ARCADIS Design & Consultancy for natural and built assets

ENVIRONMENTAL DUE DILIGENCE

Hanjin Shipyard – Philippines
Version 19 December 2019



IMPORTANT NOTES

1. Instructions were received from Acquiror on 11 October 2019 to carry out a Technical & Environmental Due Diligence Survey on Hanjin Shipyard located at Clarke. (herein “Project Agila”). This report summarizes our findings following our site inspection and documentation review.
2. This report is addressed to and may be relied upon by Acquiror use only. No reliance can be extended to other parties without our express written consent.
3. Arcadis has exercised reasonable skill and care in the production of this report, however, we cannot guarantee the success of the deal or the performance of or advice from other parties involved in the transaction.
4. The advice and comments contained within this report are based on reviews undertaken of information received to date and site visits attended. Our conclusions are based on and limited to the information provided at this point in the transaction. This is a point in time assessment, and it should be noted that any subsequent information or action that may arise after the issue of this report might impact on its conclusions.
5. Our inspection was limited to a non-intrusive visual survey only. review of design codes will be limited to a visual observation survey only with any immediately obvious compliance breaches being noted. The survey will be limited to a surface examination of accessible parts of the property. Therefore, no advice will be given, nor responsibility accepted, for the condition of such concealed areas. It should not be assumed that covered, unexposed or inaccessible areas are free from defects.
6. We will evaluate the general condition of readily accessible staircases, corridors, floors and doors. We will assess the interiors of representative rooms/units to evaluate the readily accessible elements. Upon access granted, we will evaluate the general condition of tenant space.
7. Specialist mobile equipment will not be investigated, for example; refrigeration equipment, lifting equipment, conveyors, industrial process equipment, manufacturing equipment, warehouse operational equipment and other significant port facilities equipment.
8. The Phase 1 Environmental Site Assessment specifically excludes any Unexploded Ordinance (UXO) survey, EHS compliance, surveying, building materials assessment, sampling or analyses of soil, groundwater, surface water, air or hazardous building materials, qualitative or quantitative risk assessments, identification or assessment of any geotechnical considerations, identification of costs for physical investigation, mitigation or remediation of any identified environment issues or the completion of a chain of title review.
9. Arcadis will not comment in detail with regard to the risk of the site from flooding and recommend reference to risk is made within a specialist report by others.
10. Low frequency electronic field, electro-magnetic radiation, toxic mold or similar currently controversial environmental issues will not normally be commented upon within the report unless otherwise stated.
11. No searches will be made of statutory bodies to establish whether the property may be affected by subsidence as a result of mining or tunneling operations. Unless otherwise stated, tunneling, mining, geological and soil investigation reports are not undertaken or inspected. We are therefore unable to certify that any land is capable of development or redevelopment at a reasonable cost.
12. The purpose of the ESA Phase I is to identify current or historical environmental conditions associated with the property only.
12. The costs provided within the report are subject to the following conditions:
    - Arcadis will attempt to identify and estimate the cost necessary to correct immediate repairs, deferred maintenance, and capital improvement needs of individual items (to a forward expenditure profile no longer than 10 years) at the subject site with a value of USD 20,000 or more in a given year.
    - Costings related to essential repairs and maintenance and replacement necessary for the buildings short to medium-term integrity and weatherproofing are included. Minor day-to-day cleaning, repair, testing and routine maintenance are excluded.
    - Costings are intended for overall budgeting purposes only and are not based on detailed quantities and specifications. The actual cost of each item or element may vary depending upon the standard and quality of specification, type and size of contractor employed and method of procurement.
    - Costing are inclusive of contractor’s preliminaries but exclude contingencies, value-added and sales tax, professional and statutory authority fees and are based on the works being carried out during normal working hours without any abnormal restrictions being imposed in regard to programme and sequence.
    - Costings are based on works being undertaken as a package by traditional arrangement of employing a main contractor to manage and oversee the same. Should works be done in isolation under a planned preventive maintenance regime by employing a term maintenance contractor, the costs may be higher.
    - Costing are based on current estimates are not uplifted to account for inflation. Major items or elements likely to require replacing beyond 10 years (or the agreed forward expenditure profile) are generally excluded as costs cannot be accurately forecasted and will be affected by changing circumstances, legislation and technology. An indication of costs based on current functional criteria may be provided in the Executive Summary for major repairs / replacement within the next 10 years for guidance purposes only.
    - M&E Costs include those items requiring immediate attention. Further replacement and major elements beyond 10 years are excluded. Where ‘standalone’ budget figures are provided, they are for guidance only.
    - Costings will not include for the affects of any disruption, disturbance or economic loss that the works may have on the occupiers’ business.
13. Arcadis is entitled to reply upon all information supplied and consider it to be accurate.
14. We have allowed for undertaking a high-level review of key documents provided. We will strive to review documentation related to the original construction, subsequent alteration, maintenance, repair and replacement of major property parts, components or systems, if made available. Arcadis will not assess design documents to verify adequacy of the structure, fabric or services of the buildings, nor will we review design calculations. A full structural inspection can be arranged at an additional cost.
15. We have not allowed for undertaking site measurements within our fee quote. In addition, any cost information provided, or valuations requested will have been prepared using ‘average’ construction prices for the types of construction. As such it does not take account of difference in floor to wall ratios, specific services installation s and fitting out etc. that would be automatically allowed for if we prepared a detailed estimate for the reinstatement value.
16. Arcadis’ report is confidential to the party whom it is addressed, and it is intended for the use of that party only. No responsibility can be accepted to any other party in respect of the report contents in whole or in part. Before the report or any of it is reproduced or referred to in any document, circular or statement, Arcadis’ written approval as to the forma and content must first be obtained. With reference to the Contracts (Rights of Third Parties) Act, for the avoidance of doubt, nothing in these conditions shall confirm or purport to confer on any third party, the benefit or the right to enforce any term of this agreement.
17. Formal site inspections were undertaken on 15th to 17th October 2019.

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1. Executive summary

Executive summary

Scope of the audit

For a potential acquisition of the HHIC shipyard in the Philippines, Arcadis performed an Environmental Due Diligence (EDD) including a desktop natural disaster risk assessment to support investor decision making.

Regulatory Setting

Arcadis performed the EDD according to topics included in the ASTM standards E 1527-13 for Phase 1 Environmental Site Assessments, thereby including a review on the IFC Performance Standards and World Bank EHS Guidelines for as far as practicable considering the non-operational nature of the site and the available information.

Audit and Site investigation procedure

The EDD included a 3-day site visit for visual inspection of the different assets, interviews with available site personnel and afterwards an extensive documentation review on provided reports/records and publicly available information.

Findings and Concerns

Considering the Philippines is maintaining a strict regime of tracking environmental performance, the site was able to show relevant permits and monitoring records, that are reviewed by the relevant Philippine government authorities on compliance to specified limits. Considering permits and monitoring data reviewed, it is anticipated that from a regulatory perspective the shipyard is compliant to the Philippine regulations.

The following slide will go into more details on the observed risks and corrective actions to be taken. In summary, one high risk was identified, and some items require rectification to reduce some of the medium/moderate risks. Arcadis recommends the following to further reduce further Environmental liability. Measures are assigned TDD or EDD label, referring to either a technical revision or an environmental revision:

Area of Concern	Risk Type	Rating	Corrective Action	Cost
5.2 Permits, Fines, and Previous Convictions	**Permits and Monitoring**	Low	Ensure all permits are present and environmental monitoring is continued on a quarterly basis, sending monitoring results to the appropriate authority for compliance checking. Permits should be renewed if currently not valid and schedule accordingly for other permits losing validity.	Tenant operational expenses
5.3 Natural disaster risk	**Potentially unstable slope behind waste storage**	Medium	Ensure slope protection for mountain west of the waste storage area (quay 7) to reduce the chance of landslides affecting the area and endangering personnel working there.	$ 80,000
	Storm surge risk	Medium	Develop an emergency evacuation procedure in case of typhoons and storm surges, to avoid material damage and ensure safety of personnel working on site. This includes shipping safety due to an increase in sea level and wave height.	$ 50,000
	Typhoons and earthquakes	Medium	Upgrade site assets to the latest Philippine building code to minimize the risk of typhoons and earthquakes causing significant asset damage.	$ 15,117,690
	On site flood risk	Medium	Ensure maintenance and cleaning of all drainage channels of the complete site, to assure water on the site will be drained in extreme precipitation or storm surge events.	Part of upgrade to Philippine building code
	Asset flood damage	Medium	Improve resiliency of the dockyard's lowest lying areas, by protecting vulnerable assets considering potential floods in case of storm surges (like substations and electrical facilities).	Part of upgrade to Philippine building code
5.8 Materials handling & storage	**Hazardous materials management**	Medium	Provide secondary containment pallets for all storage areas of hazardous materials, considering the chemical/paint storage and maintenance workshop and hazardous waste storage.	$ 100,000
	Spill prevention	Medium	Provide spill kits to locations where a potential spill might reach the stormwater drainage (e.g. gasoline station, open paint/chemical storage, waste storage).	$ 30,000
	Soil/groundwater contamination	Medium	Although the site is fully concreted, spill prevention procedures are in place and no previous spills were reported, the site does host industrial processes like painting, galvanizing, pre-treatment and a gasoline station with UST. Considering these items it is recommended to assess soil and groundwater quality if the site would be decommissioned or repurposed in the future. After consideration of the required areas to be assessed, these cost could range approximately between $ 25,000 and $ 400,000 USD.	TBD
	Inappropriate ventilation/fire hazard	Medium	Improve ventilation of closed chemical/paint storage area (building 72) and the storage areas near the piping pre-treatment and paint shop (building 79) and install explosion proof lighting in these area.	$ 67,900
5.9 Deleterious materials	**Ozone depleting substances**	Low	Replace AC unites with R22 refrigerant between 2020-2030, to comply to Philippines standards relating to the phasing out of R22 refrigerant.	$ 489,000
5.10 Fire Fighting Equipment	**Fire safety**	High	Improve fire suppression systems and fire alarms in the guest house, blasting & painting shop B, main office, blasting & painting shop C, blasting & painting shop D, Catering Center and Painting shop/Piping shelter.	$ 2,399,100

2. Scope of the Audit

2.1 Purpose of the due diligence

As part of the acquisition of the Hanjin shipyard in the Philippines, Acquiror would like to understand whether any environmental, health and safety risks might be present at the site and ensure that these risks are mitigated as part of the acquisition process or understood from both a technical and financial perspective. This gives Acquiror the opportunity to act on any known deficiencies that could potentially harm the environment or the people living in it and act on it accordingly.

For the above reasons, Acquiror and the lender OPIC require the due diligence to be done in accordance with ASTM, IFC PS and World Bank EHS Guidelines for as far as practicable. The following slide will go into more detail on those frameworks and how they relate to the overall scope of the due diligence.

2.2.1 Scope of the diligence

The due diligence was performed in general accordance with the major topics as specified and applicable to American Society for Testing and Materials (ASTM) E 1527-13 Standard Practice for Site Assessments: Phase I Environmental Site Assessment Process. Besides the Phase I ESA, a natural disaster risk assessment based on available information was performed. Please note that the Phase 1 ESA is not used as a formal assessment on lead-based paints and the analysis of Asbestos Containing Materials. This will be purely done on observations only.

Additionally and for as far relevant, the due diligence included aspects from major topics in the IFC Performance Standards and the World Bank EHS Guidelines for Ports and Harbors. Please note that the site is currently non-operational, therefore any operations related aspects have been included in **Annex G** of the report, focusing on any requirements that can be put forward for the future tenant of the shipyard. Through this way, the due diligence tries to include as many topics of the IFC PS and World Bank EHS Guidelines as possible.

Arcadis reviewed available documentation to assess potential environmental risks and create an understanding of site functioning. All documents that have been received and reviewed are included in the **Annex H** of this report.

Next to the documentation review, Arcadis has interviewed site personnel during a 3-day site visit. Personnel interviewed was part of the team that is responsible for site maintenance. The team has answered Arcadis' questions as much as possible but were not always able to answer specific questions related to the previous shipyard processes. A map of the complete site and buildings has been included in **Annex C** including proposed restoration measures.

