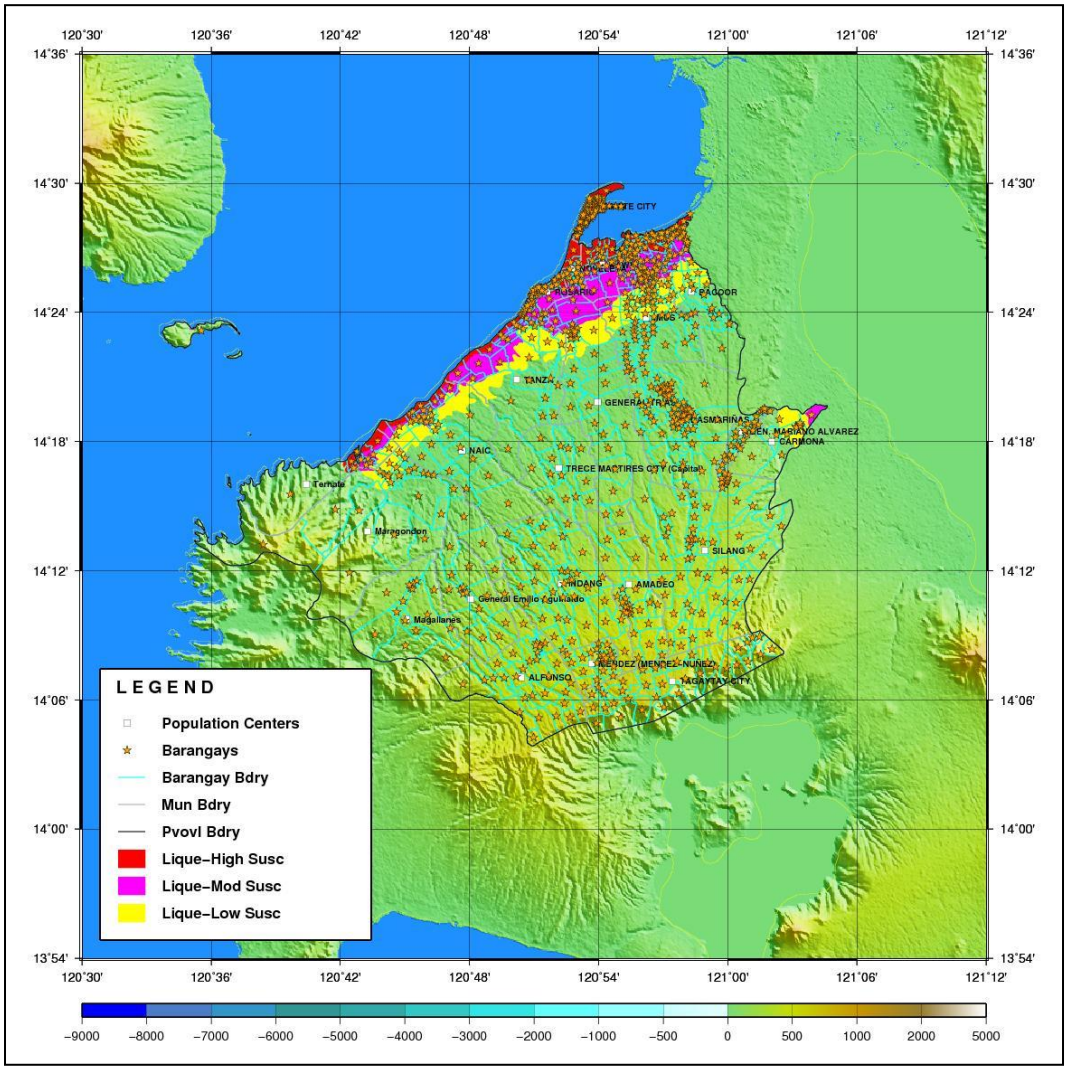


Figure 5-3 Liquefaction Hazard Map of the Province of Cavite

5.2.1.3 Liquefaction

Liquefaction is a phenomenon wherein the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Essentially, liquefaction occurs in saturated soils or soils which the space between individual particles is completely filled with water. Such water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Without movement such an earthquake, the water pressure is relatively low but when shaking or earthquake occurs, the water pressure may increase to the point where the soil particles can readily move with respect to each other.

Data reflected in **Figure 5-3** suggests that coastal areas of Ternate and Naic have high Liquefaction susceptibility.

5.2.1.4 Tsunami

Tsunami or giant sea waves are produced as a result of faulting under submarine conditions at shallow depths. Tsunami can also be triggered by submarine landslides, volcanic eruptions and movements along subduction zones. Areas vulnerable to this hazard are the coastal zones fronting an open sea. Depicted in **Figure 5-4** is the Tsunami Map of the Province of Cavite wherein 7 barangays in the Municipality of Naic are categorized with high susceptibility.

It should be noted however that tsunamis in the Philippines are extremely rare with the last significant event occurred in the Verde Island Passage (between Batangas and Mindoro Island affecting Puerto Galera) in 1976 with about 2-3 meters when it reached land. The apparent low vulnerability albeit high susceptibility levels of nearby communities of the proposed project area can be attributed to the narrow configuration of the mouth of Manila Bay with an over-all abating effect to the incoming tsunami waves, thus lessening any impact on the proposed area. Furthermore, the presence of the Island of Corregidor near the mouth of manila Bay likewise tends to deflect and abate the effects of incoming waves.

Be as it may, the hazard posed by tsunami is probably only comparable to that from storm surges.

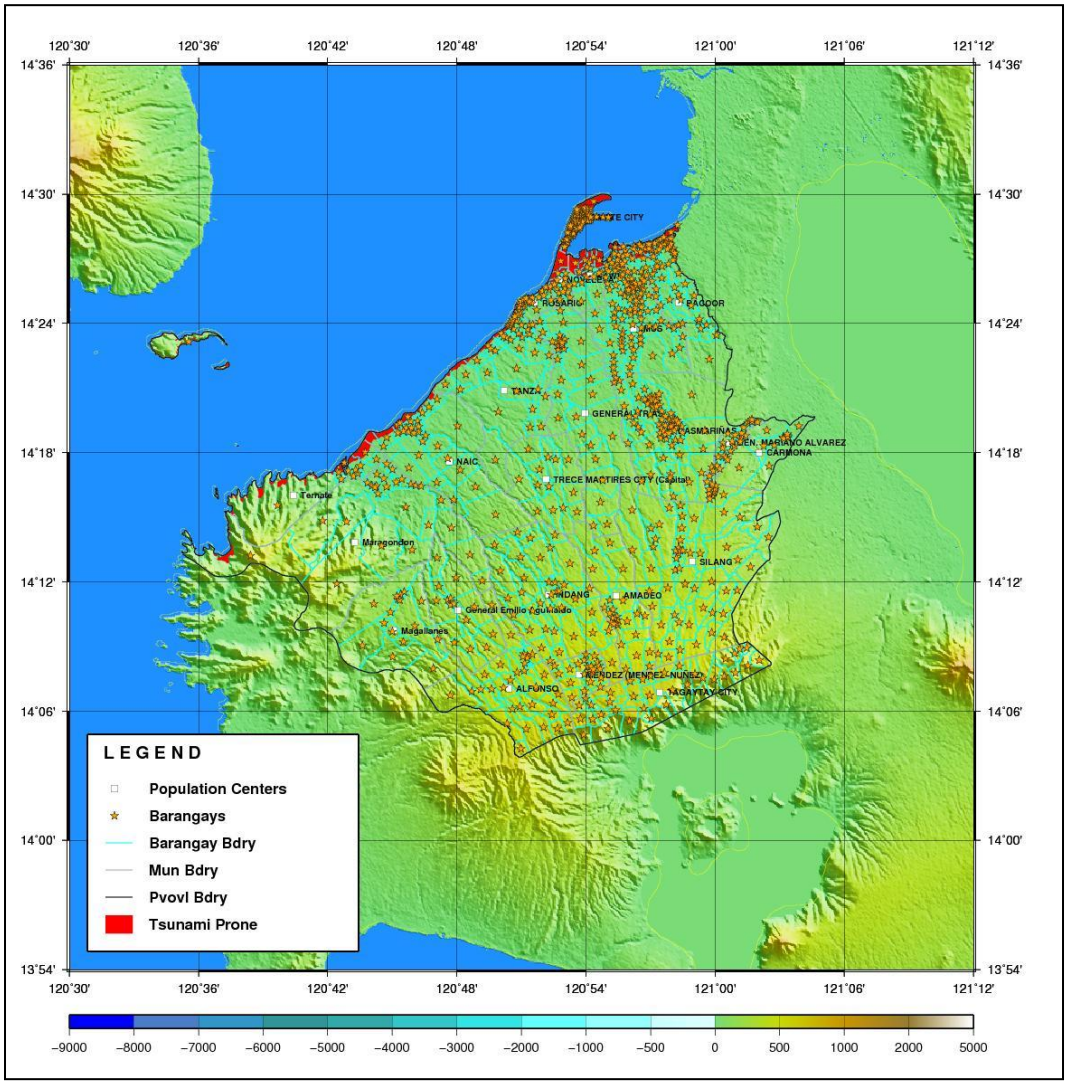


Figure 5-4 Tsunami Hazard Map of the Province of Cavite

5.2.1.5 Volcanic Eruption

There are about 18 active out of 37 volcanoes in the Philippines with Taal Volcano the closes in the proposed project site. Taal Volcano has been called the smallest active volcano in the world. Since 1572, Taal Volcano already registered 33 eruption, mostly confined to the intracaldera area. However, in 2020, the volcano erupted that spewed ashes across CALABARZON, Metro Manila, and some parts of Central Luzon and as far as Ilocos Region resulting in suspension of school classes, work schedules and flights. In reference to **Figure 5-5** and **Figure 5-6**, the proposed project area is not within the area susceptible base surger and ballistic projectiles, respectively.

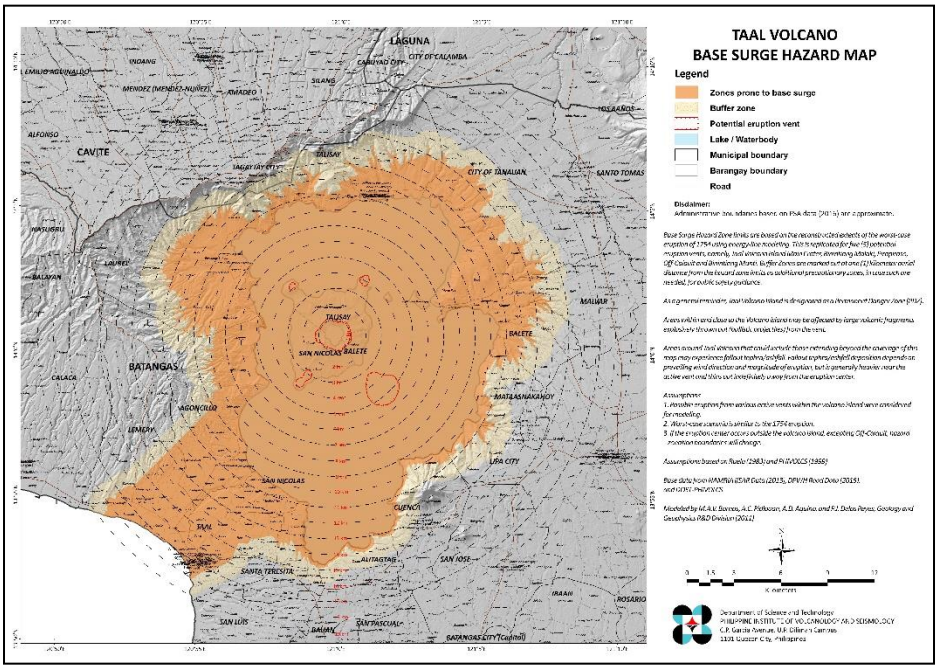


Figure 5-5 Taal Volcano Base Surge Hazard Map

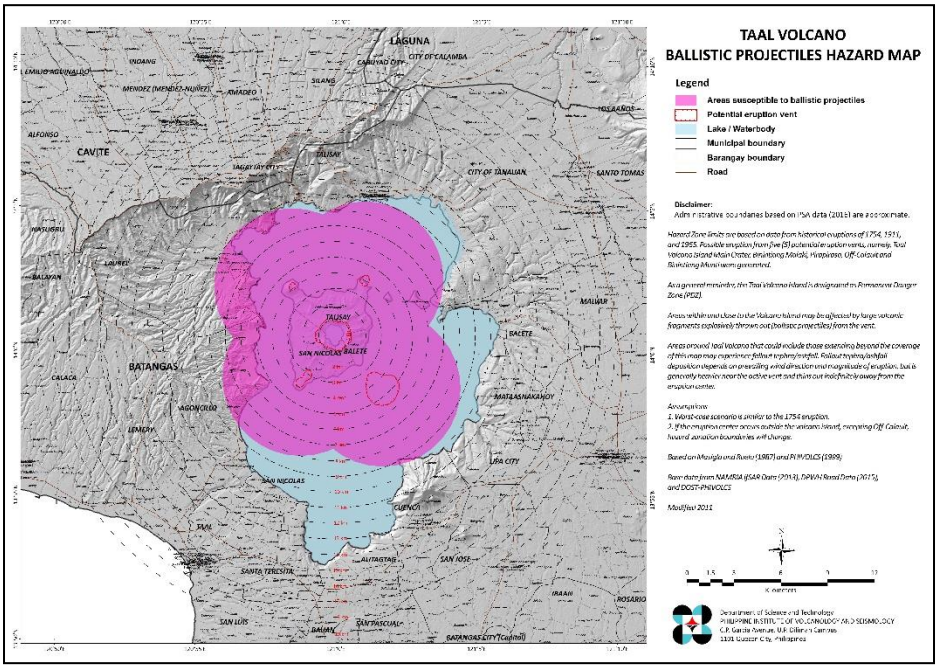


Figure 5-6 Taal Ballistic Projectiles Hazard Map

5.2.2 Hydrologic Hazards

5.2.2.1 Typhoon

Typhoons are violent cyclone that occurs in the Northwest Pacific Ocean. They feature heavy rains and winds that maintain speeds equal to or greater than 74 miles (119 kilometers) per hour. Similar storms that occur in other parts of the world are called cyclones or hurricanes.