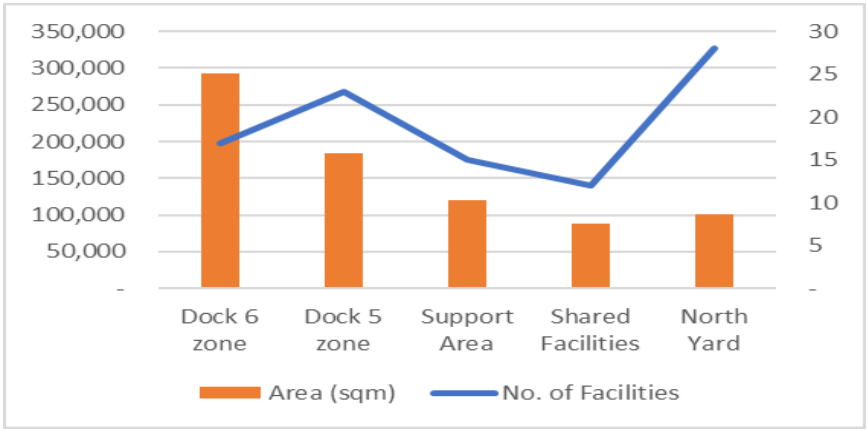
For the Environmental Due Diligence (EDD) Arcadis visited the site (see **Annex B**) over a 3-day period (15 – 17 October 2019), focusing on a visual inspection and assessment of current site conditions, noting any recognizable environmental conditions (RECs). The site visit focused on:

- Areas of dead, distressed or dying vegetation, if vegetated
- Seeps
- Oil slicks or discoloration on surface soils
- Discernible chemical odours
- Hazardous substances and hazardous substance containers
- Solid or liquid waste disposal or storage areas
- Recent soil disturbances such as grading or filling, etc.
- Presence of equipment potentially containing Polychlorinated Biphenyls (PCBs), their status and condition
- Wastewater discharges and outfalls
- Presence, condition and history of any underground or aboveground storage tanks
- Waste disposal and waste disposal practices
- Presence and use of pits, sumps and floor drains
- Presence of wetlands, standing water and/or saturated soil conditions

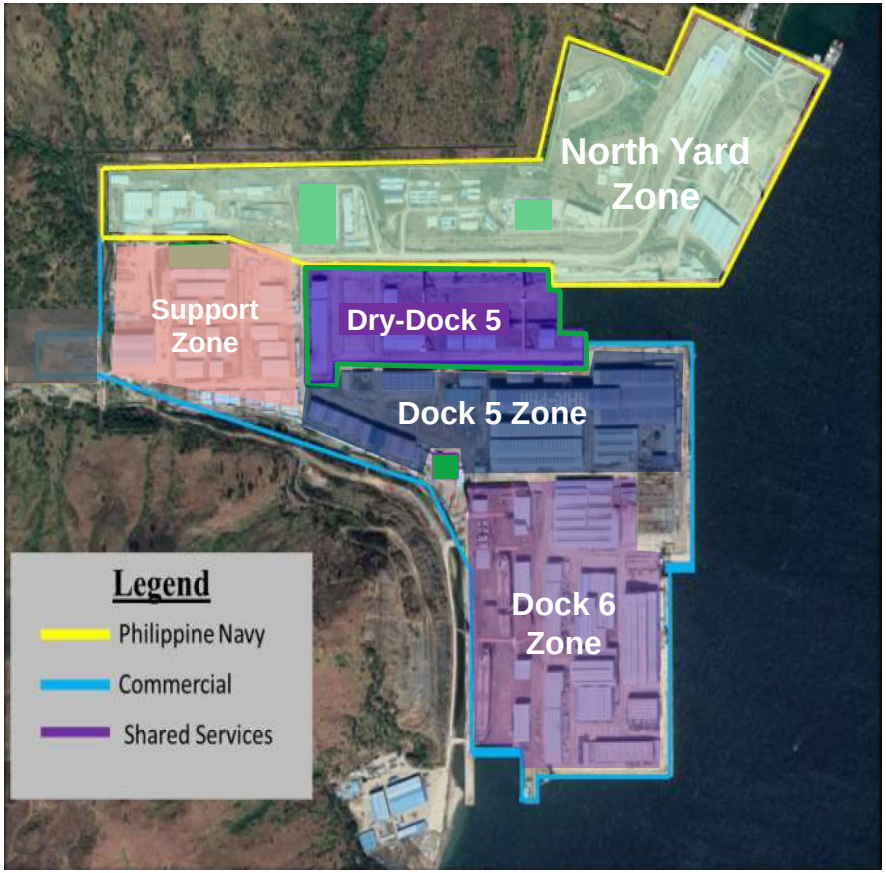
2.2.2 Technical Due Diligence Overview

Portfolio Overview

Zone	Building Description	No. of Facilities	Area (sqm)
Dock 6 zone	Hull Shop A, Sub/Assembly Shop B, Assembly Shop A, Pre-erection area, pre-outting shop, blasting & painting	17	291,988
Dock 5 zone	Panel shop, Hull Shop B, Assembly Shop C, Welding/cutting shop, Pre-erection area, blasting & painting	23	184,293
Support Area	D/House, T-BHD Shelter, Hatch cover shelter	15	120,960
Shared Facilities	*Commercial*: Dry-Dock 5, Sewage Plant, Gas Station, Water Treatment Plant, *North Yard*: Power Station, Catering Center	12	88,642
North Yard	Main office, helipad & building, barrack, Blasting & Painting Shop E, Assemby Shop D, Small Plate Fabrication shop	28	100,936
	Total number of facilities	**95**	**786,819**



Shipyard Zoning



2.2.3 Building Condition Overview

Highlight

- Lack of documentation associated with historic capex, replacement works that were carried out, structural inspection reports, services contracts and maintenance records.
- Building condition of the shelters at Docks 5 & 6 are generally in good condition and capex in short term is unlikely save for minor rusting condition which could be addressed as part of the routine maintenance.
- Lack of active fire protection measures at the docks' shelters (currently protected by fire extinguishers only) especially in buildings where combustible gases are used around ignition sources such as welding, hot-cutting, etc. Gas ports are also located in close proximity to the high voltage electrical panels. Capex amounts are allowed for installation of appropriate fire protection systems as well as the relocation of the panels. Review of work heath and safety policy for hazardous areas is also recommended as part of operation after the incoming investor takes over the premises and confirms the final use of buildings.
- There are a small number of buildings with a deteriorated condition, which require replacement immediately or in the short term; namely piping pre-treatment building (with galvanizing activity) and the hospital.
- The local government requires an engineering design review to be carried out in ensuring buildings of 15 years and above comply with the latest design code which are more stringent in design requirements to withstand natural catastrophes. This update of code would be applicable on this premises by 2021 and likely to overspill to 2022. Therefore, we recommend that the client consider these potential expenses as part of commercial negotiation.
- The vendor is still undertaking repair works to the roofs of some of the shelters, which have suffered damage from the catastrophes last July. Repair works at the guest house are also needed to rectify damages caused by the catastrophes, which at present has not commenced yet.
- The acquiror will need to consider the fit for purpose to the new use of the buildings prior to carrying out any major renovation works considered in this study.

Snapshot on Findings

- From our visual inspection, majority of the buildings are in a reasonable condition and are grouped under green risk category. This represents circa 73% based on total number of facilities. Based on the total area of the portfolio, it represents circa 55% by area.
- The red risk buildings represent circa 8% by number of facilities and by area.
- Site wide ancillary works such as roads, pavements, drainage and associated hardscape works were in serviceable condition, save for issues of wear and tear which are not uncommon in industrial assets.

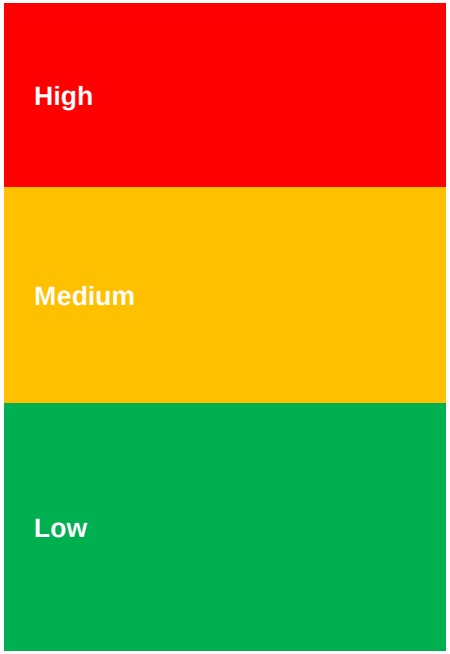
Zoning	Building Condition Risk Assessment		
	Green	Amber	Red
Dock 5 zone	17	-	6
Dock 6 zone	9	-	8
Support Area	10	-	5
Shared Facilities	9	1	2
North Yard	22	1	5
Total number of facilities	**67**	**2**	**26**

Zoning	Building Condition Risk Assessment (sqm)		
	Green	Amber	Red
Dock 5 zone	60,167	-	124,126
Dock 6 zone	172,901	-	119,088
Support Area	26,892	-	94,068
Shared Facilities	63,456	5,100	20,086
North Yard	58,936	19,500	22,500
Total area	**382,351**	**24,600**	**379,868**

2.3 Environmental Due Diligence (EDD) Risk Rating

The table to the right details the risk ratings as applied by this EDD report. Risk ratings are based on a qualitative review on likelihood and severity of the risk actually manifesting.

The ability to mitigate a risk is also include, where measures are implementable that will minimize the likelihood of occurring or significantly reduce the severity of a potential risk.



An issue that may fundamentally impact site functioning and requires significant investment to resolve.

An issue of concern that should be addressed as part of the commercial negotiations and has a substantial investment requirement.

An issue that should not adversely impact on the commercial arrangements of the deal or could be solved with fairly limited investment and easy rectifications.

Please note that the above risk classification is different than the one used in the CAPEX/OPEX table, as some of the risks might be important to consider, but are not as costly as the assessment criteria of the CAPEX/OPEX. Therefore, Arcadis decided to add an alternative risk assessment classification for the EDD.

3. Regulatory Setting

3.1 Introduction to Regulatory setting

The due diligence includes a review of requirements that are set forward as part of both national and international standards. Considering both types of standards, the relevant topics and requirements have been reviewed for as far as practicable in the context of a non-operational shipyard. Any operational requirements that are applicable to the future operations of the shipyard have been included in **Annex G** concerning the gap assessment to IFC PS and World Bank EHS Guidelines. Please also note that many applicable requirements related to labour and working conditions and other social related aspects could not be assessed, due to the non-operational nature of the project. The below frameworks are considered for as far practicable:

- Philippine regulations (see table 3.1 on next slide)
- The IFC's 2012 Performance Standards;
- The World Bank EHS General Guidelines;
- The World Bank EHS Guidelines for Ports, Harbors, and Terminals.

Table 3.1 - Regulatory Framework

Regulation/Act	Description	Applicability
REPUBLIC ACT 9275 PHILIPPINE CLEAN WATER ACT OF 2004	The law aims to protect the country's water bodies from pollution from land-based sources (industries and commercial establishments, agriculture and community/household activities).	As the shipyard discharges water into waterbodies, this act is applicable to the quality of that water.
REPUBLIC ACT 8749 PHILIPPINE CLEAN AIR ACT OF 1999	The law aims to achieve and maintain clean air that meets the National Air Quality guideline values for criteria pollutants, throughout the Philippines, while minimizing the possible associated impacts to the economy.	The shipyard has several generator sets, dust collectors and scrubbers that emit air that should stay within the specified limits.
REPUBLIC ACT 9003 ECOLOGICAL SOLID WASTE MANAGEMENT ACT OF 2000	In partnership with stakeholders, the law aims to adopt a systematic, comprehensive and ecological solid waste management program that shall ensure the protection of public health and environment. The law ensures proper segregation, collection, storage, treatment and disposal of solid waste through the formulation and adaptation of best eco-waste products.	The shipyard produces solid waste that will have to be managed appropriately according to this act.
REPUBLIC ACT 6969 TOXIC SUBSTANCES, HAZARDOUS AND NUCLEAR WASTE CONTROL ACT OF 1990	The law aims to regulate restrict or prohibit the importation, manufacture, processing, sale, distribution, use and disposal of chemical substances and mixtures the present unreasonable risk to human health. It likewise prohibits the entry, even in transit, of hazardous and nuclear wastes and their disposal into the Philippine territorial limits for whatever purpose; and to provide advancement and facilitate research and studies on toxic chemicals.	The shipyard produces hazardous waste. Hazardous waste produced on site will have to be managed according to this act.
PRESIDENTIAL DECREE 1586 ENVIRONMENTAL IMPACT STATEMENT (EIS) STATEMENT OF 1978	The Environment Impact Assessment System was formally established in 1978 with the enactment of Presidential Decree no. 1586 to facilitate the attainment and maintenance of rational and orderly balance between socio-economic development and environmental protection. EIA is a planning and management tool that will help government, decision makers, the proponents and the affected community address the negative consequences or risks on the environment. The process assures implementation of environment-friendly projects.	The shipyard should have an approved EIA in place before construction started.

4. Audit and Site Investigation Procedure

Audit and Site Investigation Procedure

4.1 Site Visit

Arcadis travelled to the site for a 3-day site investigation of the shipyard. During the site visit, Arcadis was welcomed by the site team currently continuing work on the maintenance of the shipyard's remaining facilities. Arcadis received a general introduction into the Hanjin Shipyard and commenced the first day with a meeting, including several site personnel, amongst which the General Manager and site staff with knowledge on waste water treatment, waste storage, environmental monitoring and general shipyard assembly processes.

The group of Arcadis consultants was split in 2-groups, which were supported by transportation of the Hanjin site, visiting different areas of the site, to accommodate the complete site visit within the specified 3-day period.

All areas were made readily accessible for Arcadis personnel and site staff was overall very supportive of providing access to the different areas. Arcadis personnel was able to visit all necessary areas and was able to visually inspect the major areas of potential environmental concern, including the sewage treatment plant, chemical/hazardous materials storage, gasoline station, any Aboveground Storage Tanks (ASTs) and the location of the Underground Storage Tank (UST), locations of transformers, waste storage and the significant potential contaminating processes like galvanizing, pre-treatment, painting and blasting.

4.2 Documentation review

Arcadis provided a long list with documentation necessary to be obtained for the EDD (both technical and environmental) on multiple occasions, Arcadis has requested additional information, when information was not provided accordingly. The eventual list of obtained documentation and missing information has been included in **Annex H**.

Besides the documentation provided by site personnel, Arcadis made sure to access any publicly available information that could support the assessment, mainly revolving around the search for previous convictions, the EIA process, natural disaster risk assessments and specifics to the regional/local physical environment.

Please note that the due diligence has been based on site visit observations, documentation made available by the current tenant and publicly available documentation. If documentation was absent or not received and site personnel was not able to answer certain queries, Arcadis has done their best to provide solid recommendations on the information at hand.

5. Findings and Areas of Concern

5.1 Background information

5.1.1 Historic land use



Satellite imagery only dates to April 2005 as shown above. Before 1997 the land was part of a small village called Sito Agusuhin with 355 households of which many were fishermen or holders of small farms (fruit trees and rice paddies) and fishponds. The village had a school, church, sports facility and more.

From 1998 onwards the site was developed into a casting basin, as Shell started to construct a Concrete Gravity Structure (CGS) at the site (the concrete base for a production platform), which was intended to be deployed in the waters near Palawan for oil exploration. The site was reported to have their own concrete production facility that was used to supply concrete for the CGS. Eventually, the CGS go towed out of the facility, towards Palawan in May 2000. After the site closed, Shell was reported to have restored part of the lands and developed some infrastructural facilities for the villagers, amongst which a school.

After Shell moved from the location, a comprehensive EIA (**Annex I**) was performed in preparation for the Hanjin Shipyard. This EIA included detailed environmental and social assessments of the region, including soil and groundwater studies. No contamination was found, hence the risk of contamination due to previous land use is considered **low**.

Map of December 2009, the year of construction completion



Map of October 2013, some additional buildings (piping manufacturing) in North-western part of site



Map of February 2017, waste storage area developed (south) and building at northern quay (assembly shop, blasting & painting shop)



5.1.2 Topography



The site lies on a slightly inclined hill towards the west. The dockyards are predominantly situated around 3.5m above mean sea level (AMSL), where the western most edges of the site are lying around 36m AMSL. On the North of the site Mount Redondo is situated at 611m and at the south a hill at around 220m. The site is cupped in between mountains, directing any pluvial water towards the shipyard.

5.1.3 Geology and Hydrogeology

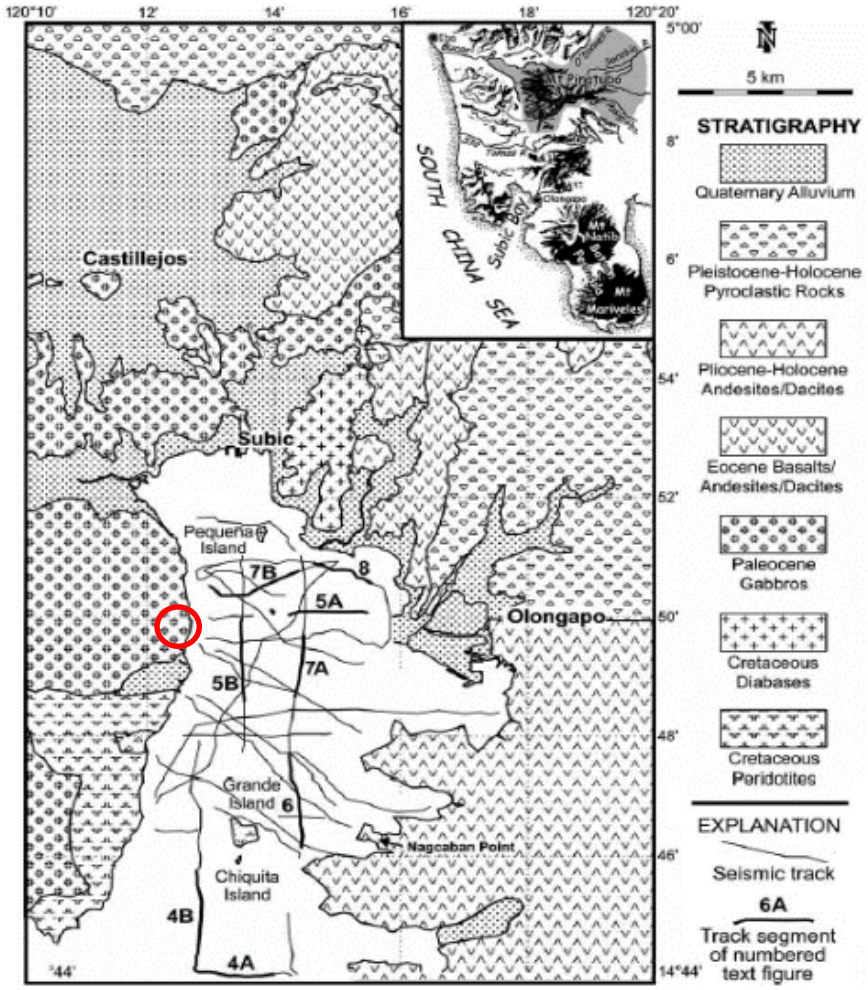
The shipyard is located on a geological bedrock layer consisting mainly of the **Paleocene gabbros**, which is a dense rock like formation which is usually part of the oceanic crust. On top of this bedrock layer lies an alluvial fan of roughly 1.8km long and 1km wide, as specified in the EIA for the shipyard. Thickness of the alluvial deposits range form 3.5m to more than 44m.

The Agusuhin Catchment that lies in the area of the shipyard is approximately 13,934 km2, which is a fan shaped basin of about 6m long and 4.7km at its widest breadth. The drainage of this basin runs towards the Subic bay following the Agusuhin river and North Agusuhin Creek.

The wells as drilled for the EIA baseline study showed that saltwater intrusion ranged from areas within 50m from the shoreline.

The upper aquifer is mainly alluvium/beach deposits with a thickness of 4 – 10m. Water level was approximately at mean sea level.

Lower aquifer has a clayey/gravel consistency and a thickness of 3.5 – 22m. Water in this aquifer was predominantly fresh.



5.1.4 Environmental Impact Assessment (EIA)

For the development of the Hanjin Shipyard, an EIA was drafted by Kultura at Kalikasan Consultancy Services, which started in August 2005 and the final revised version was delivered in November 2005. Although reasonable efforts have been made to assess many different environmental and social aspects, this EIA was performed at a time when the full blown IFC PS of 2012 were clearly not yet existent. The EIA was performed according to Philippine standards at that time for EIA and eventually received the Environmental Compliance Certificate (ECC) of the Philippine Government, which should mark compliance to local standards. The EIA has been included in Annex I, which also shows the Environmental Management and Monitoring Plan applicable to the shipyard.

Environmental

Throughout September and November, primary and secondary data was collected through sampling and surveys focusing on baseline data for environmental aspects of air, noise, soil, water, sediment quality, terrestrial ecology, hydrodynamic modelling, freshwater- and marine ecology. Overall the study seems the be performed thoroughly on the above-mentioned subjects considering the available techniques at that moment in time and in the Philippines.

Social

Thereby, an extensive social survey was performed focusing on one village in the proposed construction area (Sitio Agusuhin) and 2 villages in the area of influence of the project (Sitio Nagyantok and Sitio Nagtulong). In total 417 respondents have attended focus group discussions and responded to questionnaires. Of these respondents 355 (100%) were from the village to be resettled (Sitio Agushin). 42% of the villagers agreed to be resettled, whilst 8.5% disagreed and 28.5% was note sure yet whether they wanted to be resettled.

Eventually resettlement of Sitio Agusuhin was performed. HHIC was made responsible for the cost of resettlement (including the resettlement site, basic services and replacement of community structures as specified in the EIA) and compensation of the villagers that were displaced, where the Subic Bay Marine Authority (SBMA) was made responsible for handling the resettlement and payments of the villagers, having to deliver an empty plot to HHIC.

It is unclear how much compensation was given to the villagers, but the EIA is focusing a lot on the entitlements to compensation and for which assets. The EIA tries to make a clear distinction between informal settlers that require full compensation and what the consultant of the EIA details as “encroached settlers” after 2001 that according to them have located in Sitio Agusuhin to reap the benefits of resettlement compensation. Arcadis believes information is insufficient to conclude whether settlers after 2001 should have been considered as encroachers. Publicly available information was sought and some of the news items and articles found have been summarised in the Area of Social Influence in section 5.14 of this report.

5.2 Permits, Fines and Previous Convictions

Permits, fines and previous convictions

Permits

As part of the environmental requirements, the following permits and certificates have been reviewed and are compliant:

- Discharge permit for STP effluent
- Hazardous waste generator permit
- Permit to operate air pollution sources and control devices
- Environmental Compliance Certificates (ECC) for shipbuilding and terminal facilities.
- Certificate of disposal for residual waste in landfill
- Certificate of treatment for diesel with water
- Third party compliance certificates for
  - Hazardous waste haulers
  - Landfill compliance
  - Transport compliance
  - Residual and Recycling Compliance
  - Scrap materials compliance
  - Treatment storage and disposal compliance

Permits that have not been reviewed, but have been reported to be present for the site are:

- Groundwater extraction permit
- Permit for Underground Storage Tank of gasoline
- Permit for storage of hazardous chemicals and flammable goods

Fines and previous convictions

One incident was reported at the material stock area (quay 7) in relation to burning of rubber tires. After inspection of the CCTV camera footage, it showed that the most probable cause was a super-heated element coming from the cutting torch nearby, where oxygen and LPG are used in the process.

Actions taken to avoid the recurrence of this incident were:

- Immediate hauling of used tires by waste hauler Don Bojie
- Proper labelling of hazardous and flammable waste
- Secondary containment for hazardous waste
- Rephrase dumping site to storage facility
- Submit show-cause letter to Subic Bay Authority.