Cavite is significantly more at risk to typhoons compared to other southern areas in the country particularly by monsoon (rain-bearing) winds, which blow from the Southwest from approximately may to October and from the Northeast from November to February. Reflected in the Cavite Disaster Risk Reduction Plan 2011-2016, a total of Tropical Cyclones crossed or directly hit Cavite from 1948-2009 with Tropical Storm “Ondoy” in 2009 causing the most damages and recently, Typhoon Ulysses.

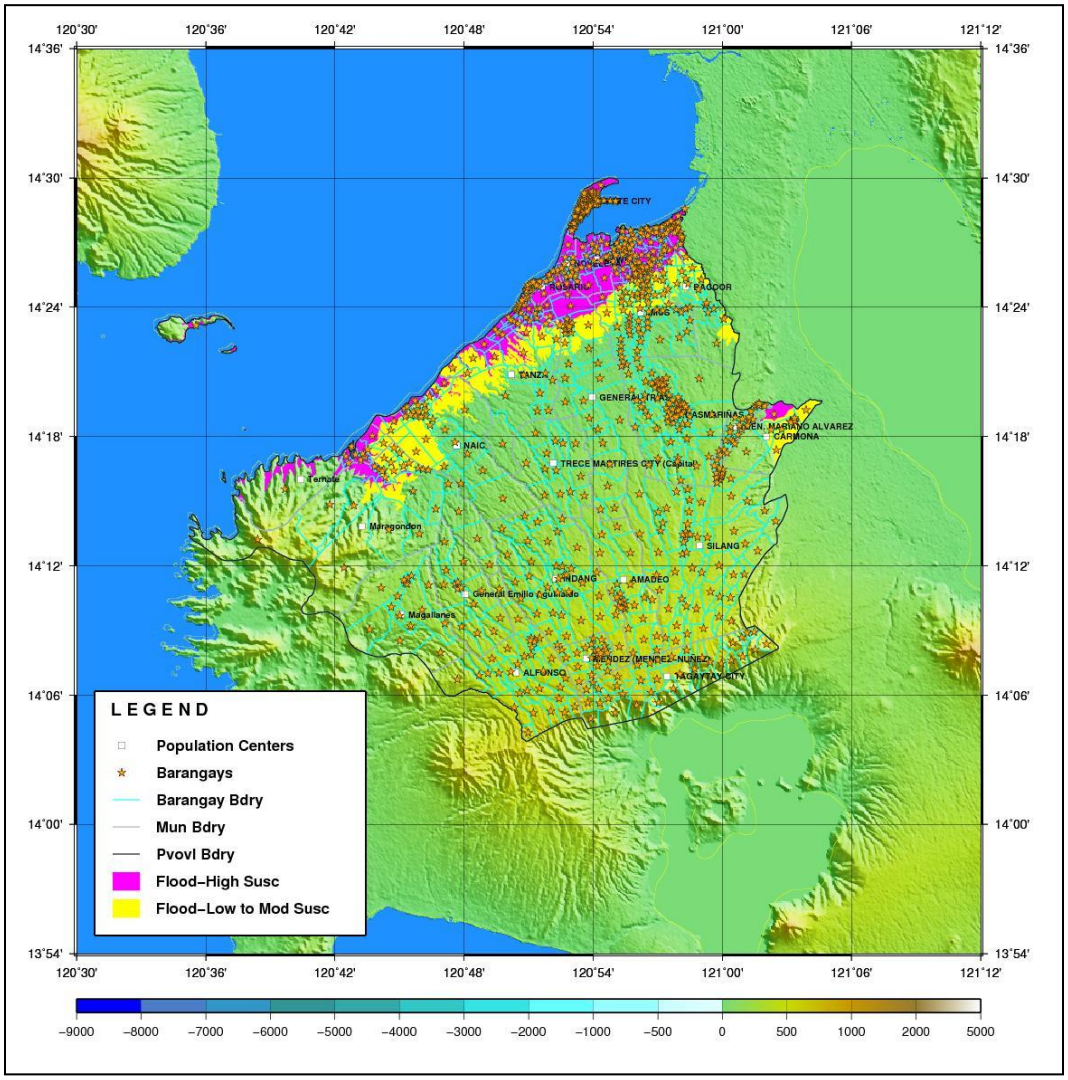


Figure 5-7 Flood Hazard Map of the Province of Cavite

5.2.2.2 Flooding

Flooding is usually caused by heavy rains accompanying typhoons or the southwest monsoons. Now a chronic problem, flooding has been affecting a number of areas especially those low-lying areas. Furthermore, coastal area flooding is also on the rise. Common nuisance or tidal flooding occurs during extremely high tides, causing seawater to spill onto land and inundate low-lying areas until the tide recedes, there are also moderate and major floods that can be caused by heavy rains, storm surges, and high waves that occur during coastal storms. Incidentally, due to climate change, sea level rise aggregates such flooding more than ever.

A number of barangays in the Municipality of Ternate and Naic have high susceptibility with the latter with additional low t0 moderate susceptibility barangays as shown in Figure 5-7.

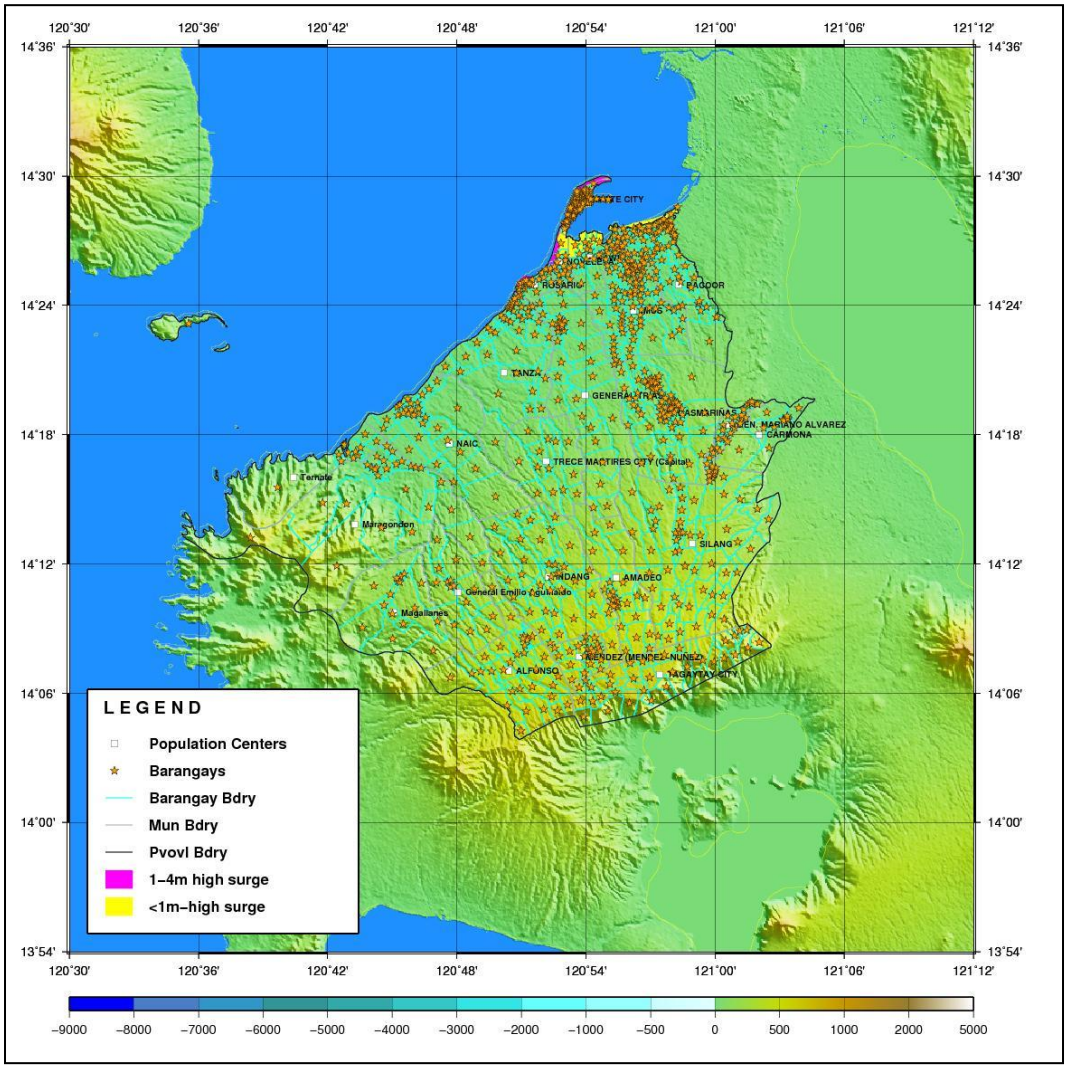


Figure 5-8 Storm Surge Hazard Map of the Province of Cavite

5.2.2.3 Storm Surges

Storm surges refers to the temporary increase at a particular locality in the height of sea due to extreme meteorological conditions that may be low atmospheric pressure and/or strong winds. Storm surges is caused primarily by strong winds pushing on the ocean's surface causing the water to pile up higher than the ordinary sea level. The combination of coastal configuration and seasonal wind regime raise tide levels during the rainy southwest monsoon at the Manila Bay. For example, Typhoon Pedring in 2011 resulted to 6 meters in the coastal areas of Manila Bay, particularly in Barangay San Rafael 3 and 4 in Noveleta, Cavite.

Reflected in **Figure 5-8** is the Storm Surge hazard map of the Province of Cavite, Municipalities of Ternate and Naic included among localities with low-moderate susceptible areas; adjacent barangays of the proposed project area not included.

5.3 Emergency Response Policy and Guidelines

5.3.1Emergency Response Policy

To ensure the viability of the project, the proponent is ensuring the health, safety and security of its personnel, resources and the adjacent environment through the prevention of accidents by eliminating potential threats/hazards and anticipating other probably causes. The project shall observe the primary approach to emergency response, which is to prevent any circumstance that can create emergency situations.

Table 4-3.

Table 5-3 **Emergency Scenarios for the Project**

Type of Emergency Situation	Possible Causes	Potential effects
Occupational Safety Accidents	▪ Improper training and supervision of personnel ▪ Equipment/facility failure ▪ Lack of full understanding regarding the surrounding environment	▪ Injuries and fatalities to personnel ▪ Partial or total loss of equipment
Earthquakes	▪ Movement/rupture of nearby fault lines ▪ Volcanic eruption	▪ Failure of equipment/facility ▪ Injuries or fatalities to personnel and communities
Tsunami	▪ Movement/rupture of nearby fault lines ▪ Volcanic eruption ▪ Intense earth movement	▪ Failure of equipment/facility ▪ Injuries or fatalities to personnel and communities
Flooding	▪ Typhoon-prone area ▪ Flood-prone/ topography of area ▪ Complex weather systems	▪ Destruction of project equipment/facility ▪ Injuries or fatalities to personnel and communities
Storm Surge	▪ Typhoon-prone area ▪ Complex weather systems ▪ Intense rainfall, wind and high tides	▪ Destruction of project equipment/facility ▪ Injuries or fatalities to personnel and communities

A safety officer shall be designated by SMRI who will regularly conduct safety briefings as well as periodic emergency response drills. The safety officer will also supervise the daily safety performance of operations and maintenance procedures. He will inspect the work and crew situation and ensure maintenance of and compliance to safety guidelines. Aside from the occupational safety accidents, the project area is also exposed to a number of geologic hazards such as ground shaking, liquefaction, and storm surges.

The potential incidents and emergency situations that may be encountered in the future operation of the proposed project are detailed in **Table 4-3**. Furthermore, depicted in **Figure 4-9** is a schematic diagram for

the emergency response procedure and the roles and responsibilities of necessary personnel enumerated in **Table 4-4**.

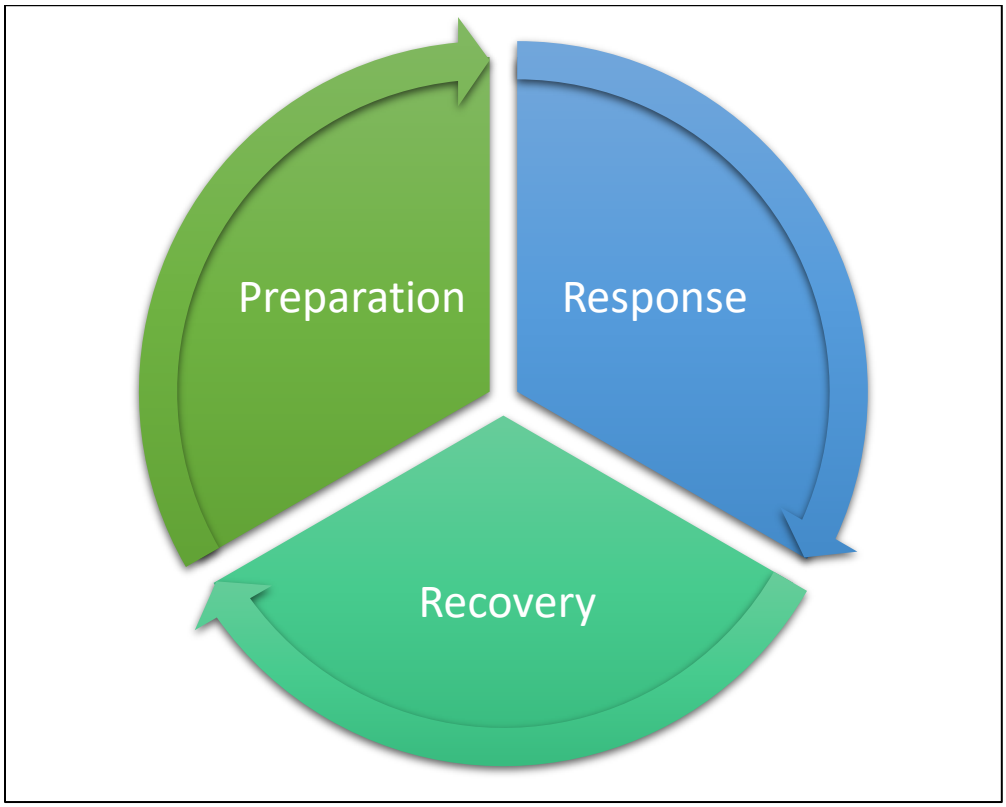


Figure 5-9 Emergency Response Procedure

The emergency response procedure begins with **PREPARATION** wherein actual plans are developed should an emergency occur as such, eliminating and avoiding hazards from happening. However, in the even that such emergency occurs, there is a need to conduct **RESPONSE** by executing the prepared plans and procedures. After which, there must be a retrieval of important assets and restoration of the site/project to its original state or prior to the emergency, this refers to **RECOVERY**.