Arcadis would recommend the missing permits to be requested at Hanjin, to ensure all relevant permits are available from an environmental perspective. Currently, due to the absence of some permits, the risk of non-compliance is considered **medium**. A list of permits has been included in Annex A.

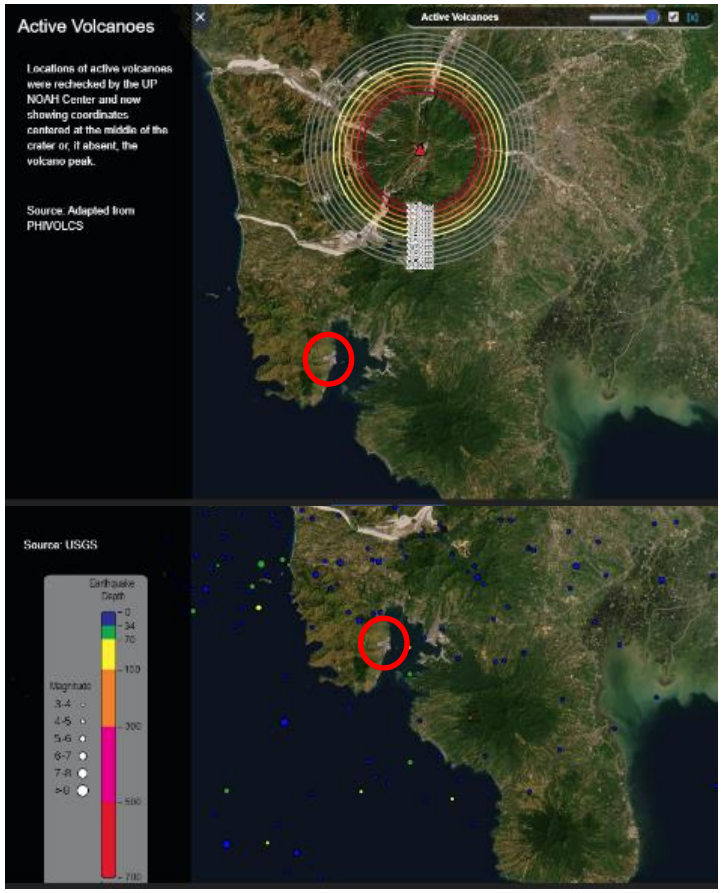
Medium

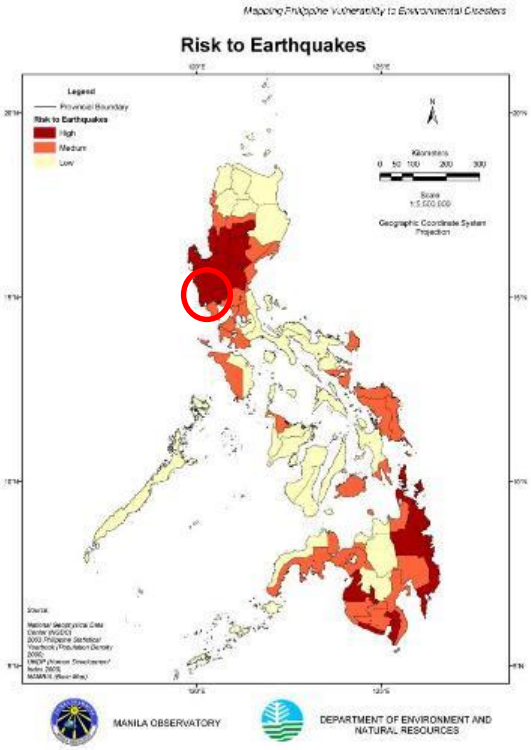
5.3 Natural Disaster Risk

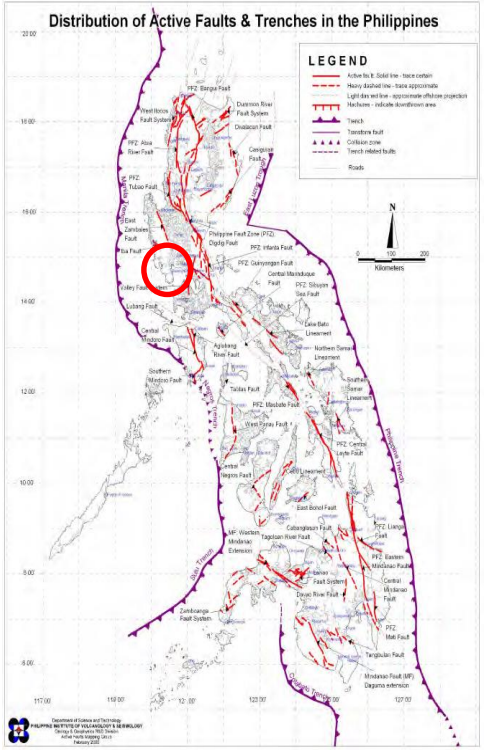
Please note that the natural disaster risk assessment has been based on publicly available information. No detailed flood risk assessment has been performed by Arcadis.

Thereby, risk ratings in visuals often resemble the chance of occurrence and severity of earthquakes, typhoons, storm surges etc. The risk rating of these visuals do not consider the potential risk it poses for the site and availability of mitigation measures. Therefore, risk ratings assigned by Arcadis can differ from the risk of a natural disaster having an impact in general.

5.3.1 Earthquakes



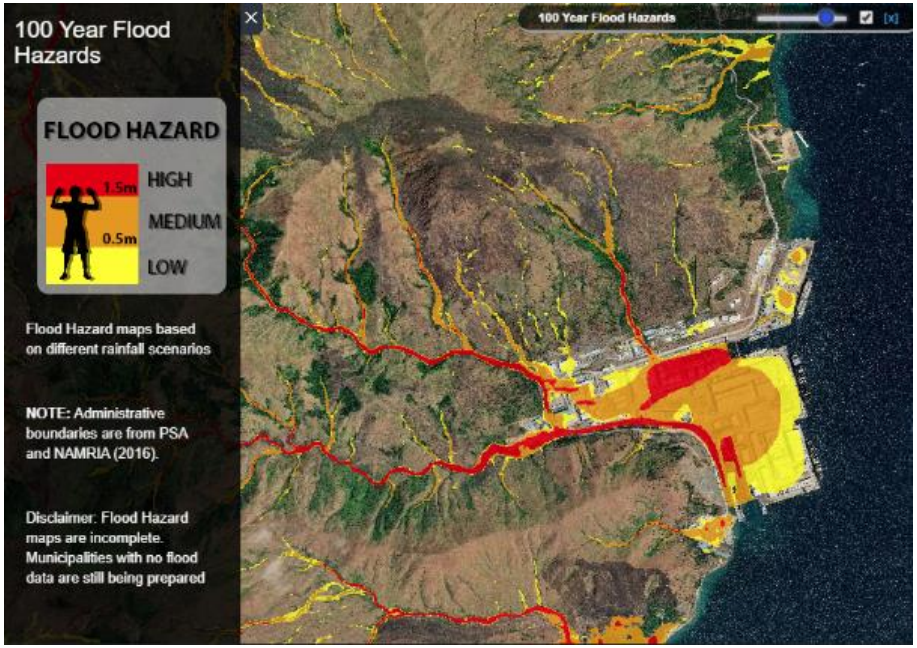




The Subic Bay and Zambales province lie in a high risk zone for earthquakes, mainly due to the vicinity of the Marina Trench and other fault lines (Subic, Iba, East Zambales, San Antonio). Although the risk of an earthquake occurring is high and magnitudes between 6-7 on the Richter scale have been reported nearby, the risk for the shipyard is considered **medium** due to the strict regulations on improving building codes in the Philippines and no previous records have shown any significant damage done to shipyard assets by earthquakes.

Medium

5.3.2 Flood Risk: Extreme Precipitation



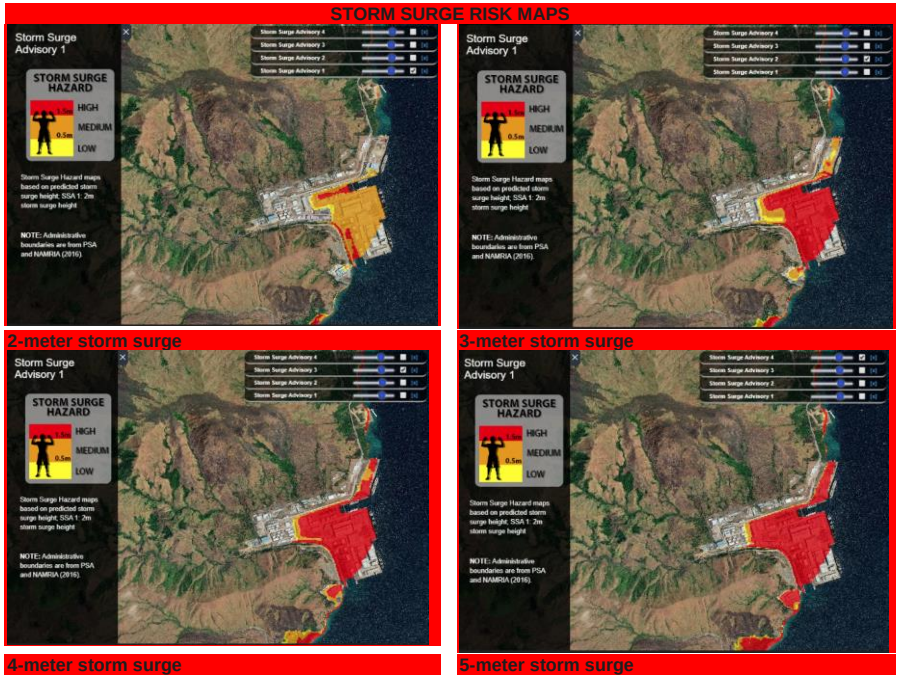
Flood hazard due to extreme precipitation is in the medium to high ranges for some parts of the site, considering a 100-year flood event (pluvial) which is a 1% chance a year. For 50-year and 25-year flood events, the site does not show any vulnerability, based on the available information.

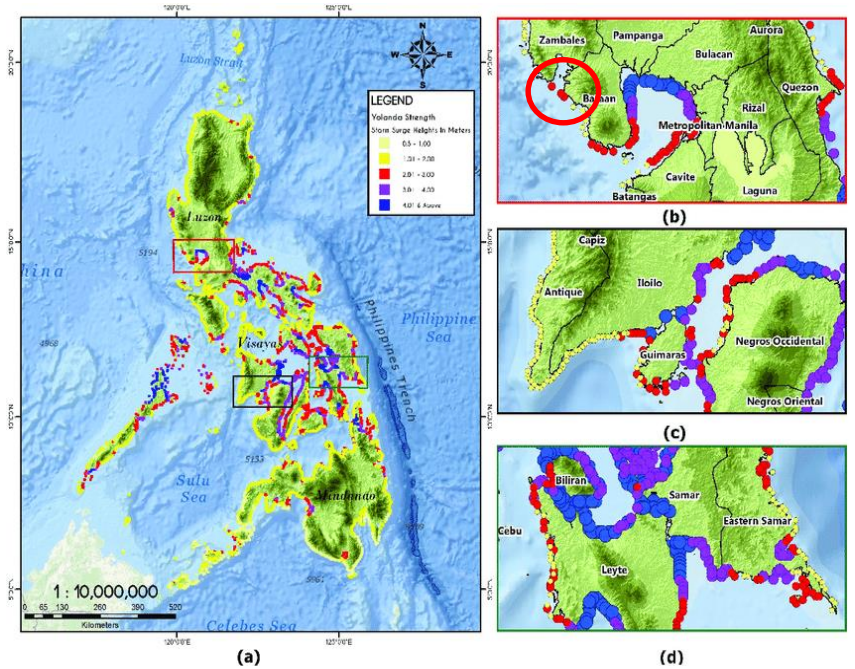
As the high risk areas are mainly consisting of the river area, and lower lying dockyards, the high risk can be abated, as the map does not consider the availability of large drainage channels, and the ability to improve functions that are vulnerable to water. For this reason the risk is considered **medium**.

Medium

Advised to maintain drainage channels regularly, and ensure building functions of the dockyard are made resilient to floods (e.g. increase height of electrical assets) and have an emergency procedure in place.

5.3.3 Flood risk: Storm surges





Available storm surge level sin the Subic Bay, during Typhoon Yolanda (Haiyan, the most destructive typhoon) show storm surges between 2 – 3m, which would relate to a medium-high impact.

Although the hazard during a storm surge might be medium-high, the risk for the shipyard is considered **medium** anticipating the impact is temporary (water will flow back into the sea through drainage) and measures can be taken to avoid significant damage and assure business continuity. It is advised to maintain a clean drainage system at all times, develop a storm surge evacuation plan and upgrade the dockyards (lower lying areas) to improve flood resilience (see previous slide).

Medium

5.3.4 Flood risk: Sea level rise

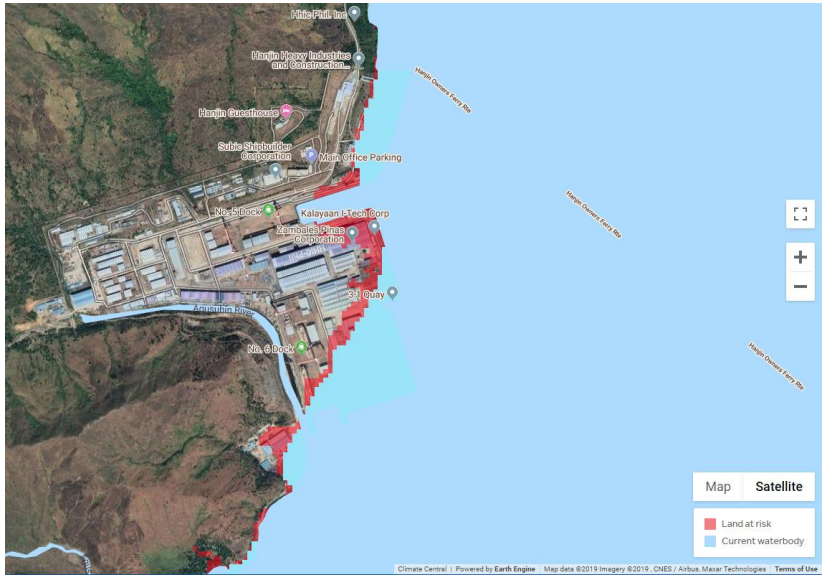
A study of the International Research Development Centre (IRDC) in the Philippines is projecting sea level rise in the Philippines to rise between 7.6 and 10.2 cm each 10 years (from 2015 onwards). This would result in a worst-case projection approximately 1m in 2100.

Current maximum tidal range in the Subic Bay is set to 1.47m according to tide-forecast.com. The quay side is set to 3.5m according to the drawings received, coming to a difference between maximum tidal range and the quay side of 2.03m.

The map to the right is a flood map considering sea level rise for the year 2100 with new data and considering the mid-range Kopp et. Al. study (2017) with projections of sea level rise. Although it shows areas at risk, Arcadis understanding is that the elevation data of the shipyard is wrong, as the turquoise/blue areas of the shipyard are currently set to 0m above sea level, which is clearly not right.

Considering sea level rise projections and the data of current site elevation from technical drawings, the risk level of sea level rise is set to **medium** as mainly the combination with storm surges will have an increased flood risk effect. Nevertheless mitigation measures like evacuation plans and resiliency improvements to equipment setup can be implemented to minimize damage in the occurrence of a flood.

Current data does not allow for any detailed assessment of the actual flood risk, wherefore if required by Acquiror, a flood risk assessment should be performed.



Medium

5.3.5 Sea level rise – Recent study used

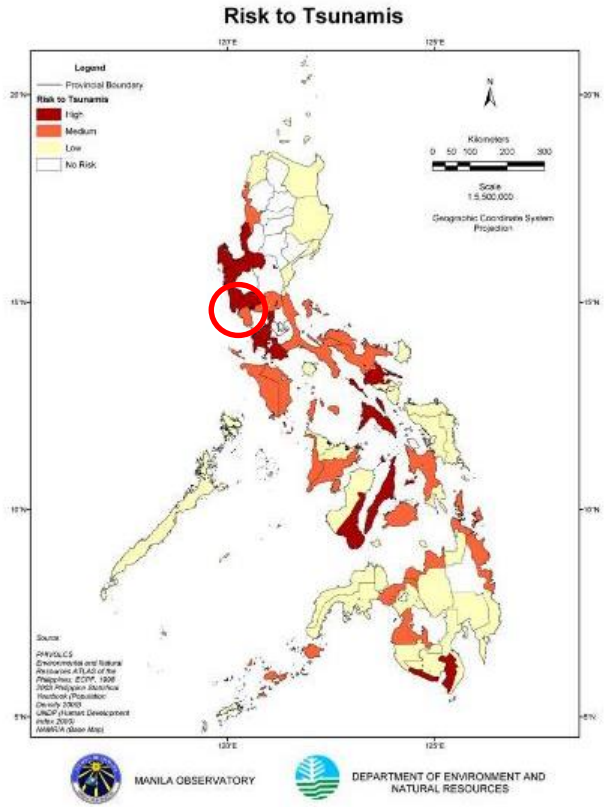
The previous map was developed using the Climate Central Map as developed for the study *Kulp, S.A., Strauss, B.H. New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. Nat Commun 10, 4844 (2019) doi:10.1038/s41467-019-12808-z*

The new study uses the improved Digital Elevation Model (DEM) to correct for errors in the regularly used NASA SRTM model. CoastalDEM is a new DEM utilizing neural networks to reduce NASA SRTM error. These figures triple SRTM-based values.

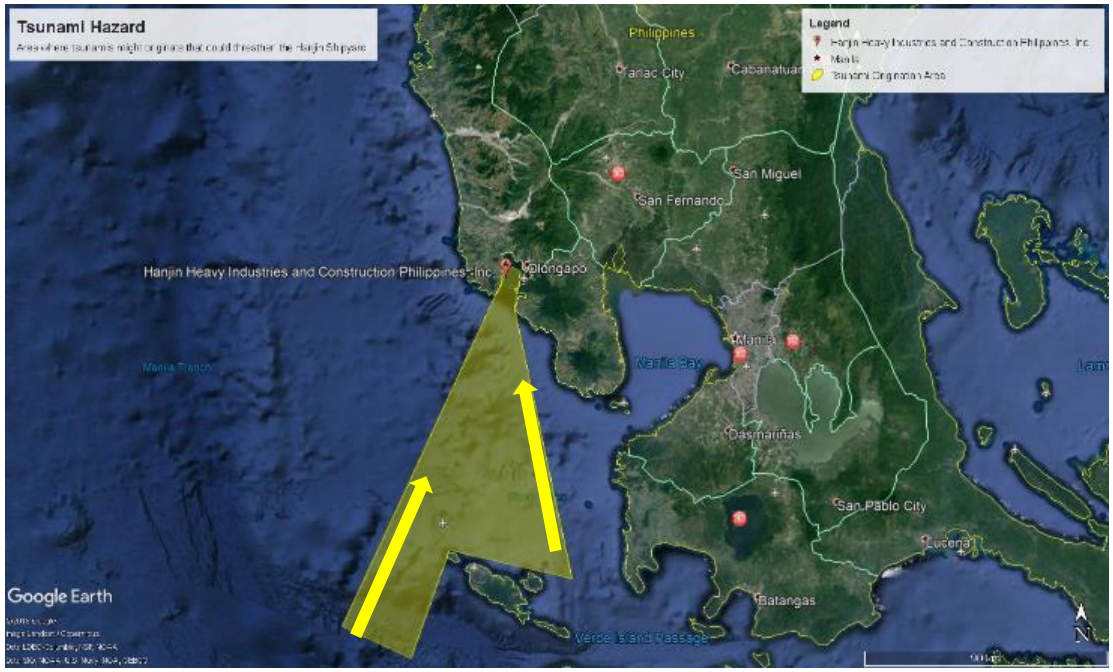
Settings for the sea level rise map were put as follows.

- Sea level rise projections only
- Year: 2100 (please note that no change is seen in earlier projects compared to 2100)
- Moderate cuts: Annual global climate pollution peaks near 2040 and then declines to half of current levels. Consistent with about 2 ° Celsius (about 3.5 ° Fahrenheit) of warming, the main target from the Paris Agreement. Implies 1,266 gigatons of total carbon pollution by 2100. Technical term: RCP 4.5.
- Mid-range (Kopp et al. 2014; highly cited): Globally-extensive local projections providing different ranges of future sea-level rise under different climate pollution scenarios; widely cited and used. Built on average global projections from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2013).

Please note that for the Hanjin Shipyard, it seems that the DEM shows some wrongful numbers, as some parts of the site are at 0m AMSL. Nevertheless, the data does show that the lower lying areas might be at risk in the longer term.



5.3.6 Tsunamis

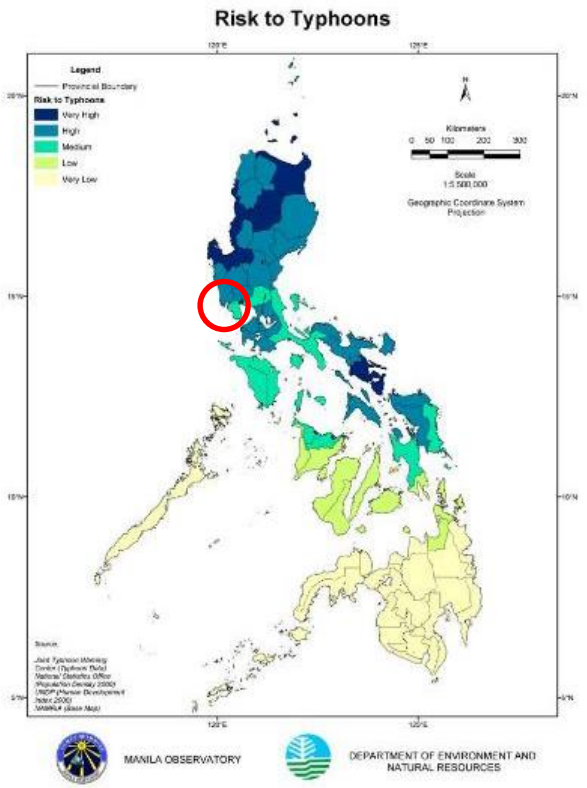


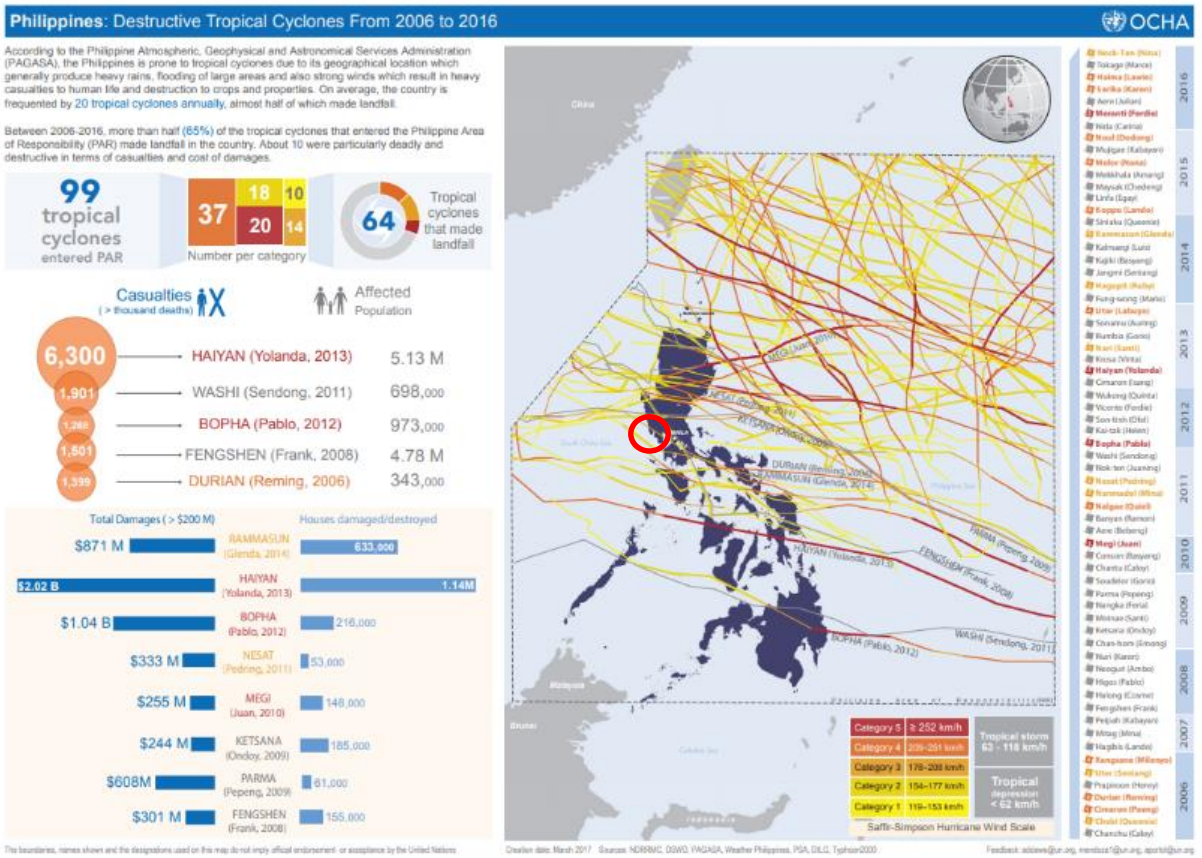
The Zambales province is considered a high-risk zone for Tsunamis, this mainly is due to the western coastline, that is prone to Tsunamis originating from the Manila Trench. The shipyard is naturally protected by mountains to the North and West and the Subic Bay has only a small opening towards the Manila trench.