The list of key personnel for emergency response operation may be reduced or increased depending on the size of the project or scope of the emergency. Additionally, the use of Incident Command System (ICS) as provided by the national Disaster Risk Reduction and Management Council (NDRRMC) Memorandum Circular No. 04-2012 may also be recommended given that the proponent aspire to adapt a framework of an appropriate and suitable model for on-scene disaster response and management system.

Table 5-4 Key Personnel for Emergency Response Operations

Emergency Response Personnel	Roles and Responsibilities
Leadman (Incident Commander)	▪ Overall in-charge of operations during an emergency ▪ Provides direction and orders to the response team in managing an emergency ▪ Informs supervisor/project manager about the incident
Supervisor/ Project Manager	▪ Assists at the site when necessary ▪ Know the condition of the people involved in the emergency, assesses the situation, and give instruction to the First Aid Team as needed ▪ Inform the family/ies concerned, and provide information of hospital location and other necessary details
Safety Officer	▪ Supervises daily safety performance of operations and maintenance procedures including emergency response procedures ▪ Conduct DOLE-required compliances on Occupational Health and Safety (OSH)
Liaison Officer	▪ Secure necessary permits and training certification for all personnel
First Aid Team	▪ Conduct the actual response, rescue and retrieval of personnel and equipment during emergency ▪ Calls for ambulance or needed specialists to immediately assist case when necessary
Logistics Team	▪ Provides the necessary supplies and equipment for the First Aid Team ▪ Provides additional support/assistance as may necessary to emergency response

5.3.2 Guidelines for the Prevention, Alleviation or Response to Emergency Situations

To be able to reduce, if not eliminate, extreme emergency situations leading to loss of life and property, hereunder are the Project's safety guidelines which will be refined during operations.

5.3.2.1 Occupational Health and Safety

5.3.2.1.1 Company Safety and Health Policy

SMRI shall ensure that its contractor(s) will implement Company safety Policy which serves as the guiding principle in the implementation of safety and health programs onsite. The policy includes the contractors' policies on occupational safety, worker's welfare and health, and environment. The Safety Policy includes the commitment that the contractor(s) will comply with the Department of Labor and Employment (DOLE)

minimum safety requirements, reporting requirements of the Occupational Health and Safety Standards (OSHS), and other relevant DOLE issuances:

- Registration (Rule 1020 and D.O. 18-02)
- Report of Safety Committee Organization (Rule 1040)
- Notification of Accidents and Occupational Illnesses (Rule 1050)
- Annual Work Accident/Illness Exposure Data Report (Rule 1050)
- Annual Medical Report (Rule 1960)

5.3.2.1.2 Safety and Health Personnel

The following are the requirements for the different personnel relating to the Occupational Health and Safety Program (OSHSP):

- First-aid personnel: should be certified by the Philippine National Red Cross with a valid PNRC ID Card.
- Safety Officers: must complete the 40-hour BWC prescribed safety and health course as required by Rule 1030 of the OSHS, as amended by DO. 16. All full-time safety personnel shall be accredited by the BWC pursuant to DO. 16.
- Physicians and nurses: must complete the BWC prescribed course on occupational safety and health course, pursuant to Rule 1960 of the OSHS.

5.3.2.1.3 Specific Duties and Responsibilities of the Safety Officer

Specific duties and responsibilities of the safety Officer are outlined in Rule 1047 of the Occupational Safety and Health Standards (OSHS).

5.3.2.1.4 Applicable safety and Health Promotion and Continuing Information Dissemination

- Information dissemination or advisories to the new employees prior to on-site assignment, e.g., conduct of safety orientation, company's health and safety policies, hazards related to the job, safety measures, safe work procedures.
- Programs on continuing education such as trainings and seminars, if any, that shall be given to employees, e.g., refresher course, first aid training, refresher course toolbox meeting, construction safety training for site safety officers.
- Arrangements for conveying information on safety and health IEC materials, e.g., Posters/comics/flyers, safety signage, handbooks/manuals, bulletin boards
- Arrangements for setting up sub-committees on safety and health, if necessary.
- Schedule of safety related activities, e.g., toolbox meeting, health and safety committee meeting.

5.3.2.1.5 Accident and Incident Investigation, Recording, and Reporting

- Investigation and recording of all accidents or incidences.
- Notification of the appropriate DOLE Regional Office within 24 hours in case of fatal accidents.

5.3.2.1.6 Environmental Control (Rule 1070 of the OSHS)

- Monitoring and control of hazardous noise, vibration and air-borne contaminants such as gases, fumes, mists and vapors
- Provisions to comply with minimum requirements for lighting, ventilation and air movement.

5.3.2.1.7 Guarding of Hazardous Machinery (Rule 1200 of the Standards)

- Provisions for installation/design of built-in machine guards
- Provisions for built-in safety in case of machine failure
- Provisions for guarding of exposed walkways, access-ways, working platforms

5.3.2.1.8 Provisions for and use of Personal Protective Equipment (PPE) (Rule 1080 of the OSHS)

- Appropriate type and duly tested PPEs to be issued to workers after the required training on their use
- Provisions for maintenance, inspection and replacement of PPEs

5.3.2.1.9 General Materials Handling and Storage Procedures (Rule 1150 of the Standards)

- Safe use of mechanical materials handling equipment
- Secured and safe storage facilities
- Regular housekeeping
- Clearly marked clearance limits
- Proper area guarding of storage facilities

5.3.2.1.10 Testing and Inspection of Electrical and Mechanical Facilities and Equipment

- OSHS Rule 1210 – Electrical Safety

- OSHS Rule 1220 – Elevators and Related equipment
- OSHS Rule 1410 – Construction Safety
- OSHS Rule 14150.10 – Training and Examination of Lifting Appliance

5.3.2.1.11 Workers Skills and Certification

- Provisions to ensure that workers are qualified to perform the work safely
- Provisions to ensure that only qualified operators are authorized to use and operate electrical and mechanical equipment

5.3.2.1.12 Provisions for Emergency Transportation Facilities for Workers

- OSHS Rule 1963.02 – Emergency Medical and Dental Services applies

5.3.2.1.13 Fire Protection Facilities and Equipment

- Fire protection facilities and equipment as required under Rule 1940 of the OSHS
- Proposed structure and membership of fire brigade
- Provision for training on emergency preparedness

5.3.2.1.14 First-Aid and Health Care Medicines, equipment and Facilities

- Identification of the proposed first aid and health care facilities that the contractor will provide to meet the minimum requirements of OSHS.
- Identification of the medical and health supplies, such as medicines and equipment to be provided.
- Mandatory provision of first aid medicines and emergency treatment.
- In the absence of the required onsite health care facility, the contractor should attach a copy of a written contract with a recognized emergency health provider as required under the OSHS.

5.3.2.1.15 Workers Welfare Facilities

- Provision for toilet and sanitary facilities
- Provision for bathing and washing facilities
- Provision for supplying food and meals
- Provision for potable water for drinking and washing
- Provision for locker rooms, storing, and changing of clothes for workers

5.3.2.1.16 Proposed Hours of Work and Rest and Rest Breaks

- Work schedules, working hours, shifting schedules should be specified
- Frequency and length of meals and breaks
- Schedule of rest periods

5.3.2.1.17 Waste Disposal

- Method of waste management as per Republic Act 9003 otherwise known as the Ecological Solid Waste Management Act of 2000

5.3.2.1.18 Disaster and Emergency Preparedness Contingency

- Guidelines in responding to bomb threats
- Guidelines in emergency preparedness and response on vehicular/road accidents
- Preparedness and response for severe weather conditions
- Preparedness and response for fires and explosion
- Preparedness and response for earthquake
- Preparedness and response for accidents in workplace

5.3.2.1.19 Safety Program

Provision for standard work procedures for the following activities:

- Excavation
- Use of power tools and equipment
- Gas and electric welding and cutting operations
- Use of hand tools
- Use of mechanized lifting appliances for movement of materials
- Use of construction heavy equipment

5.3.2.2 Fire and Explosion

Fire and explosion may result due to refueling and/or machine failure of seabed quarry ships and may cause damages to nearby infrastructures and surrounding environment. It may also cause possible personnel injury and/or fatality and incur economic losses to the proponent. Below are some guidelines in avoiding and/or mitigating fires and explosion:

- Ensure good housekeeping, good work habits
- Conduct regular employee training and workplace inspection
- Conduct regular preventive maintenance and frequent inspection and testing of equipment and electrical systems
- Observe appropriate refueling standard operating procedures

- For all hazards, there must be a motorized transportation vessel with first aid facilities, stretcher, breathing equipment, capable wireless communication equipment and trained first aid personnel nearby the site as long as there is an on-going work.

If fire and explosion occur, below are the procedures to be undertaken:

- Any person or employee who will see the fire or explosion incident must take an urgent effort to notify its Safety Officer.
- The personnel/employee or the safety officer must activate the "fire alarm" and announce the situation.
- If the fire and/or explosion may not require escalated response, personnel must use fire extinguisher or other related fire suppression equipment present. Evacuation procedures must be undertaken regardless of the fire and/or explosion case.
- All injured personnel (if any) must be evacuated to a safe distance away from the scene. The safe distance shall depend on the gravity of the situation and purely discretionary based on trainings or existing guidelines.
- If the gravity of the incident is beyond the capacity of the key personnel, the liaison officer, or officer in charge must communicate with the local authorities (e.g., PCG, BFP, Local DRRMO) for appropriate immediate response

5.3.2.3 Oil Spill

As with most dredging activities, particularly hydraulic dredging, generating an overspill of fine solid material as a consequence of the activity. Furthermore, since most ocean-going ships use oil-lubricated stern tubes, the possibility of oil spill is inevitable. Such can also be expected if the gravity of fire and/or explosion affects the integrity of the seabed quarry ships oil tanks. To avoid or minimize such incidences, the following important procedures will be followed:

- Ensure good housekeeping, good work habits
- Conduct regular employee training and workplace inspection
- Conduct regular preventive maintenance and frequent inspection
- Ensure regular vessel maintenance – replace cracked or worn hydraulic lines and fittings before any operations
- Placement of oil tray or drip pan on engines.
- Placement of bilge socks to prevent oil water discharge.
- Avoid overflows while refueling
- Shut off bilge pump while refueling
- Use/place absorbent pad or fuel collar to catch drips

If oil spill occur, below are the procedures to be undertaken:

- Ensure the availability and familiarity of personnel on oil spill preparedness program
- Depending on the gravity of oil spill, personnel must report incident to local authorities (e.g., PCG, Local DRRMO, BFAR)

- If the spill can be controlled, particularly those that are less than 5 liters or less than 1 meter in diameter, personnel will control the spill using absorbent pads or minibooms to prevent escape to water or further disperse in the water. For larger spills, cushion, where available, will be used instead of pads.

5.3.2.3.1 Storm, Typhoon, Tropical Depression, and Storm Surges

Since storms, typhoons and tropical depression cannot be avoided, the proponent through its contractor/s will ensure compliance to the updates readily available and provided by PAGASA. Advisories released by the Philippine Coast Guard shall be strictly followed. No ship shall sail if authorities declared as such.

Additionally, the following procedures shall be undertaken:

- Upon receiving advisories from authorities, key personnel will advise management and its workforce on the disturbance and possible cancellation of operation
- In the event hydrological signal (e.g., Typhoon, Storm) 1, if permitted to operate, faithful monitoring shall be exercised particularly if advisories will be elevated. Key personnel must also take into account any additional advisories on possible storm surges.
- Key personnel shall take action and secure the ship and its equipment to mitigate any possible effect the typhoon might cause
- If signal further escalated, key personnel must communicate with the management for the proper operations shutdown until further notice.
- After any major weather disturbances, key personnel must determine the extent of damage if any, and make necessary arrangement for the repair of the damaged equipment/structure
- A thorough checking of all equipment specially those damaged by the typhoon shall be conducted for appropriate maintenance so that the ship and its equipment can be operated safely.

5.3.2.4 Earthquakes and Tsunamis

Another natural hazard that cannot be controlled nor anticipated are Earthquakes and Tsunamis. In the event of an earthquake, regardless of its intensity or how strong it is, key personnel need to make a quick assessment whether to keep the plant operating or not. Key personnel will keep abreast on advisories of possible aftershocks and resulting tsunami(s).

Although in a ship, in the event of shaking, personnel will exercise the following procedure:

- **STOP**: all work must be secured and stopped as an initial response.
- **DUCK/DROP**: stay low, move and stay alert for possible falling debris, parts or any equipment
- **COVER**: cover head with helmet or any light but hard object for a cover such as under a table and under a column or vertical beam

- **INSPECT**: after shaking/tremor, inspect the place for any further danger. If there is a possibility of Tsunami, ensure that the ship can brace impact and equipment stowed for the highest possible mitigation of damage.

Additionally, the following procedures shall be undertaken:

- Provide first aid to injured personnel.
- In the event that injuries are life threatening or personnel require immediate advance medical attention or further emergency response, call for assistance from local authorities
- If other disaster such as fire/explosion, oil spill, etc. occur, refer to previous procedures
- In the event of tsunami, ships shall not return to port and instead if possible, move ships to deeper water.
- After a tsunami or if there are no further advisories for a tsunami, key personnel will contact harbor/port authorities if there is a need for it to dock.
- After the event and no further advisories received, a comprehensive inspection must be scheduled on the ship(s) and equipment to avoid further risks

SECTION 6.0 ENVIRONMENTAL MANAGEMENT PLAN

This chapter discusses the key environmental impacts and proposed management measures in relation to the dredging operations. The environmental management plans are identified per EIS module.