The right map, show the area in which earthquakes might trigger a tsunami. “Earthquakes trigger tsunamis when the seismic activity causes the land along fault lines to move up or down. When parts of the seafloor shift vertically, either becoming raised or lowered, entire water columns become displaced. This creates a "wave" of energy, which propels the water”. Although it is possible that a tsunami reaches the Hanjin port, the area where this Tsunami would potentially originate (yellow polygon) is relatively small. Due to the ability to mitigate the risk in similar ways as for storm surges, the risk is considered **medium**. *The map with the tsunami origination is given as an indication and is not a precise resemblance.*

Medium

5.3.7 Typhoons





The risk of a typhoon crossing close to the Zambales province is considered high. Looking at the historic pathways of the typhoons (2006-2016) most of the typhoons crossing the Subic bay closely are Category 3 and 4, getting windspeeds between 178kmh – 251kmh. Only Typhoon Glenda (Rammasun, 2014) crossed the Subic bay directly, having already abated, with maximum winds of 175kmh. Considering the improvements required according to the Philippine building code, only 1 previous occurrence of wind damage to site, and a storm surge (a result of typhoons) risk classified as medium, the risk of typhoons for the shipyard is also considered **medium.**

Medium

5.3.8 Landslides and Unstable Slopes





The South/Southwestern border of the site is surrounded by unstable slopes. Thereby, a small fringe of the south/southwestern border of the site is located in the landslide “no dwelling zone” which means it is prohibited to build residential buildings, but building for commercial purposes is allowed, although not recommended.

The no dwelling zone mainly consists of the river south of the site and some buildings on the fringes of the site. The Waste storage area is partly covered in the No-Dwelling zone. Considering the river divides the site from the slope with a large trench, it is anticipated it will support in a reduced risk from landslides affecting the site in that particular area. The waste storage area is well within the “no-dwelling zone” without any buffer zone in between. It is advised to improve slope stability around the waste storage area, develop emergency procedures in case of extreme precipitation and an earthquake and monitor annually and after extreme events. Due to the availability of mitigation measures, the risk is considered **medium.**

Medium

5.4 Water Resources

5.4.1 Water supply





The project sites receives it's general water supply of the municipal water system (Subic Water District) and extracts groundwater at the water treatment plant, which is used (after treatment/settling) as process water for pre-treatment and galvanizing. No extraction permit was reviewed, but staff informed it was available. At full operation, the site reported to pump 7,500 m3 of groundwater per day.

No concerns were found in relation to the water quality (as given by water quality monitoring results for process water in **Annex D**) and it is anticipated that groundwater is allowed to be extracted as personnel informed Arcadis accordingly. Water quality results for potability did show slight elevations in residual chlorine and total coliform, therefore it should not be used as drinking water. Monitoring records are given in **Annex D**. Overall the risk is anticipated as **low** since the water is not reported to be used for drinking purposes (observations of bottled water were made during the site visit), monitoring results are shared with Philippine authorities and checked for compliance and permits have reportedly been in place for the operational period.

Low

5.4.2 Wastewater: STP and Drainage





Sanitary and Kitchen waste water are treated in the STP (left) and at full operational capacity it treated 3,500 m3 water per day. Grease traps are present in the kitchen, but no API oil/water separators were observed. Stormwater is discharged through a drainage system (right) towards the sea. No spills leading towards the drainage were found and water drained towards sea is tested on quarterly basis on water quality parameters as specified in Annex D. No exceedance of Philippine water quality limits was found and marine ecological monitoring results show no significant changes in the past year (2019). Monitoring records for marine and aquatic have been included in **Annex F**.

Low

At sites with significant contaminants present (blasting, paint shops, storage) management measures were reportedly provided to contain spills with dry solutions (no water usage) reducing the risk of spills entering the stormwater drainage. Proper wastewater treatment (sanitary) and drainage related impacts due to stormwater runoff are considered low, due to monitoring results of 2019 showing no elevations surpassing Philippines regulatory limits, these monitoring results have to be submitted to the authorities and are checked on compliance, permits are still in place meaning compliance is supposedly met and active procedures are in place. For the before reasons, the risk is anticipated **low**.

5.4.3 Wastewater: Process wastewater





Chemicals used in pre-treatment/galvanizing
Dichloromethane/methylene chloride
Corrosive solid (tribasic sodium phosphate)
Sodium metasilicate
Sodium hydroxide
Hydrochloric acid
Phosphate coating
Sodium carbonate
Sulphuric acid
Aluminium sulphate
Polyacrylamide
Zinc plate
Ingot aluminium
Ammonium Chloride
Chromium Trioxide

Site personnel informed that contaminated process water from pre-treatment (left and right) and galvanizing is treated in the attached wastewater treatment facility (WT-50, Shinzo) and afterwards is stored in containers and transferred as hazardous waste towards the waste storage area. At the waste storage, the hazardous wastewater is picked-up, transported and disposed of by a contractor. Chemicals used in the pre-treatment and galvanizing process are given in the table to the right.

Considering the process wastewater is treated, the waste management procedure specifies the need for treating process water of pre-treatment and galvanizing as hazardous waste and the area around the pre-treatment and galvanizing plants are completely concreted (with no clear signs of damage to the flooring), the risk of contamination ins anticipated to be **low.** *Nevertheless, it is important to consider the location is being used for galvanizing and future repurposing or site decommissioning should always take this into account.*

Low

5.5 Air emissions

Air Emission Management





Amount	Type
4	3250 CMM Dust Collector
7	4250 CMM Dust Collector
6	300CMM Dust Collector
68	50 CMM Vacuum Recovery
18	1800 CMM Ventilation System
1	900 CMM Dust Collector
2	400 CMM Carbon Tower
1	1000 CMM Dust Collector
1	1500 CMM precipitator
2	500 CMM wet scrubber
1	95.65 hp Miura Boiler
2	1250 kW Cummins Generator Set
1	2000 kW Cummins Generator Set
2	500 kW Cummins Generator Set
2	400 kW Caterpillar sub-generator
1	400 kW Cummins Generator Set
1	1000 kg/ac CO2 Generator System

Dust collectors (right) and scrubbers (left) are collecting particles and filtering gases from production processes. Dust collectors are mainly used for blasting and painting processes, whilst the wet scrubbers are used for more intense processes as galvanizing, pre-treatment and alternative paint processes. Waste from the dust collectors are collected in large containers (including filter bag) and transported to the waste storage facility as hazardous waste.

Under RA 8749, all industries classified as a stationary source should perform their own emissions monitoring and report the results to the DENR. All stationary sources of air emissions must comply with National Emission Standards for Sources Specific Air Pollution (NESSAP) and Ambient Air Quality Standard (AAQS) pertaining to the source. Upon compliance to standards, the DENR issues a Permit to Operate (PTO) to these industries prior to their operation. Air emissions are only tested for the generator sets that are present on site, and air emission results for 2018 (**Annex E**) do not show any exceedance of the specified limits of the National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial sources/operations in the Philippines. Generator sets have been assessed on Nitrogen Dioxide and Carbon Monoxide, which is required as specified in the guidelines of DENR for conducting stack emission tests (June 2016) and which limits have been set to 500 mg/NCM for both pollutants. Monitoring records of the shipyard on Carbon Monoxide for the generator sets are deemed to have the wrong unit assigned. As the unit says ppm, where most likely mg/NCM is meant as specified in the standards.

The Miura Boilers at the Galvanization shop have also been tested on Particulate Matter (200 mg limit) and Sulfur Dioxide (50 mg limit).

Considering air emissions are monitored according to Philippines regulations, are reported on a quarterly basis to the Philippines authorities, are not showing any exceedance and are checked on compliance the risk of air emissions posing a potential hazard to people or non-compliance is considered **low**.

Low

5.6 Waste management

5.6.1 Waste transportation on site







Site infrastructure was observed to be set for collection and separation. On site waste is therefore believed to have been segregated and transported to the waste storage for hauling and disposal.

5.6.2 Waste storage





Hazardous waste storage (left) is covered and sorted according to type of hazardous waste. Non-hazardous waste is segregated and picked up twice a week in operational period. Some signs of leachate were observed at the general waste dump (garbage pile), although this waste is not anticipated to be hazardous, considering discharge monitoring results of 2019 of drainage channels and the river do not show exceedance of local Philippine limits for effluent of industrial sites. Thereby these results are shared with regulatory bodies for compliance check and the continuation of the discharge permit (**Annex D** shows monitoring results of the drainage water). No secondary containment was provided for the hazardous waste management storage.

Low

Certificates of compliance (provided by DENR) have been reviewed for waste haulers and no issues are reported in those documentations. Hanjin has been registered as hazardous waste producer at DENR and can store hazardous waste on site. A hazardous waste management process is present and reportedly active, whilst waste hauling pick-up and disposal manifests are signed and documented, showing that waste has been picked up by the contractor and has been delivered to the hazardous waste disposal/treatment site (an example was reviewed for hydrochloric acid disposal). Considering a waste management procedure is in place and waste is separated accordingly, whilst being disposed of by different, legitimate waste haulers, the risk is anticipated to be **low.**

5.6.3 Hazardous Waste

CURRENT CONTRACTORS FOR HAULING OF SCRAP AND HAZARDOUS WASTE		
SEQ.	COMPANY NAME	TYPE OF WASTE HAULED
1	DON BOJIE TRADING	Scrap Hauling Services
2	YGA JUNKSHOP	Scrap Hauling Services
3	FBL JUNKSHOP	Scrap Hauling Services
4	MELBA'S JUNKSHOP	Scrap Hauling Services
5	NELSON CHAM GENERAL MERCHANDISE	Scrap Hauling Services
6	PRIME ENVIRONMENTAL & INTEGRATED TECHNOLOGIES SOLUTIONS, INC.	Scrap Hauling Services
7	ADL WASTE MANAGEMENT	Hazardous Waste Transporter
8	ASIAUNITED OIL INDUSTRY CORP.	Hazardous Waste Transporter
9	RMS PETROLEUM TECHNOLOGY AND WASTE MANAGEMENT CORPORATION (FORMERLY ARNIELLE TRADING)	Hazardous Waste Transporter

HHIC-PHIL HAZARDOUS WASTE INVENTORY

as of September 30, 2019

HW. NO.	HW CLASS	QTY	UNIT
F602	Waste Paints	194,600	Kilogram
I101	Used Oil	54,200	Liter
I104	Water with Oil	84,000	Liter
B202	Hydrochloric Acid	38,000	Liter
B299	Potassium Permanganate	-	Liter
D406	Used Battery	312	Piece
D407	Busted Fluorescent Bulbs	50	Kilogram
H802	Grease Trap	31,200	Liter
I101	Grease	-	Liter
I102	Used Cooking Oil	37,200	Liter
M506	Waste Electrical and Electronic Equipment (WEEE)	60,000	Kilogram

HHIC currently has several types of waste that are categorized as hazardous. These wastes are reportedly transported and disposed of by waste haulers. As hazardous waste is transported and disposed of accordingly, a waste management plan is in place and no previous incidents have been reported (besides the accidental tire burning as mentioned on page), the risk of contamination for hazardous waste transportation and disposal is considered **low**.

Low

5.6.4 Ballast water management and ship waste handling/disposal

Ballast water management

During the site visit and considering received documentation, Arcadis is of the understanding that ballast water management facilities are currently not available on site. Thereby, no reference to ballast water management procedures were made and no ballast water management plan was received. Considering this, Arcadis is of the understanding that ballast water was not managed on site.

Ship waste handling

Next to ballast water, ship waste handling procedures were not received during the due diligence process. As the site is currently not operational, no observation could be made on the handling of ship waste.

The future site tenant should develop a standard operating procedure/requirement in relation to the management of ballast water and ship waste handling. The site could either ensure that ships mooring at the site are aware that ship waste and ballast water cannot be handled on site or should invest in the appropriate infrastructure to accommodate ballast water treatment and ship waste handling.

5.7 Storage Tanks

5.7.1 Underground Storage Tanks





There are reportedly 4 USTs that can be reached via the entry hatches at the gasoline station (right). No spills were detected near the UST. Only calibration records of the tank were received, but no actual maintenance records or a permit for operation. Calibration records of 2009 show that the tank sizes are respectively 16,882, 27,913, 27,768 and 28,042 liters.

Although site personnel informed that maintenance records were available and a permit for storing gasoline on site was present, this information has not been received by Arcadis. USTs are prone to leakage and should be inspected on regular basis to avoid any damage occurring over a period or in the event of an earthquake. Due to the unavailability of data, Arcadis classifies the risk as **medium** until further notice.

Medium

5.7.2 Aboveground Storage Tanks





NO	NAME	CAPACITY	WEIGHT		REMARK
			FULL	EMPTY	
1	LO_2 STORAGE TANK	30 TON	45 TON	15 TON	
2	LO_2 STORAGE TANK	30 TON	45 TON	15 TON	
3	LCO_2 STORAGE TANK	40 TON	75.5 TON	35.5 TON	
4	LCO_2 STORAGE TANK	40 TON	75.5 TON	35.5 TON	
5	LC_2H_4 STORAGE TANK	10 TON	20.3 TON	10.3 TON	
6	LO_2 VAPORIZER	1000 m³/H	1.5 TON	1.5 TON	
7	LCO_2 VAPORIZER	1000 m³/H	2.5 TON	2.5 TON	
8	LCO_2 VAPORIZER	1000 m³/H	2.5 TON	2.5 TON	
9	LC_2H_4 VAPORIZER	1000 m³/H	0.3 TON	0.3 TON	
10	LPG TANK	10 TON	10.1 TON	0.1 TON	

Aboveground storage tanks are spread across the site. Production gas station has oxygen, ethylene, LPG and carbon dioxide storage (left) and capacity has been given in the table (right). The storage tanks for the production gas station and the air receivers at this location have all completed and approved inspection records available. Pre-treatment and paint shop have diesel tanks (mid) which are bunded (good condition) and a carbon dioxide AST.

No significant risks have been observed based on outer inspection of the ASTs. Permits for storage of these gases/hydrocarbons were not received and no maintenance records have been made available. Even though no maintenance records were received, the outside of the tanks were observed in order, therefore the risk is considered **low**.

Low

5.8 Material Handling & Storage

5.8.1 Chemical/Paint Storage







Open chemical storage (left) is locked for unauthorized personnel, but still prone to outside events (weather). Chemicals/Paints are not stored on drip trays (mid). Drainage of the storage leads out to sea (right). Naked lights are present in the open storage, close to flammables. As no secondary containment is provided in the open chemical storage, and drainage leads out to sea, the risk of contaminating seawater and potential marine wildlife is present. Secondary containment in the form of drip trays and spill kits (dry) should be provided.

Considering the current situation, the risk of chemical/paint storage on potential contamination is considered **medium.**

Medium

5.8.2 Closed chemical/paint storage





Closed chemical/paint storage has explosion proof lighting, but is insufficiently ventilated (left). Spill was present on the floor (right) , which did not spread outside, but the potential is there, due to holes in the walls near the surface level.

No drip trays were provided for stored paint/chemicals. Considering chemicals and paints are not managed properly as with the closed paint/chemical storage, risk for contamination is present and therefore equally assessed **medium**.

Medium

5.8.3 Other storage areas



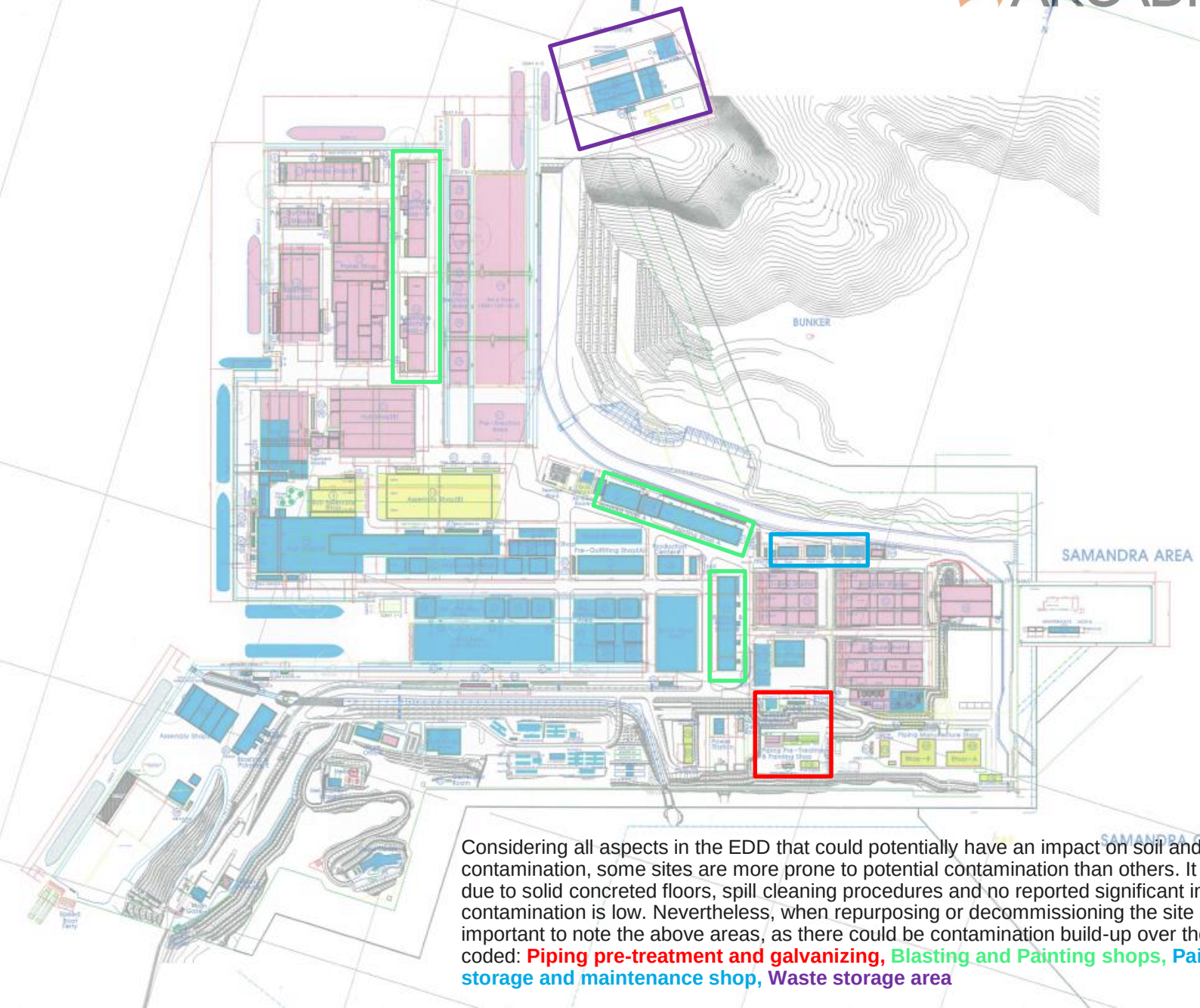




In other areas, batch storage is present, none secondary contained. Left is the maintenance shop, middle is piping pre-treatment (including spill), right is piping paint shop. Risk of contamination is present due to the absence of secondary containment, although the flooring is fully concreted and no stains were observed to move to the outdoor areas. Anticipating the before-mentioned aspects, the risk is classified as **medium**.

Medium

5.8.4 Sites with risk of contamination



Considering all aspects in the EDD that could potentially have an impact on soil and groundwater contamination, some sites are more prone to potential contamination than others. It is anticipated that due to solid concreted floors, spill cleaning procedures and no reported significant incidents, the risk of contamination is low. Nevertheless, when repurposing or decommissioning the site in the future, it is important to note the above areas, as there could be contamination build-up over the years. Colour coded: **Piping pre-treatment and galvanizing, Blasting and Painting shops, Paint/chemical storage and maintenance shop, Waste storage area**

5.9 Deleterious materials

5.9.1 Ozone Depleting Substances

Some of the air-conditioning units on site are still using R22 refrigerant, which his considered an Ozone Depleting Substance (ODS). The Philippines has ordered to phase out the use of R22 refrigerant by 2021, hence the site should replace the AC units by that year with units that are not using the R22 refrigerant or any other refrigerant that is classified as ODS.

It is advised that the AC split units still containing R22 refrigerant are replaced between 2020 and 2030, to ensure compliance to Philippine regulations.

5.10 Firefighting equipment

5.10.1 Firefighting equipment



Currently there is a lack of active fire protection measures at the docks' shelters (currently protected by fire extinguishers only) especially in buildings where combustible gases are used around ignition sources such as welding, hot-cutting, etc. Gas ports are also located near the high voltage electrical panels. Capex amounts are allowed for installation of appropriate fire protection systems as well as the relocation of the panels. Review of worker health and safety policy for hazardous areas is also recommended as part of operation after the incoming tenant takes over the premises and confirms the final use of buildings.

As part of the investment, fire protection measures will be taken of a combined approx. value of 2.5 million USD considering improvement of fire suppression systems and fire alarms in the guest house, blasting & painting shop B, main office, blasting & painting shop C, blasting & painting shop D, Catering Center and Painting shop/Piping shelter amongst others.