This chapter also outlines the Social Development Program, Environmental Monitoring Plan and the Institutional Plan to address and manage these impacts.

6.1. IMPACT MANAGEMENT PLAN

6.1.1. Assessment of Land Impacts

6.1.1.1. During Pre-dredging Phase

Pre dredging activities entail the conduct of bathymetric surveys to determine the configuration of the shoal and drilling of exploratory holes to ascertain the nature and properties of the various layers of sediments. These activities will translate to localized and minor disturbance of the sediment layers.

6.1.1.2. During Dredging Phase

Trailing suction hopper dredgers will be used in the progressive removal of the sediments from the project area. The target volume is approximately 90 million m^3 over a period of 10 years. Dredging will lead to the partial modification of the gentle slope of the project area. A series of local trenches or furrows will be generated upon removal of the sediments.

The local modification of the slope of the project area is a natural consequence of dredging and cannot be avoided. The natural process of sedimentation and deposition into the trenches and slope irregularities will proceed after the completion of dredging works. Eventual replenishment of the removed sediments will take a long time to attain.

Considering that the project area corresponds to 1% of the total area of Manila Bay, the local modification of the slopes can be considered as low to moderately significant.

A sediment plume will be generated the extent of which will depend on the rate of extraction, size of the stirred-up particles and the prevailing currents. The plume will locally affect turbidity of the marine waters around the dredging area.

The plume will persist during the dredging period but will vary in size depending on the extent of sediment extraction, prevailing current and the intervals between operational cycles.

Due to the submerged and offshore location of the project area, dredging will not affect the river systems on land and will not induce flooding. The aquifer systems inland will not be affected since these are not hydraulically connected to marine water saturated sediments of the project area.

Dredging will not induce subsidence, liquefaction, landslides, mud/debris flow since these are land-based hazards and events which are not linked to the project area.

6.1.1.2.1. Sediment Transport modelling

The numerical modeling study investigated the circulation and transport features of the coastal environments with scenario analysis on the possible impacts of releases of sediments due to operations of dredging vessels, in the area of the proposed offshore sand mining area in Cavite portion of Manila Bay. The numerical modeling exercise included key components and assumptions, for example, the actual hydrodynamic processes were represented by the model theoretical equations; barotropic and baroclinic pressure gradients were disregarded in the model set-up (river discharges from other river systems within the gulf were neglected due to absence of data, evaporation and direct rainfall were not incorporated); long-term average wind field conditions instead of actual data, etc.

While there is always a degree of uncertainty in the model assumptions, a conservative approach was adopted to ensure that this uncertainty is well incorporated into the variability of the results. For example, extreme scenario simulations thru calm wind condition were undertaken to only consider the effects of tidal oscillations to obliterate the effects of wind-driven turbulence on pollutant transport. Low wind condition results to low mixing of pollutant in the water column which would then predict higher pollutant concentrations.

From the results of the scenario analyses, the model results revealed that pollutant dispersion fluctuates depending on the rise and fall of the tides. As shown in the comparative results of tidal fluctuations and TSS concentrations presented in the figure below, higher pollutant concentration is predicted to be consistent with low tidal level event and vice versa.

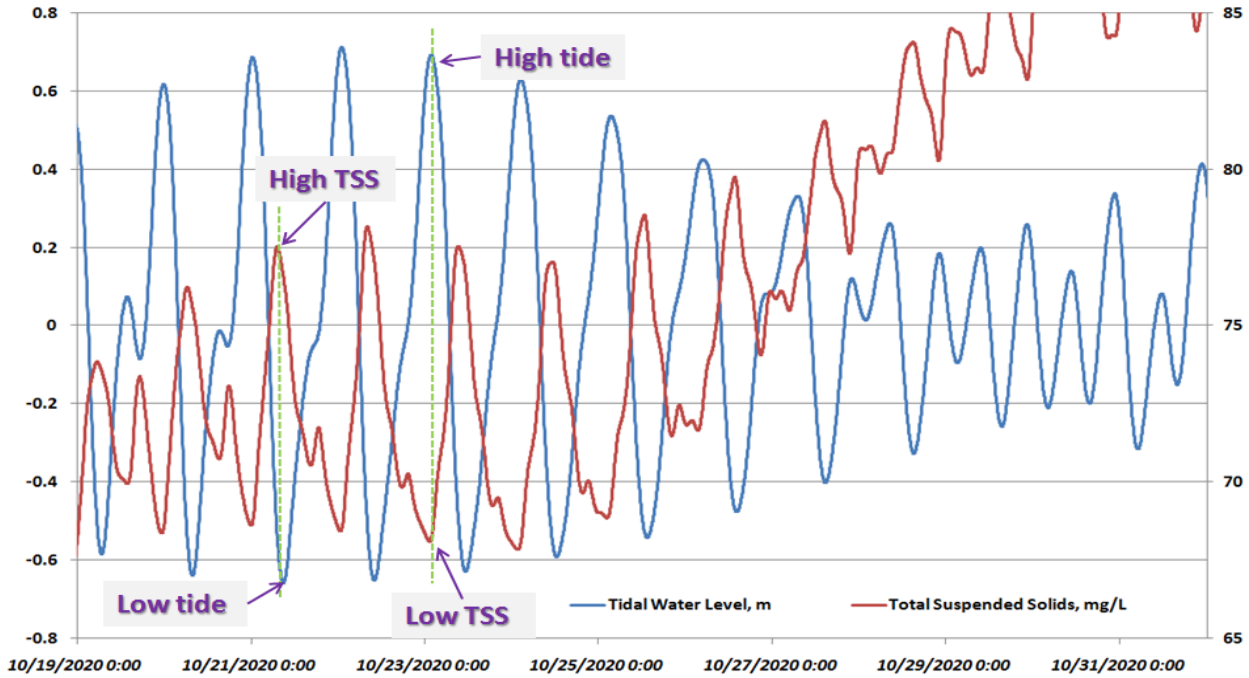


Figure 6-1 Comparison of predicted TSS and water level fluctuations near the project area

Likewise, the scenario simulations revealed that the sediment being released or disturbed during the dredging operations has higher concentrations in the areas immediate of dredging vessels and may lead to exceedance to the 50 mg/L allowable TSS concentrations unde DENR standards for Class SB marine waters, as delineated by black contour plots included in the series of figures shown above. This is especially true if there are no mitigating measures in place like the installation of silt curtains to arrest the spread of the dredged materials outside of the project area. The model scenarios presented here do not consider these mitigating measures.

Note that since the deployment of the dredging vessels cannot be known in advance and is highly mobile, the only constraint being that it should not be placed outside of the project dredging area boundaries, the modelling conducted here assumes worse case conditions. That is, the four units of trailing suction hopper dredgers (TSHD) were deployed in the project boundaries nearest the shore where the depth is rather shallow than the area farther offshore. By placing it there, the concentrations of TSS plumes that can be generated are higher and therefore the predicted areal coverage of the likely impact is larger.

The critical situation is during calm wind condition, with predicted concentrations nearest the point sources of pollutant reaching more than 50 mg/L, but generally is less than said concentration once the spreading reaches a few hundred meters away from these sources. In the area far offshore, the concentration of pollutant is less than 10 mg/L. Most of the pollutant released are dispersed mainly towards the northeast during habagat and to southwest during amihan wind fields.

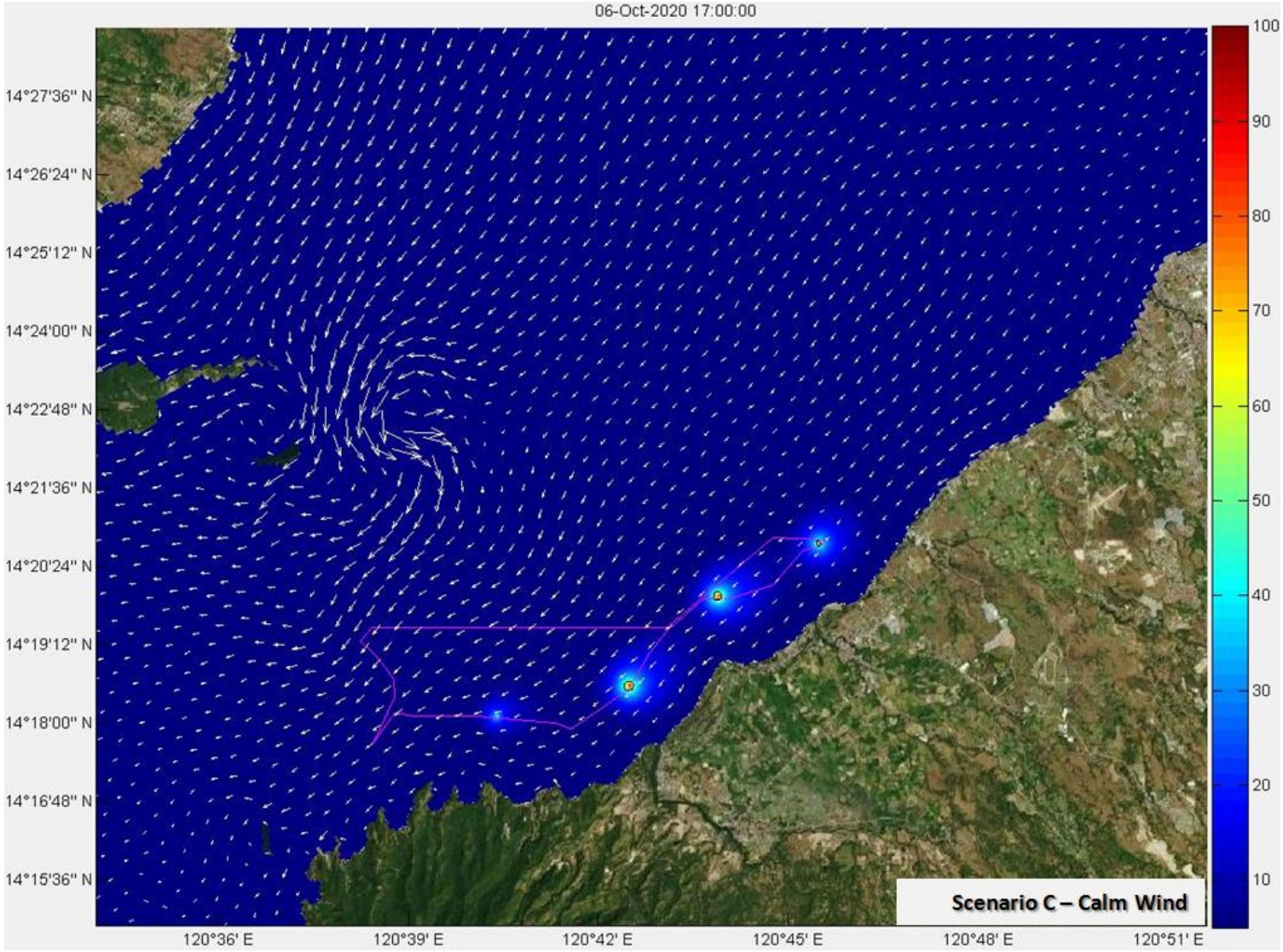


Figure 6-2 Predicted transport of TSS pollutant after 17 hours of continuous pollutant releases under calm wind condition

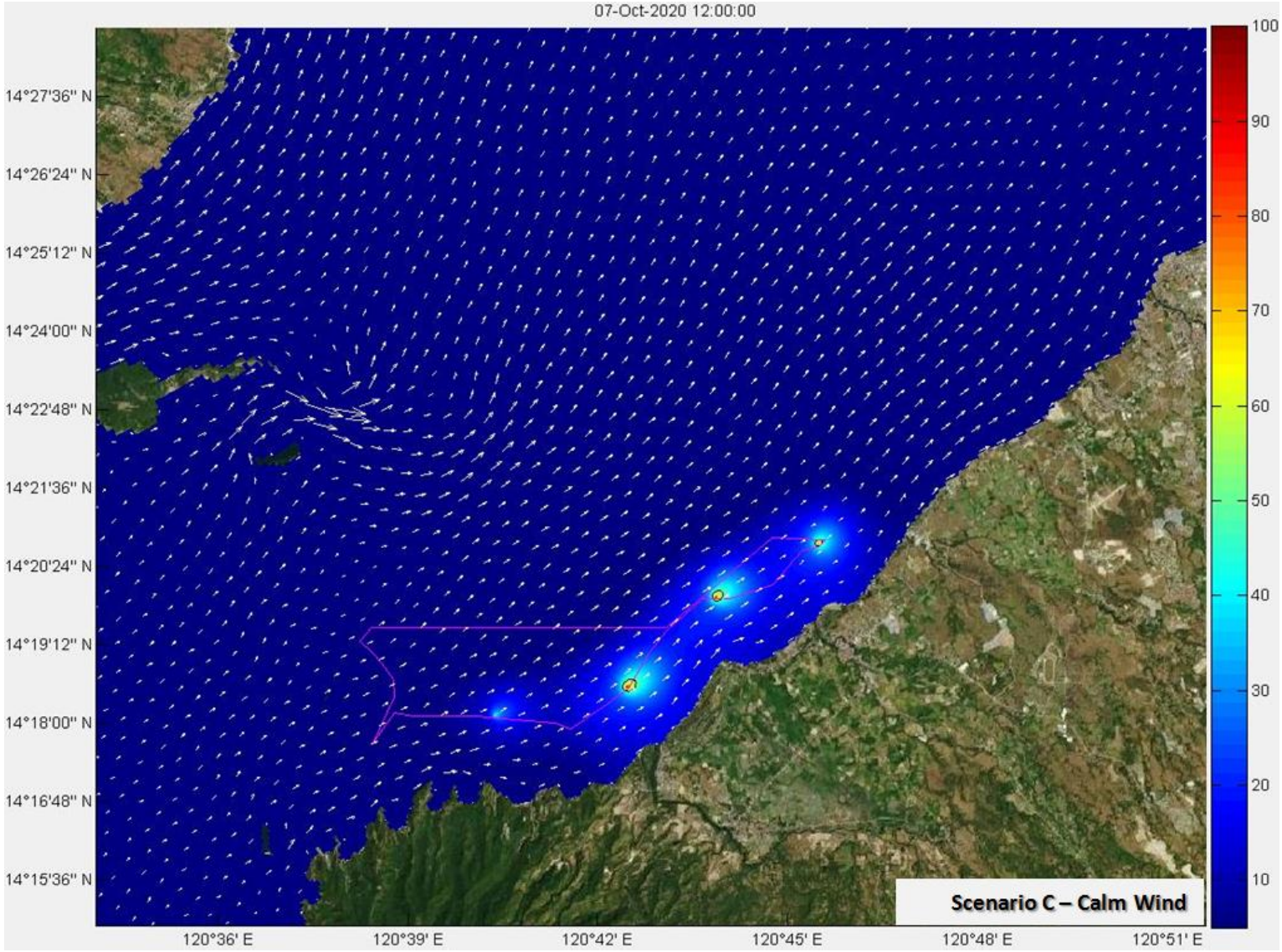


Figure 6-3 Predicted transport of TSS pollutant after 36 hours of continuous releases under calm wind condition

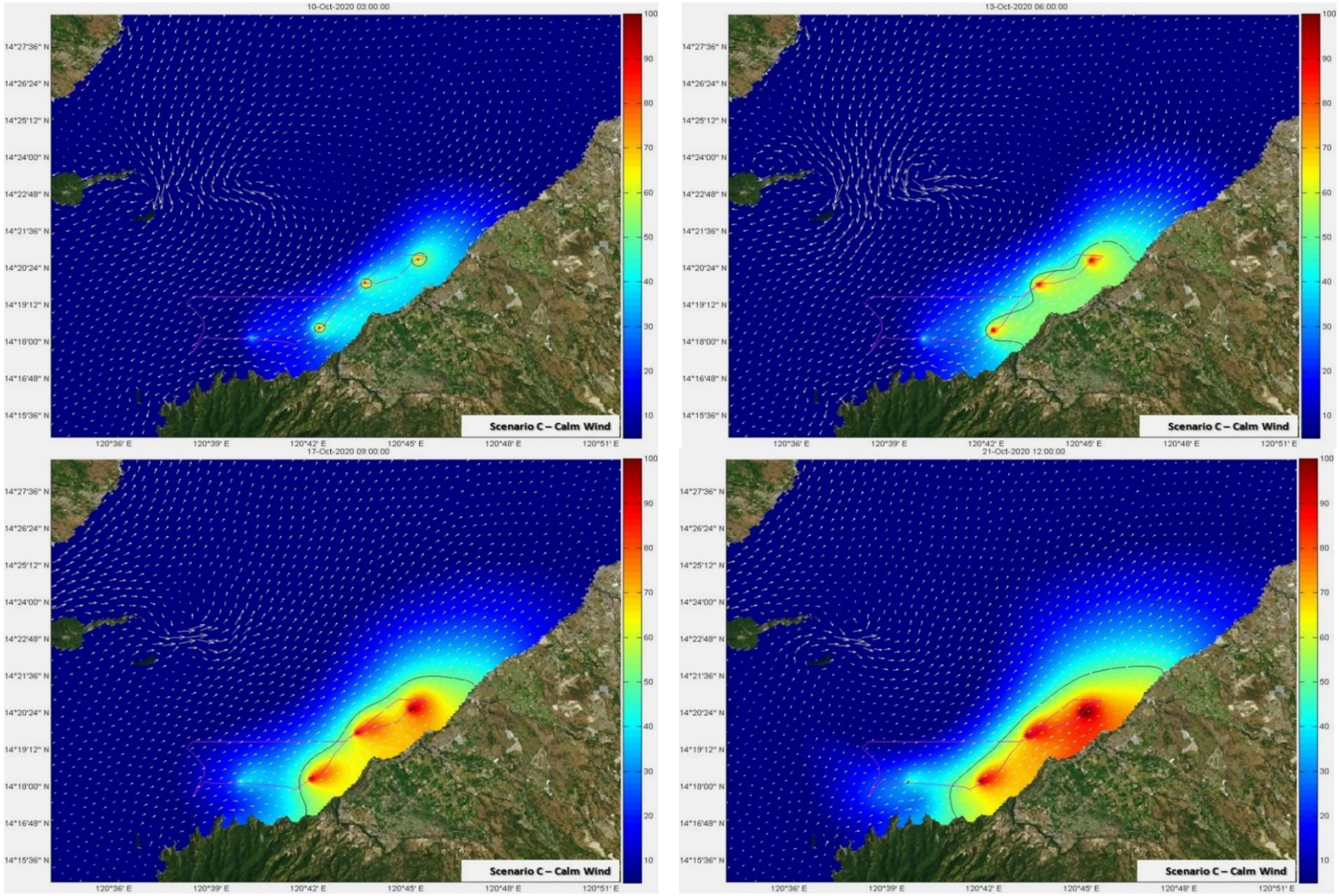


Figure 6-4 Predicted transport of TSS pollutant: after 4.125 days (upper left), 7.25 days after (upper right), 11.375 days after (lower left), and after 15.50 days (lower right) of continuous releases

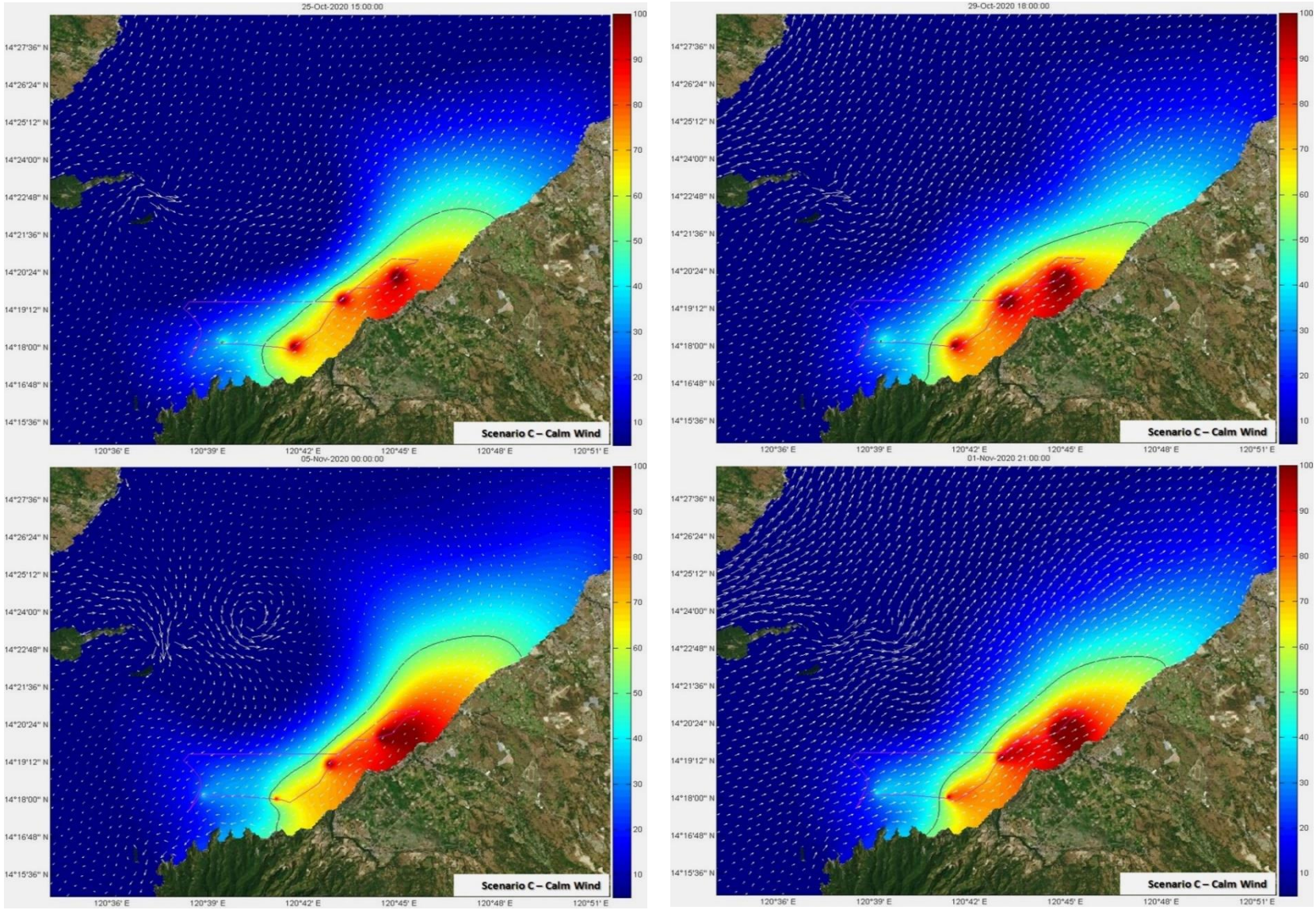


Figure 6-5 Predicted transport of TSS pollutant: after 19.625 days (upper left), 23.75 days after (upper right), 26.875 days after (lower left), and after 30 days (lower right) of continuous releases

As the model results presented here revealed increase in suspended sediment concentrations due to the proposed offshore sand mining operations, and may exceed the DENR limit of not more than 50 mg/L for TSS for Manila Bay Class SB waters, the following are the suggested actions to minimize the TSS levels during operation:

1. Proper mitigating measures are strongly recommended to be set in place to ensure the confinement of the suspended material to prevent accidental spillage during the operational phase of the project (or during transport and hauling of mined sand materials) for maintaining the environmental integrity of the coastal zone.
2. The four units of TSHD should not be deployed near each other to lessen the concentration of suspended sediments. The ideal deployment is that smaller-capacity TSHD should be deployed in the project area that are near the coast, while larger-capacity TSHD should be assigned far offshore. The larger the capacity, the higher it can generate suspended solids and deploying them in deeper waters lessen the concentration due to high mixing potential in those area.
3. The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels.
4. Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides.

In summary, while the TSS concentrations may exceed the DENR threshold limit as predicted by the model, the proposed mitigating measures and ideal operations recommended above are not included in the model simulations; therefore, the results could be interpreted as extreme instances wherein the silt curtains and other mitigating measures that will be put in place failed or become inadequate. Also, the model simulations consider continuous dredging operation of the four TSHD, 24/7 for 30 days. As there will always be idle days in the operation, the continuity of the transport and mixing of plumes generated by dredgers may not necessarily be correct. In effect, the actual areas affected by dredging operations may be lower than what is predicted by the model for various wind conditions and is therefore deemed conservative in terms of impact assessment.

6.1.1.3. During Abandonment Phase

The stirred-up sediments will eventually settle into the seabed at rates dependent on particle size and the prevailing currents. The local irregularity of the dredged slope will favor deposition of the sediments coming from the northeast and southwest. The passage of currents will cause the subsequent adjustment of the slope of the project area over time in accordance with the natural angle of repose of the sediment deposit.

6.1.1.4. Key Impacts and Mitigation Measures

Table 6-1 Impact Management for the Land

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
• **Dredging Phase** Local terrain modification, trenches will be generated on the project area as a result of sediment extraction; generation of sediment plumes and increase in turbidity of the marine waters within the project area.		X	X		• Planning of dredging operations via bathymetric surveys, current measurements and plume modeling • Monitoring of dredging operations and volume of extracted materials • Proper handling of dredged materials and transport to the reclamation area • Use of siltation traps to reduce the dispersal of sediments into the adjacent sections of Manila Bay • Water quality monitoring
• **Impact on Beaches and Tourism** Turbidity, while already high off the coast (see water quality) may be increased which may impact the use of beaches		X	X		• The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides.

6.1.2. Assessment of Water Impacts

6.1.2.1. During Pre-Dredging Phase

As provided in the Land Sector, Pre dredging activities entail the conduct of bathymetric surveys to determine the configuration of the shoal and drilling of exploratory holes to ascertain the nature and

properties of the various layers of sediments. These activities will translate to localized and minor disturbance in the seawater surrounding the area.

6.1.2.2. During the Dredging Phase

Underwater dredging activity is expected to release fine sediment materials into the water column. Suspended materials would be carried by the water flow. General wind-driven hydrodynamics of Manila Bay indicates a general north eastward direction of flow near the coast during Habagat (Villanoy and Martin, 1997). Backflow usually occur on the interior of the water column as water accumulates on the head of the bay. Surface flow in the middle of the Bay is generally less than the flow near the coasts.

Sediments in Manila Bay were found to be deficient to minimally enriched compared to shale rocks (Olivares, Sta. Maria, and Sobrito, 2019; Sy et al., 2017). Ecological impact of releasing heavy metal thus can be considered minimal except for filter feeders that concentrate the ions on their system. The mechanical impact of sediment on benthic lifeforms, however, may be more significant. The coastal area of Maragodon, the town adjacent to Ternate is known to have 19.2 hectares of coral reef (Cavite Ecological Profile, 2018). The reef is one of the few known reefs within Manila Bay. Coral cover in Maragondon Reef is 34% as of 2018. Sediments have the potential to smother corals when they settled on coral surfaces. Smaller particles which are suspended over longer periods can decrease light penetration within the water column and thus impacts photosynthetic processes. Coral bleaching had been known to be severe when anthropogenic factors such as sedimentation occurs in areas where temperature of water masses is higher than normal.

Re-suspension of materials into the water column also have the potential of organically enriching the water that may impact algal community that may result to algal blooms. Study done in zooplankton within the bay indicated strong correlation with nitrates and phosphates within the water column (Jose et al., 2015). With a general hydrodynamics of a north eastward flow, materials may also enrich waters in the bay heads where phytoplanktons are known to be in higher concentrations (Gatdula, et al., 2017).

Transport of dredged materials is also expected to increase boat traffic within the project site. The resulting dynamics may increase the probability of oil spills. Hydrocarbon spills can endanger marine organisms both benthic and pelagic by smothering, clogging gills, and toxicity reactions.

Excavation of materials from underwater may potentially affect the depth contour of the area. Water circulation from wind and tidal forcing are strongly influence by the topography of the bay and thus dredging can potentially impact hydrodynamic processes.

Potential oil and grease contamination in coastal waters especially in dock area and from actual spillages during dredging activities may also occur. Likewise, without proper training and supervision, Solid waste may be disposed off-vessel and wastewater from operators of dredging equipment and barge.

6.1.2.3. During the Abandonment Phase

It is expected that the resulting turbidity from the activities will eventually cease once dredging is completed.

6.1.2.4. Key Impacts and Mitigation Measures

Table 6-2 Impact Management for the Water Sector

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Threat to existence and/or loss of important local species Threat to abundance. Frequency and distribution Increase in Turbidity due to Resuspension of Sediments. Possibility of Effects on Maragondon corals		X	X		*No pre-operational and abandonment impact is expected from the Project.* • The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides. • An emergency plan should be in place in case of oil spills. Provisions on confinement bouys, absorptive materials and siphoning equipment should be on stand-by to address accidental spills. Careful dredging plan should also be laid out to minimally change depth contour of the area to allow the normal water circulation dynamics within the bay.

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
					• To address the potential ecosystem loss from possible smothering of corals on precious reefs of Maragondon, the proponent should invest on ecosystem enhancement projects. Hard materials within the coast of Ternate showed potentials of recruiting benthic organisms. Fishermen recounted deployment of fish aggregating devices and artificial reefs within Ternate waters but were not managed well. This possible project will also showcase that the impact of the project to the ecosystem is nil.
Increased Possibility of Oil Spills. Garbage Disposal to the sea		X	X		The dredging equipment should be regularly maintained to ensure that oil and grease leaks will be addressed prior to its actual deployment. Solid waste should not be directly disposed to the sea. Strict protocol on waste disposal should be implemented including provision disposal bins and regular collection right after the operation.

6.1.3. Assessment of Air Impacts

6.1.3.1. During the Pre-Dredging Phase

As provided in the Land Sector , Pre dredging activities entail the conduct of bathymetric surveys to determine the configuration of the shoal and drilling of exploratory holes to ascertain the nature and properties of the various layers of sediments. These activities will translate to localized and minor disturbance of the atmosphere with only small amounts of emissions from the ships

6.1.3.2. During the Dredging Phase

The likelihood of significant air emissions from the Project is low as the major dredging activities will be done off shore where the effects of land and sea breeze will easily dissipate any emissions from the ships

Potential sources of air emissions during the dredging phase of the Project include:

- Dust emissions from mechanical disturbance during the placement of dredged material once it is above the high water mark;
- Exhaust emissions from dredge vessels.

Dredge vessel exhaust emissions during construction have the potential to impact on air quality; impact is likely to be low due to the distance of the vessels from the shore, the effects of the breeze, and short-term period of construction. Dust emissions have the potential to affect health and amenity, however due to the short-term nature of construction, the limited amount of construction activity being undertaken above water and the distance from sensitive receptors, there is a very low likelihood of dust emissions impacting on either health or amenity.

Dredging equipment release emissions to the atmosphere depending on the use of the required power for the suction pipes and pumps for the materials. The average consumption of diesel fuel of these dredgers are at 0.36 pounds of diesel per horsepower-hour[1] or 0.219 kg /kw-hr. Emissions for diesel consumption are as follows:

Table 6-3 Kg of emissions per kg consumption of diesel

Substance	lbs/1000 gallons diesel	kg/l diesel	Density of diesel kg/l	kg/kg diesel
CO_2	22,543.43	13.12915	0.85	15.44606
CO	117.070765	0.068181	0.85	0.080213
NO_2	0.5661	0.00033	0.85	0.000388
SO_x	4.9956	0.002909	0.85	0.003423
PM-10	13.7727	0.008021	0.85	0.009437
VOC	11.282	0.006571	0.85	0.00773

[1] Anderson, Mark J. P.E., "Comparison of common dredging equipment air emissions ", Master's Thesis, Michigan Technological University, 2008. https://doi.org/10.37099/mtu.dc.etds/215

Table 6-4 Emissions per hour of the dredgers

No	Name	Hold Capacity (m^3)	Total Installed Power (kW)	TOTAL hours to full capacity	Diesel Consumption (kg/cycle)	CO2 (kg/hr)	CO (kg/hr)	NO2 (kg/hr)	SOx (kg/hr)	PM-10 (kg/hr)	VOC (kg/hr)
1	Tong Tu	20,000	22,320	40	195,507.19	75,495.40	392.06	1.90	16.73	46.12	37.78
2	Tong Cheng	18,000	20,290	39.27273	174,494.47	68,629.11	356.40	1.72	15.21	41.93	34.35
3	Tong Xu	13,000	20,280	31.2	138,557.84	68,595.29	356.22	1.72	15.20	41.91	34.33
4	Tong Yuan	10,000	15,457	31.57895	106,888.61	52,281.92	271.51	1.31	11.59	31.94	26.16
TOTAL						265,001.72	1,376.19	6.65	58.72	161.90	132.62

Table 6-5 Emissions per year of the dredgers considering 9 months operation per year

No	Name	CO (kg/month)	CO (kg/year)	NO2 (kg/month)	NO2 (kg/yr)	SOx (kg/month)	SOx (kg/yr)	PM-10 (kg/month)	PM-10 (kg/yr)	VOC (kg/month)	VOC (kg/yr)
1	Tong Tu	229,097.50	2,061,877.53	1,107.81	9,970.28	9,775.96	87,983.67	26,952.00	242,567.99	22,077.91	198,701.21
2	Tong Cheng	207,759.29	1,869,833.63	1,004.63	9,041.65	8,865.43	79,788.84	24,441.68	219,975.14	20,021.57	180,194.12
3	Tong Xu	200,772.22	1,806,949.94	970.84	8,737.57	8,567.28	77,105.49	23,619.69	212,577.23	19,348.23	174,134.07
4	Tong Yuan	153,321.22	1,379,890.94	741.39	6,672.51	6,542.47	58,882.19	18,037.36	162,336.21	14,775.42	132,978.80
TOTAL		790,950.23	7,118,552.04	3,824.67	34,422.02	33,751.13	303,760.20	93,050.73	837,456.57	76,223.13	686,008.19

6.1.3.3. During the Abandonment Phase

With the cessation of vessel activities, no more noise or air emissions will be released at or near the project site. The majority of the air emissions will come from the dust emissions at the reclamation site, which will be focus of the environmental management plan under the Waterfront Reclamation ECC.

6.1.3.4. Key Impacts and Mitigation Measures

Table 6-6 Impact Management for the Air Sector

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Greenhouse gas emissions and other air emissions Greenhouse gases may increase from the increase due to the operations of the dredging ships both while dredging and sailing to and from the reclamation		**X**	**X**		Sea breeze and land breezes will work to quickly dissipate emissions. Silverquest would adhere to the new International Maritime Organization's new 0.5% global marine fuel sulfur cap to limit sulfur dioxide emissions. SMRI to conduct tree planting
Dust emissions at the reclamation site Once the accumulated dredge materials rises above the high water mark at the Waterfront Reclamation			**X**		Constant watering of the exposed land; this is to be done by the Waterfront team since this is covered by a separate EIS

6.1.4. Assessment of People Impacts

6.1.4.1. During the Pre-Dredging Phase

Majority of the activities at the pre-dredging phase will focus on the dissemination of information about the proposed project through the EIA process; perception surveys (which has been completed), meetings, public scoping, and hearings.

6.1.4.2. During the Dredging Phase

The major impact of dredging will be the fishing industry, since the area will fall within the 15 kilometer stretch of municipal fisheries. Turbidity can impact the fish migration patterns and make it harder for fishermen to catch in the area. Likewise, the additional 4 dredgers sucking the sediments from the seabed at low speeds will impede on fishing traffic, and there may be risks of collisions between vessels. This can be remedied by provided fishermen with a manner of communicating with the dredge ships at all times and providing information to the local government of the dredging plans for a period so that fishermen may move to different areas to fish.

Beach tourism may also be affected by turbidity, although the waters are already more turbid than Class SB water classification allows. This may happen during relatively calm days when the sediment plume may reach the shore.

6.1.4.3. During the Abandonment Phase

After the slopes of the areas settle, the 60 million cubic meters removed from the area may mean deeper waters for fish to move to which can be a bane or a boon to fishermen depending on their fishing techniques and the species which they fish. Beaches will not experience turbidity anymore but the waters will still remain more turbid than Class SB waters allow.

6.1.4.4. Key Impacts and Mitigation Measures

Table 6-7 Impact Management for the Air Sector

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Reduced INCOME for Fishermen Increased prevalence of Turbidity may cause diminished fish catch for the residents who are fishermen or rely on selling fish for a living **Possibility of Vessel Collisions**		**X**	**X**		• Provide Livelihood opportunities • Provide a means of communication between fishermen and dredging ships to prevent collisions • Provide advance information to the LGU on areas to be dredged to protect fisheries and fish catch

Impact to Tourism due to Turbidity Increased turbidity may affect the tourism at beaches.		**X**	**X**		• Turbidity at the beaches to be monitored by locals and information quickly sent to the dredging team. • The four units of the Trailing Suction Hopper Dredger (TSHD) should not be deployed near each other to lessen the concentration of suspended sediments. • The dredging track of TSHD should be north-south and vice versa and as much as possible, should not run parallel to the coast as this area has shallower depths. Note that the deeper the water, the lesser the concentration of TSS. This is due to deeper water column that helps in minimizing the concentration levels. • Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides.

Table 6-8 Summary of Environmental Management Plan

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
PRE CONSTRUCTION PHASE						
Marine Ecology Survey for EIS, Bathymetric Survey	Limited and non destructive			SILVERQUEST and EIS contractor	P10million	Part of EIS and application for the Government Seabed Quarry Permit
CONSTRUCTION /OPERATION PHASE						
Extraction of sediments from the project area using trailing suction hopper dredgers	Dredging site area	Possible Archaeological site / shipwrecks and other marine historical artifacts	Consult maps of possible historical wrecks / do inspection prior to extraction and deposition	Already done during EIS and Bathymetric surveys	Included in pre-construction activities	ECC/ Contract between Silverquest and Dredging Contractor / Contractor environmental management plan
	Dredging site Seabed	Local terrain modification; generation of sediment plumes	Planning of dredging operations via bathymetric surveys, current measurements and plume modeling	Dredging Contractor/Silverquest	Part of dredging cost estimated at P15 Billion	ECC/ Contract between Silverquest and Dredging Contractor
			Monitoring of dredging operations and volume of extracted materials	Dredging Contractor/Silverquest		

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
			Proper handling of dredged materials and transport to the reclamation area	Dredging Contractor/Silverquest		
	Sea Water at Dredging Site	Wastewater generation aboard ships	Proper disposal of ship wastewaters upon docking	Dredging Contractor/Silverquest	Included in dredging cost	ECC / Requirement under current laws and regulations
		Sea Water turbidity and Silt dispersion	Use of silt curtain enclosure on the work area during dredging and filling operation	Dredging Contractor/Silverquest		ECC/ Contract between Silverquest and Dredging Contractor
			Periodic Water quality monitoring			
		Increased possibility of Spills from vessels due to increased traffic	Proper maintenance of ship engines	Dredging Contractor/Silverquest	Maintenance cost on the part of the dredging operator	ECC/ Contract between Silverquest and Dredging Contractor
			Audits of ship processes to ensure proper storage of oil and ballast		P150,000 per third party auditor	ECC/ Contract between Silverquest and Dredging Contractor
	AIR	Ship Emission, Particulate Matter, CO and Nox	Proper Maintenance of ship engines and pumps	Dredging Contractor/Silverquest	Maintenance cost on the part of the dredging operator	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
		Noise Generation	Operations are far from coastal areas and will generate minimal noise, night time operations will be done as far from shore as possible	Dredging Contractor/Silverquest	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
	PEOPLE: workers	Health and Safety Risk: Physical Hazards	Proper procedures followed onboard ships	Dredging Contractor/Silverquest	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
			Use of Personal Protective Equipment (PPE)	Dredging Contractor/Silverquest	P500,000 for the ship personnel / part of contractual obligations	ECC/ Contract between Silverquest and Dredging Contractor
			Implement a policy for periodic health checks	Dredging Contractor/Silverquest	P500,000 for the ship personnel / part of contractual obligations	ECC/ Contract between Silverquest and Dredging Contractor
		Risk of Dredging During Extreme Weather	Implement proper procedure for dredging during weather events; No dredging during typhoon signals	Dredging Contractor/Silverquest	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
	PEOPLE: Fishermen	Risk of Collision between vessels especially fishing vessels	Ensure communication between vessels, Promote public awareness of activities	Dredging Contractor/Silverquest	P50,000 to provide proper communications channel between municipal FARMC and dredge ships	ECC/ Contract between Silverquest and Dredging Contractor
		Impact of Turbidity on Fish Catches	Implement Social Development Plan; provide alternative livelihood for fishermen;	Silverquest	P250,000 to provide livelihood oppurtunities to fishermen	ECC
			smaller-capacity TSHD should be deployed in the project area that are near the coast, while larger-capacity TSHD should be assigned far offshore	Dredging Contractor/Silverques	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor
			Limit the dredging activities in project areas near the shore especially during periods of calm wind or during low tides	Dredging Contractor/Silverques	Included as part of dredging operations	ECC/ Contract between Silverquest and Dredging Contractor

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
	ECONOMY and PEOLE: LGUs	Generation of Employment	Priority will be given to the residents of Naic and Ternate for qualified residents	Silverquest	Included as part of dredging operations	ECC / SDMP
		Additional Revenue for the LGU	Pay the exact taxes and Quarry fees required by law on time	Silverquest	Php 50 M	National
			Participate in LGU's activities	Silverquest	Php 100k/year	ECC/SDP
		Employment Opportunities	Priority for qualified barangay residents	Silverquest	Included as part of dredging operations	ECC/SDP
		Health/Safety	Security in the dredging site to prevent collisions and other activities	Silverquest	NA	ECC
			Advance information on dredging sites to warn fishermen	Silverquest	Part of SDP	ECC/SDP
			Provision of communcation equipment to prevent disasters	Silverquest	P100,000 for communication equipment	ECC/SDP
ABANDONMENT PHASE						

Project Activities	Environmental Component likely to be affected	Potential Impact	Option for Prevention or Mitigation or Enhancement	Responsible Entity	Cost (Indicative)/ year	Guarantee/ Financial Arrangement
Completion of Dredging	PEOPLE	Reduction and eventual termination of employment	Promote alternative livelihood at early stage of project	Silverquest	P100,00 per quarter for livelihood	ECC/SDP
	Seabed	Stirred-up sediments will eventually settle into the seabed at rates dependent on particle size and the prevailing currents. The local irregularity of the dredged slope will favor deposition of the sediments coming from the northeast and southwest. The passage of currents will cause the subsequent adjustment of the slope of the project area over time in accordance with the natural angle of repose of the sediment deposit	Allow for natural attenuation of the seabed			

6.2. SOCIAL DEVELOPMENT FRAMEWORK

The social development plan framework (SDP), as shown in **Table 6-9**, seeks to address the issues, concerns under impacts and mitigating measures. It incorporates the proposed interventions of the project proponent in favor of the various stakeholders of the project. As part of its social responsibility, the proponent aims to empower stakeholders, especially the affected residents as partners of development. Foremost among these programs are community health and the amelioration of the livelihood of affected individuals of the dredging project, particularly the fishermen in the project area.

The actual SDP will be prepared as a collaborative undertaking between the municipalities of Naic and Ternate and the proponent Projects identified are the result of the consultations, development issues, discussions and interviews.

The framework seeks to establish the parameters in intervention to the host communities and to the various stakeholders. The social development plan framework is discussed in the following paragraphs to guide the proponent in the formulation of the SDP. These are the major features of the social development plan framework.

Proper mechanisms should be put in place to ensure that livelihood projects will continue to exist and be viable. It is an opportunity for the residents to pursue self-sustaining livelihood activities and be self-reliant in the future.

Coordination should be undertaken to identify the priority needs of the residents of the barangays affected, especially the fishermen. A mechanism should be put in place to ensure the timely payment of the taxes, fees, permits and licenses to the local government to ensure the timely provision of social services.

6.2.1. Safety Program

Foremost among the aims of the SDP is to provide a safe area for both the dredge ships and the fishermen to practice their livelihood. This would mean trainings and discussions with fishermen on the proper way of coordination during dredging operations, the use of proper communications equipment, and safety within the dredge areas. Fishermen will also be provided a means for communicating with the dredge ships if emergency situations occur.

6.2.2. Employment Generation

Because of the limited number of employees required aboard the dredge ships, which must be specialized according to the fleeting requirements, the need for employment may be minimal except as support staff on the ground for crews that are on shore leave while another crew takes over. However, SMRI commits to employing Cavite residents whenever feasible.

6.2.3. Health Program

SMRI will aim to support the coastal communities in Ternate and Naic which it in operates. It intends to improve the general health situation and nutrition among coastal residents in the municipality of Naic and Ternate. It can be done by enhancing the delivery of basic health and nutritional services to the communities thru LGUs. The SMRI project can affiliate its program with the LGU nutritional programs when available. Among other program includes medical and dental missions which may be

done together with the employees from the reclamation project. It will include monitoring the health conditions of the nearby communities through the existing RHU and /or barangay health stations as part of its social development program (SDP).

6.2.4. Livelihood Program

The SDP will surely enhance and complement the social development activities within the municipalities of Naic and Ternate, especially the fishermen who will be affected by the dredging activities. Since the dredging will run over a number of years, the SDP will support the programs of the municipality and the Manila Bay Coordinating Committee in providing alternative means of livelihood to the fishermen of the area.

6.2.5. Education and Spiritual Health

SMRI will provide assistance to both schools and churches in the area as part of its social development plan in coordination with its reclamation partner.

The summary of the SDP is presented as **Table 6-9**

Table 6-9 ***Silverquest Social Development Framework***

	CONCERN	Community Member / Beneficiary	Government Agency/ Non- government Agency and Services	PROPONENT	Indicative Timeline	Source of fund
	HEALTH					
1.	Medical missions and emergency relief programs	· Barangay Chairman · Barangay Kagawad for Health · Barangay Health Workers (BHWs) · Residents of affected barangays	Local Government Unit (LGU) · Naic and Ternate Health Office · Barangay Health Unit	City Health Office (CHO)/ Community Relations Officer (CRO)	Dredging Operations	Private Partner
2.	Medical assistance	· Barangay Chairman · Barangay Kagawad for Health · Barangay Health Workers (BHWs) · Residents of affected barangay	Local Government Unit (LGU) · Naic and Ternate Health Office · Barangay Health Unit	CHO / CRO	Dredging Operations	Private Partner
3.	Healthcare facilities and services	· Barangay Chairman · Barangay Kagawad for Health · Barangay Health Workers (BHWs) · Residents of affected barangay	Local Government Unit (LGU) · Naic and Ternate Health Office · Barangay Health Unit	CHO / CRO	Dredging Operations	Private Partner
	Safety					

	CONCERN	Community Member / Beneficiary	Government Agency/ Non- government Agency and Services	PROPONENT	Indicative Timeline	Source of fund
4.	Training of Fishermen with regards to the proper manner of communicating with the dredge ships and on safety while fishing along the dredging areas	MFARMC and Fishermen	Municipal Agriculture/ Fisheries Office	Safety Officer/ CRO	Dredging Operations	Silverquest
5.	Provision of communication Equipment to ensure communications between fishermen and dredge ships	MFARMC and Fishermen	Municipal Agriculture/ Fisheries Office	CRO	Dredging Operations	Silverquest
6.	Provision of advance information on dredging areas to the municipalities and barangays	· Municipal Mayor Barangay Chairman · MFAMRC and fishermen organization	Mayor's Office	CRO / PM	Dredging Operations	Silverquest
	EDUCATION					
7.	School facilities and services	· Barangay Kagawad for Education · Teacher and/or Principal	· DepEd · Barangay	Council member for Education/ / CRO	Dredging Operations	Private Partner
8.	Educational assistance	· Barangay Kagawad for Education · PTA · Qualified Students of Brgy 76 Zone 10	· Dep Ed · Barangay	Council member for education / CRO	Dredging Operations	Private Partner
	EMPLOYMENT AND LIVELIHOOD					

CONCERN		Community Member / Beneficiary	Government Agency/ Non- government Agency and Services	PROPONENT	Indicative Timeline	Source of fund
9.	financial and emergency relief assistance	· Fishermen affected by operations	· LGU · CSWD	Naic and Ternate	Dredging Operations	Private Partner
10	Livelihood programs	· Qualified Students of Brgy 76 Zone 10	· CPDO · City LGU · Barangays · TESDA	Naic and Ternate	Dredging Operations	Private Partner
	SPIRITUAL					
11	Assistance to the Church	· Representative from different religious groups	· Parish Priest · Religious Sector	CROs	Dredging Operations	Private Partner

6.3. INFORMATION, EDUCATION AND COMMUNICATION (IEC)

Information, Education and Communication (IEC) Program will guide the management of SMRI to effectively disseminate crucial information to advise the communities and concerned stakeholders about its plans for environmental protection and the health and safety of its fishermen and tourists. The IEC program will focus on the environmental management and monitoring plans, Social Development Plan and other project deliverables to benefit the communities. This will serve as the blueprint on how and when the participating entities would get the correct and educated information about the project and how they can contribute to the realization of the identified environmental plans and programs.

The IEC calls for transparency on the part of the company in dealing with the stakeholders on environmental issues which affect them. Community relations will be proactive and social development activities will be institutionalized.

Central to the IEC plan is what is already outlined in the SDP, a program to provide information to the fishermen where the dredge areas will be at a particular period to as to coordinate the fishing and dredging operations. Likewise, environmental awareness will also be a central topic; people will be empowered to report excessive turbidity at the beaches (coasts) to SMRI so that appropriate action can be undertaken.

Table 6-10 IEC Plan

Target sector for IEC	Major Topics	IEC strategy/Method	Information medium	Indicative timeline/frequency	Indicative cost
Municipality of Naic and Ternate fishermen	Communication procedures with Dredge Ships Safety During Dredging Operations Alternative livelihood opportunities	Seminars Workshop Discussion groups	Audio visual presentations handouts	Pre-Dredging and Dredging Phase	P50,000 initially then P100,000 for communication equipment
Municipality of Naic and Ternate	ECC compliance report Environmental monitoring of turbidity Monitoring statistics SDP compliance	Seminars/ workshops, meetings	Compliance/ monitoring reports Consultation meetings	Pre-Dredging and Dredging Phase	P25,000 initially then P10,000 per quarter
Barangay officials, RHUs, barangay health workers, truckers, senior citizens, women and youth sector, leaders of affected barangays	Planned/identified livelihood/environmental programs and other benefits derived from the project Issues and concerns and suggestions to address how	Focus group discussions Seminars/ workshops	Reports/ consultation meetings Focus group discussions	Pre-Dredging and Dredging Phase	P10.000/ meeting

	to smoothly pursue the implementation phase				

6.4. Emergency Response and Generic Guidelines

The environmental risk assessment (Section 5.0) includes the emergency response plans for specific events for SMRI. This portion provides details on the emergency response policy of proposed dredging operations.

6.4.1. Objectives

The primary objective of the policy provided here is to ensure the protection and preservation of life, property and environment in the event of disasters such as typhoons, earthquakes, volcanic eruptions, flashflood and man-made disasters such as land, air and sea disasters through the effective and efficient execution of the Emergency Response Plan (ERP). The emergency response plans for spill events and other operational and occupational accidents are provided in the ERA section 5.0.

The mandate of an ERP is to make use of the combined resources created or available at the site and/or off-site services to achieve the following:

- To minimize the detrimental effects of a disaster on people and property;
- Provide rescue services and medical treatment to affected people within and outside the periphery of the resort.
- Inform and collaborate with local emergency relief authorities;
- Initially contain and ultimately bring the disaster under control;
- Preserve relevant records and equipment for subsequent enquiry into the causes and circumstances leading to the disastrous happening;
- Investigate and take steps to prevent recurrence of similar incidents.
- The ERP therefore needs to be related to the identification of sources from which hazards can arise and the maximum loss scenario that can take place in the concerned area.

Emergency Response Policy

SMRI is committed to ensuring the health, safety and security of its personnel, ships and facilities, and surrounding environment through the prevention of accidents by eliminating or mitigating potential threats/hazards and anticipating other probable causes. Hence, SMRI shall adhere to the primary approach to emergency response–that is the prevention of circumstances that can create emergency conditions.

Each ship shall designate a safety officer, who will regularly conduct safety briefings and periodically conduct emergency response drills. The safety officer will supervise the daily safety performance of

operations and maintenance procedures. The safety officer will inspect the work and employee situation to ensure maintenance of and compliance to safety guidelines aboard each dredge ship

Aside from the occupational safety accidents, the area may be exposed to various geologic hazards such as ground shaking, surface rupturing, and typhoon.

The potential incidents and emergency situations that may be encountered during the future operation of the Project are presented in Table 6-11.

Table 6-11 Possible Emergency Scenarios other than occupational and operational scenarios

Type of emergency situation	Possible causes	Potential effects
Occupational safety accidents	Provided under the ERA (Section 5)	
Earthquakes	Movement/rupture of nearby fault lines Volcanic eruption	Failure of structures on land Tsunami
Tsunami	Movement/rupture of nearby fault lines Volcanic eruption Intense earth movement	• Failure of structures • Injuries and fatalities to personnel due to capsizing of boas
Flooding	• Complex weather condition	• Collapse of structures • Destruction of project facilities • Injuries and fatalities to personnel and communities
Storm surge	• Complex weather systems • Intense rainfall, wind and high tides	• Injuries and fatalities to personnel and communities

In order to reduce, if not eliminate, extreme emergency situations leading to loss of life and property, hereunder are the Project's initial safety guidelines which will be refined during project implementation.

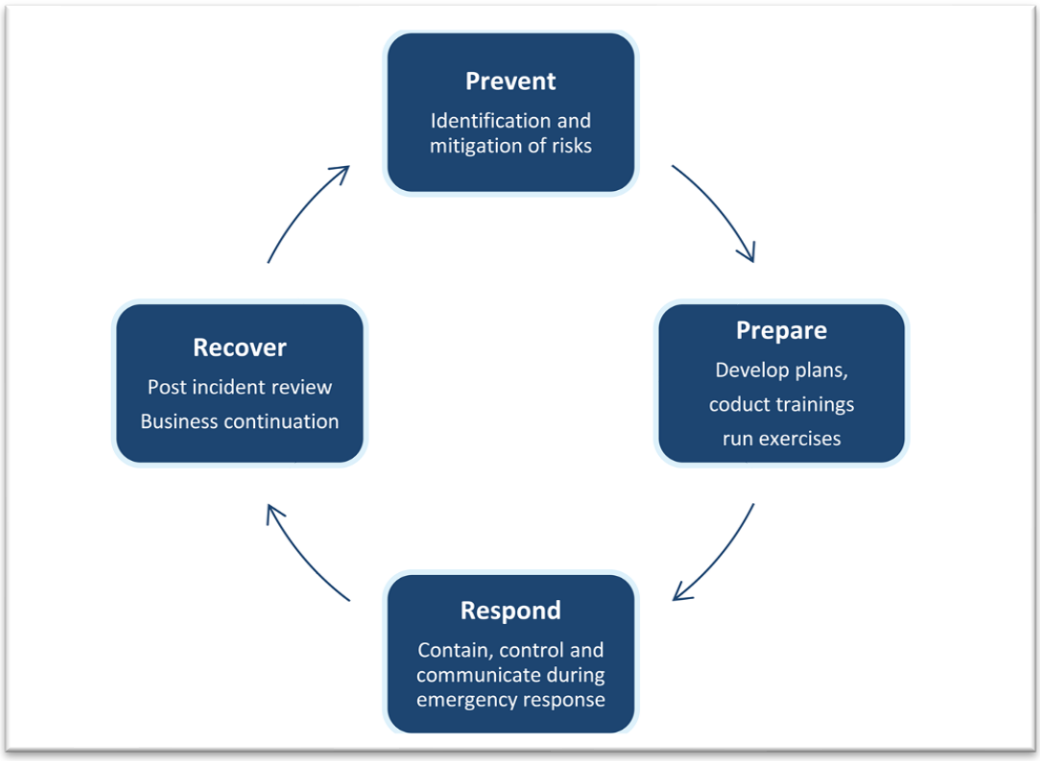
6.4.2. Emergency Plan

SMRI will adopt an Emergency Management Plan based on the recommended structure by the Philippine National Disaster Risk Reduction Management (NDRRMC) and Office of Civil Defense (OCD). The

management of emergencies can be outlined into four elements – Prevention, Preparedness, Response, Recovery.

Figure 6-6 illustrates the four elements

Figure 6-6 Elements of Emergency Management



6.4.3. Guidelines for the Prevention, Alleviation, or response to emergency situations

6.4.3.1. Safety

- All ship personnel, staff, and crew will undergo proper and complete training and regular safety meetings to understand and internalize the job/tasks assigned and the corresponding risks and hazards involved and the necessary safety procedures.
- All working personnel shall be required to wear appropriate personnel protective equipment.
- No work will be allowed under typhoon or extreme weather conditions.
- The Safety officer and its supervisors for each phase/work sector shall regularly check and monitor other personnel compliances with safety guidelines and plan.
- Applicable safety guidelines and procedures promulgated by relevant agencies such as the OHSC-DOLE, Philippine Coast Guard, and Marina hall be complied with accordingly.

6.4.3.2. Emergency procedure

In the event of an emergency, the SMRI officer or high ranking official on-site available, together with the Safety Officer and the rest of the Emergency Response Team (ERT), shall implement the Emergency Management Plan. The ranking official available on-site shall assume the role as an Incident Commander (IC). The IC will activate the ERT depending on the level and nature of emergency.

Table 6-12 Key Emergency Personnel

Emergency response personnel	Roles and responsibilities
Incident Commander	• Overall in-charge of operations during an emergency event • Provides direction and orders to the response team in managing the emergency • Informs supervisor/project manager about the incident
Supervisor	• Assists at site when necessary • Know the condition of people involved in the emergency, assess the situation, give instructions to First Aid Team in case necessary • Inform family/ies concerned, providing information of hospital location and other necessary details
Safety supervisors	• Supervises daily safety performance of operations and maintenance procedures, including emergency response procedures
Liaison officer	• Secures the necessary permits and training certification for the personnel
First aid team	• Performs the actual response, rescue and retrieval of personnel and equipment during an emergency event • Calls for ambulance or needed specialists to immediately assist case when necessary, or arrange for case forwarding to better equipped hospital, if needed equipment is not available in nearby hospital
Logistics team	• Provides the necessary supplies and equipment for the First aid team • Provides additional support/assistance to the First aid team

6.5. Abandonment /Decommissioning /Rehabilitation Policies and Generic Guidelines

General abandonment plan is not applicable to this project since at the cessation of dredging operations, the shoal will be allowed to naturally attenuate and reach a new balance with regards to its slopes and wave patterns.

6.6. Environmental Monitoring Plan

6.6.1. Self-Monitoring Plan

The Project Environmental Monitoring and Audit Prioritization Scheme (PEMAPS) is presented in Annex C. The implementation of the Dredging together with the Reclamation shall submit a modified Self-Monitoring Report (SMR) as part of the compliance monitoring system under DAO 2003-27 (Amending DAO 26, DAO 29 and DAO 2001- 89).

Silverquest Mining Resources, Inc. will monitor the dredging portion of the overall works and shall partner with the reclamation implanting arm, the Waterfront Manila Premier Development Inc. (WMPDI) for a consolidated monitoring of both the reclamation and dredging. Table 6-14 presents the EMoP for the dredging project. SMRI will commission third party testing firm to conduct monitoring activities. SMRI will submit Monitoring Report which includes detailed report on compliance to environmental standard specific to environmental laws to EMB Regional Office on a quarterly basis. SMIR will also submit a Compliance Monitoring Report (CMR) semi-annually to EMB CO. The Monitoring Report will include percentage exceedance to standard in terms of pollution and permit violations, if any.

The Multipartite Monitoring Team (MMT) and the SMR/CMR will validate project compliance per ECC Condition and Environmental Management Program, validate the conduct of monitoring; receive complaints, determine validity of complaints and monitor action taken by SMRI to address them. The inputs are reported in the Compliance Monitoring and Validation Report (CMVR) and submitted to EMB semi-annually.

6.6.2. Multi-Sectoral Monitoring Framework

The planned dredging qualifies as Environmental Critical Project (ECP) and necessitates the formation of Multipartite Monitoring Team (MMT). The municipal governments of NAic and Ternate are responsible for inviting stakeholders to the MMT. It actually encourages groups from the community to nominate their representatives. A general committee composed of these representatives will be established. **Table 6-13** shows the composition of the MMT.

Table 6-13 Possible Members of the MMT

Stakeholder Member	Basis of Selection	Proposed Roles
Municipal Council Environmental Committee	Per DAO No, 2017-15	Ensure adherence to policies and IRR of the MMT body When necessary refer items in conflict to EMB CO for resolution
Baraggay Health Officer	Same as above	Assist in monitoring and reporting Provide relevant inputs on the sector represented
Community Leader	Same as above	Participate in monitoring

Stakeholder Member	Basis of Selection	Proposed Roles
		Assist and sign MMT Report Provide MMT with related City Policies
Host Barangay	Same as above	Participate in monitoring Assist and sign MMT Report
Accredited NGO or PO (possibly the MFARMC)	Most vulnerable group Must be accredited in the muncipalities	Assist in monitoring and reporting Provide relevant inputs on the sector represented
Philippine Reclamation Authority	Authority for all reclamation projects	Ensure compliance with the internal guidelines of the PRA Ensure compliance with Agreements with PRA
Department of Tourism	Tourism enhancement	Ensure project aligned to Tourism Policy and Objectives
Philippine Coast Guard	In charge of safety aboard ships	Ensure compliance with rules of PCG relative to marine environment
Bureau of Fisheries and Aquatic Resources	Authority for the Aquatic Resources	Ensure compliance with the rules and policies for fisheries and Aquatic resources

6.6.3. Environmental Guarantee and Monitoring Fund Commitment

SMRI will commit and follow DAO 2010-21 and DAO 2000-25 pertaining the commonly called EGF. an Environmental Guarantee Fund of **Five Million Pesos (Php 5,000,000)** intended to address the quick rehabilitation of affected environment and initially compensate damage/s to properties adversely affected by dredging. SMRI will allocate Environmental Monitoring Funding for activities of the MMT and replenish the same when necessary.

SMRI will also provide Monitoring Trust Fund as described in Sec. 181 (a) of DAO 96-40. The amount is no less than One Hundred Thousand Pesos (Pl00,000.00).

An MRF will also be established and maintained by SMRI. This will ensure availability of funds for the satisfactory compliance with the commitments and performance of the activities stipulated in the EPEP/AEPEP.

The MRF shall be in two forms, namely:

- Monitoring Trust Fund (MTF). This Fund shall be initiated by the SMRI and shall be deposited in Government depository bank for the exclusive use in the monitoring program approved by the MRF Committee.
- Rehabilitation Cash Fund. SMIR shall set up a Rehabilitation Cash Fund (RCF) to ensure compliance with the approved rehabilitation activities and schedules, including research programs, as defined in the EPEP/AEPEP. The RCF is equivalent to ten percent (10%) of the total amount needed to implement the EPEP or about Five Million Pesos (PhP5,000,000.00).

At the end of the project life (dredging), a sufficient amount left from the EGF may be utilized to ensure that rehabilitation, restoration, decommissioning, or abandonment are adequately financed.

Table 6-14 Environmental Compliance Monitoring Plan

Key Environmental Aspects per Project Phase Activities	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location Note 1			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
I. PRE-CONSTRUCTION PHASE													
Potential disturbance of corals and marine ecology during the geotechnical survey of the seabed; mitigation is done by avoidance through appropriate selection of test sites. Impact is deemed not applicable though as pre-construction phase are essentially completed.													
II. CONSTRUCTION / OPERATION PHASE													
Dredging	A. Land	Solid Waste	Visual	Weekly	Onboard	Project Manager (PM)	Monitoring is through weekly visual count of garbage /containers picked up from the vessels by LGU Solid Waste Management Office.						
	B. Water	Total Suspended Solids (TSS)	Gravimetric (Dried at 103- 105◦ C) (USEPA method 3010)	Quarterly During Dredging works	Downstream of dredging site	Project Manager (PM)	Php 2000	>50 mg/L < 55 mg/L	>55 mg/L < 60 mg/L	>60 mg/L	Inspection of dredging & filling for corrective action, e.g. slow down dredging rate	Increase Silt traps, silt curtains, move closer to dredging	Temporary stoppage until issues resolved
		O & G	Std Method		At strategic points	PM	Php 1000	>2 mg/L < 2.5	>2.5 mg/L <2.5 mg/L	>2.5 mg/L			
		Arsenic	SDDC, Spectrophotometric		at/near dredge area	PM	Included in Php 50.000 est annual budget for heavy metals tests	>0.01 mg/L <0.015	>0.015 mg /L <0.02	>0.02 mg/L	Tighten performance of onboard OWS Slow down dredging/ & filling rates	area Zero discharge to sea of bilge water Increase surcharge volume	Same Same
		Chromium	Flame AAS			PM		>0.05 mg / L <0.06	>0.06 mg/L <0.075	>0.075 mg/L			
		Lead	Flame AAS			PM		>0.01 mg / L <0.015	>0.015 mg/L <0.02	>0.025 mg/L			
		Mercury	Manual Cold Vapor AAS			PM		>0.001 mg/L <0.0015	>0.0015 mg/L <0.002	>0.002 mg/L			

Key Environmental Aspects per Project Phase Activities	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location Note 1			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		Marine species	Underwater survey			PM	Php 200,000	10% decrease of significant Marine Species	15% decrease of significant Marine Species	20% decrease of significant Marine Species			
		Fecal Coliform	Coliform Count	Quarterly	Same as above	Project Manager	Php 10,000	>100 MPN/100 mL <200	>200 MPN/100 ML <500	.>500 MPN/ 100 mL	Tighten operation of onboard wastewater treatment	No discharge of bilge water to sea	Temporary stoppage until corrections made
		Quantity of fish resource	Ocular inspection Audit of incident	Accident-Worst case scenario only	scene of accident	Dredging Contractor	Part of dredging contract	Recorded Potential Accident / potential damage to fish lifts			PCG action and recommendations to be complied with in the absence of quantitative parameters		
	Safety	Implement safety guidelines	observation	Daily	Dredging and Reclamation Site	PM	Part of dredging contract	No injuries or deaths No regulatory framework for quantitative evaluation			Progressive restrictions as imposed by the PCG and other concerned agencies		Temporary stoppage of work until corrective actions complied with

6.7. Institutional Plan for EMP Implementation

This section presents the Institutional Plan for Silverquest Seabed Quarry Project that incorporates the activities in establishing the Environmental Management Unit (EMU), Safety Office, and the Community Relations Office (CRO), all of which are tasked to address the environmental, socio-economic, public health, and related issues on-site particularly those that are identified in other sections of this EIS. The EMU, CRO, and Safety Office are the key actors in this plan.

SMRI will establish a company-wide Safety, Health and Environmental Management Unit to be headed by a Pollution Control Officer / Mine Environmental Protection and Enhancement Officer. The PCO/MEPEO will directly supervise the Environmental Management Programs in all the activities of dredging. As a practice, the PCO/MEPEO will regularly attend, visit, and monitor the activities inside the facilities to ensure environmental compliance.

SMRI will set up the MEPEO responsible for establishing and implementing all related environmental programs. Its main duties are as follows:

- Plan, manage, and supervise/monitor the implementation of the environmental management programs and plans;
- Monitor and evaluate the effectiveness of the mitigating/enhancement measures;
- Monitor the compliance of contractors' implementation of the EPEP;
- Identify sources of pollution;
- Propose and implement additional environmental measures that are deemed necessary to more effectively protect the environment; and
- Coordinate with relevant oversight agencies including the local government units to ensure their effective participation in the implementation of the EPEP.

The MEPEP will be headed by the Environmental Manager. SMRI will conduct a monthly self-monitoring base on the program outlined previous chapters.

6.7.1.1. Community Relations Office (CRO)

The Community Relations Office (CRO) is responsible in maintaining the cordial relationship with host communities and to ensure that the dredging operation is acceptable. In cases where a disagreement or tension arises between SMRI and various stakeholders, CRO's responsibility is to resolve the conflict and present resolution beneficial to both management and stakeholders. The implementation of the Information, Education, and Communication (IEC) campaigns and Social Development and Management Program (SDMP) are part of the responsibilities of this office.

The functions of the CRO are:

- To maintain communication lines with the host communities and other groups;

- To implement and monitor Social Development Programs; and
- To implement Information, Education and Communication (IEC) Campaign.

6.7.1.2. Safety Office

The Safety Office ensures the safety and health program for the workers and the host communities are maintained. It is to be headed by the certified Safety Officer. The safety programs are designed to prevent accidents and occupational disease. The functions of the Safety Office are:

- Implement the safety rules and regulations to personnel, contractors and visitors;
- Promote occupational safety and health awareness among the employees;
- Ensure the compliance with occupational safety and health requirements of regulatory bodies;
- Update the hazard analysis and risk assessment and controls of all processes with significant impacts to the employees and the community; and
- Establish or Strengthen the Contingency Response Team responsible during emergencies within and around Ship facilities.

A safety committee will be established under the Safety Office and is tasked to conduct health and safety inspections, prepare and development accident management programs, conduct review of accidents reports among others.

SECTION 7.0 REFERENCES

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Contents

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SECTION 8.0 ANNEXES