High

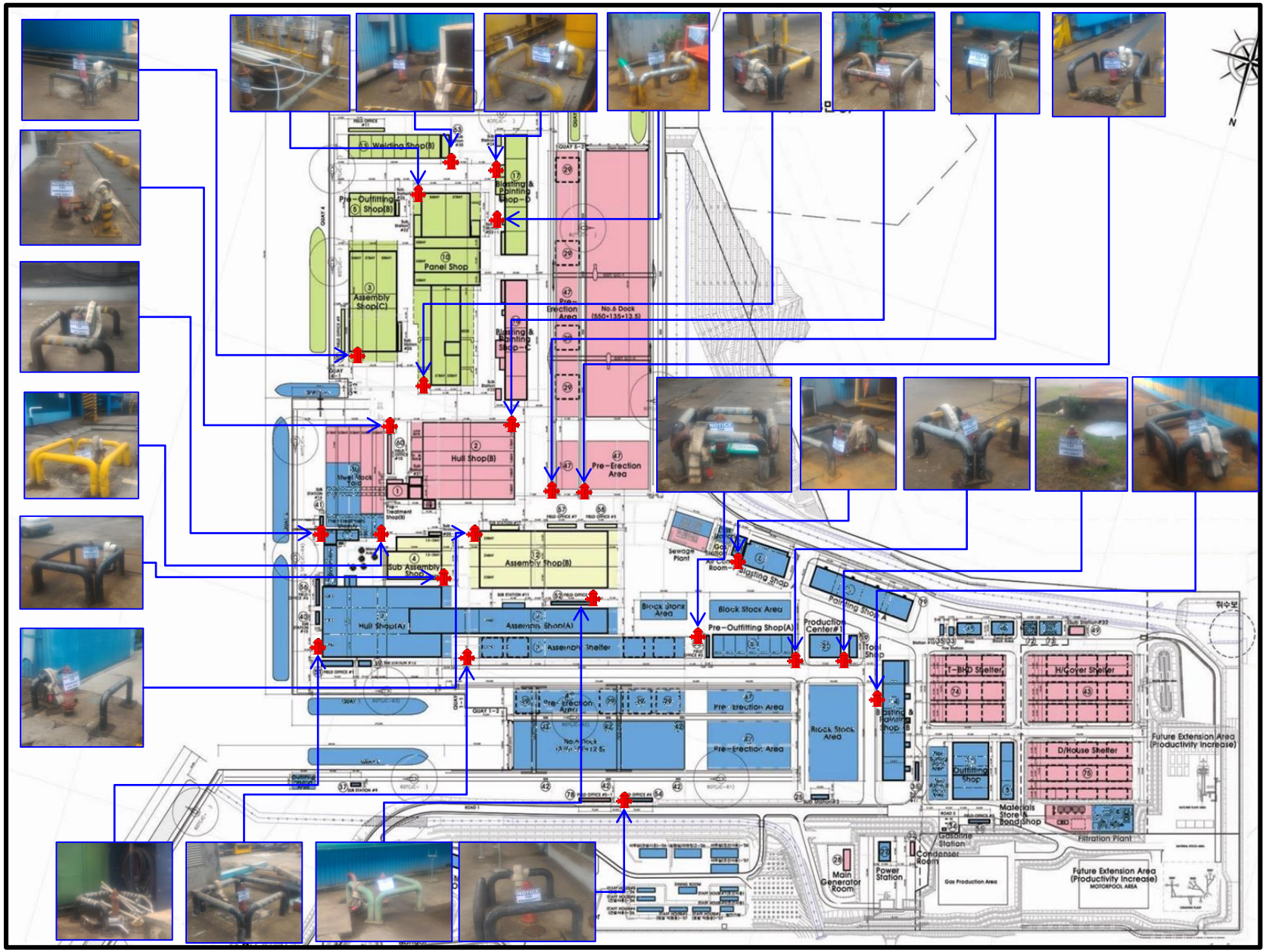
On site there are 23 ground hydrants available and the main pumps and supporting pumps for the fire hydrants are located in the STP building and the Water Treatment Plant. Many of the fire extinguishers on site were checked on a regular basis, but some of the fire extinguishers were observed to be very old and it is unsure whether they are still fully functional. The site does host a fire fighting facility with 2 fire fighting trucks, which is located near the maintenance shop and paint/chemical storage.



Considering adequate fire fighting equipment is currently in need of improvement and significant investment, the risk is considered **high**.

5.10.2 Ground Hydrant Locations

ARCADIS Design & Consultancy for natural and built assets



5.10.3 Fire hydrant pumps

The fire hydrant pumps are located at the water treatment plant and in the building of the STP (as shown in the picture below). They involve 1 main supply pump, a spare support pump and a assistance supply pump as specified in the figure on the right.



Water Treatment Plant Equipment

		Equipment Name	Fire Extinguishing Main Supply Pump
		Specification	A horizontal Shaft Volute Pump 150A x 1.8m³/min x H100m
		Motor	75 kw
		Quantity	2 units
			
Equipment Name	Fire Assistance Supply Pump	Equipment Name	Fire Extinguishing Spare Support Pump
Specification	Wesco Pump 40A x 0.06m³/min x H100m	Specification	Engine Pump 200A x 3.6m³/min x H100m
Motor	11 kw	Motor	110 kw
Quantity	1 unit	Quantity	1 unit
			

5.11 Emergency Preparedness and Response Plan

Emergency Preparedness and Response Plan

The shipyard delivered their HSE Emergency Management Procedure dated 6 June 2018 Rev. no 3 to the Arcadis team. After review, the emergency management procedure includes responsibilities, emergency response definition, training and drills, types of emergency situations, response procedures, specification of cases with human accidents and how to treat the injured, physical accidents also pertaining storms/floods, and an environmental accident procedure (for spills of different kinds). Besides the procedure, no other records were received.

The facility is currently non-operational and Tier 2 spill measures (e.g., floating booms, oil absorbers, small boats) will be incorporated as part of a tenant's responsibility once a tenant is confirmed..

Although the previous shipyard owner had an Emergency Preparedness and Response Plan, this does not mean that this plan will apply for the new tenant. It is recommended that the new tenant draft an emergency preparedness and response plan appropriate for the organization and the site activities as performed in the future. The plan should amongst others include a spill prevention and control procedure.

5.12 Dredging

Dredging

For the preparation of the site and the implementation of the quay walls, dredging and excavation had to be performed. In the EIA study performed in 2005, these dredging impacts have been modelled according to the then available models for hydrodynamics. Considering the time and the developments in the field in the Philippines during that time, efforts seem to have been performed in order to estimate potential suspended solids in the marine waters.

Mitigation measures were provided in the form of limiting the dredging activities to time periods per day and avoiding 24-hour dredging.

The future situation could need dredging for the maintenance of a minimum depth for ships to be able to moor and use the dry-docks. Considering the amount of dredging required, the new tenant should assess the necessary steps to minimize residual impacts on marine ecology, fishermen and water quality within acceptable limits. This may require an Environmental Impact Statement (EIS) although the current framework for EIS in the Philippines only states an EIS requirement if reclamation is required.

5.13 E&S Policies of Proposed Operator

ESMS of the proposed operator

Currently the HHIC Shipyard is not operational, therefore the majority of the Environmental and Social Management System (ESMS) is revolving around current process that are still in place (like waste management, environmental monitoring and fire safety procedures). In the case that a new operator of the shipyard will be selected, this operator will have to ensure that an ESMS will be developed that is conform IFC Performance Standards, World Bank EHS Guidelines and Good International Industry Practice (GIIP), whilst implementing such a system accordingly. The acquiror of the shipyard will have to delegate these requirements to the new operator.

The ESMS of the operator shall comply to:

- All relevant Philippines legislation
- The IFC's 2012 Performance Standards;
- The World Bank EHS General Guidelines;
- The World Bank EHS Guidelines for Ports, Harbors, and Terminals; and
- The ILO's 2019 Code of Practice on Safety and Health in Shipbuilding and Ship Repair

5.14 Area of Social Influence

Area of Social Influence

As included in 5.1.4 the resettlement of Sitio Agusuhin caused some social unrest in the area where now the HHIC shipyard is located. It was clear that the resettlement process was difficult and efforts were done to decide who was and was not entitled on compensation. The overall EIA did not include all potential socio-economic impacts that are considered to be part of a shipyard, like impacts on fisheries and fishermen located in other villages. Arcadis has tried to find alternative information on the potential social impacts of the shipyard at the time of construction and operation, which can be used to create an understanding of the area of social influence of the shipyard. This area of social influence can later be used to ensure proper stakeholder engagement and community involvement for the new operator of the shipyard.

One of the news items in Bulatlat as posted in March 2006 interviewed villagers after the resettlement was performed. The news items included perspectives of the villagers, stating that they have been under resettlement threat for years, since an oil & gas company previously used the site for the construction of a concrete gravity structure and afterwards HHIC came in to acquire the land for the shipyard. Information was disclosed to them on the project by the Agusuhin Neighborhood Association (ANA) who informed them that payments had to be taken as their houses would have to be resettled in any case. First villagers approved the resettlement and compensation measures, but afterwards the villagers changed mindset and formed SAMANARA in January 2006, as they wanted to oppose the project. A villager refers to compensation of 274,000 PHP for his house and trees.

On philstar.com a news item was posted on the implementation of resettlement activities by the SBMA. A president of the ANA was interviewed and informed that the compensation that was given, was below expectation, but they agreed, as they saw the economic benefits of the shipyard for the Philippines as a whole.

One article posted in Ethnos, Journal of Anthropology (2016) written by Elisabeth Schober did a detailed study on the social impacts of the HHIC shipyard on local communities. The article highlights that thousands of villagers had to be resettled (not only the ones in Sitio Agusuhin, but also near the shipyard) and impacts were felt by labour influx malaria cases, fisheries that worsened and impacted local subsistence fishers and replacement land was often of poorer quality than the land close to the sea. The article also highlights another round of evictions in 2013 of approximately 1,000 families living close to the shipyard, although this was not on account of the shipyard.

More information on the social impacts of the shipyard might be available and can be shared with the acquirors accordingly. When operations commence, the operators will have to ensure proper stakeholder and community engagement is maintained to limit negative impacts as much as possible.

5.15 Other aspects

Please note that below aspects are all considered low risk as no reasons for concern were found.

- Protected areas
- Noise emission management
- Asbestos Containing Materials (ACM)
- Poly-chlorinated Biphenyls (PCBs)
- Lead based paint

5.15.1 Protected Areas

The closest national parks near the project site are Roosevelt national park and Bataan national park, which are located respectively 18km and 20km as the crow flies.

The Bataan National Park and Subic Bay Forest Reserve (located next to each other) are considered important bird areas (IBAs). Several of the threatened and restricted-range birds of the Luzon Endemic Bird Area have recently been recorded in this IBA, and the relatively extensive forests which remain there support important populations of several of these species, notably Green Racquet-tail. One of the largest recent counts of Philippine Duck was in Subic Bay.

Non-bird biodiversity: The northern Luzon giant cloud rat Phloeomys pallidus, golden-crowned flying fox Acerodon jubatus, Philippine brown deer Cervus mariannus and Philippine warty pig Sus philippensis are known to occur in the area, but surveys of the mammals and herpetofauna of the area are incomplete.

Considering the location of the shipyard, it is not expected to significantly impact the IBA and biodiversity on land.

5.15.2 Other aspects

- As the shipyard is currently not in use, there are hardly any **noise emitting activities** present. Noise monitoring is continued to date, and recent results are never higher than 45 db(A) near the main gate and the pool area. This is well within the allowable limits of the Philippines authorities.
- No **asbestos containing materials** are reported to have been present on the site. No suspect asbestos containing material was sighted during the site walk. Since 2000 brown and blue asbestos are banned in the Philippines, whilst Chrysotile asbestos is regulated by the Chemical Control Order 02 by DENR. The site started construction in 2004 and site personnel informed the team that no asbestos was present on site and used in building materials. The site visit reviewed (visually) for potential chrysotile asbestos materials but did not spot any during the visit. Considering the above, the risk of asbestos at the shipyard are anticipated low.
- Transformers are known to historically contain oils with **PCBs**, hence the risk for this Persistent Organic Pollutant (POP). The Philippines signed the Stockholm Convention Agreement on POPs in 2001, which resulted in the administrative order No. 1 of 2004 (DAO 04-01) otherwise known as Chemical Control of PCBs which was in effect on the 19th of March 2004. The objective of this order was to eliminate and phase out the use of PCBs over a 10-year period ending 19 March 2014. Construction of the shipyard started in 2004 and was completed in 2006. As the order was already active and site personnel informed that no PCB oils were used in the transformers, there is no reason to believe any PCB containing oils are present in the transformers used at site.
- The Philippines promulgated its **lead paint** policy in 2013 through a Chemical Control Order (CCO) for Lead and Lead Compounds, which prohibits lead in paint above 90 ppm of the total non-volatile content of the dried paint film and provides for phase-out periods for different paint categories. Results of the TCLP for paint sludge resulted in a 0.35 mg/l (0.35ppm) which is well within the limits that are allowable. Personnel at the shipyard informed that they only use paints that are within the allowable limit of 90ppm on lead content. No concern was found here.

6. Corrective Action Plan, Costs, and Schedule (CAP)

Area of Concern	Risk Type	Rating	Corrective Action	Cost
5.2 Permits, Fines, and Previous Convictions	**Permits and Monitoring**	Low	Ensure all permits are present and environmental monitoring is continued on a quarterly basis, sending monitoring results to the appropriate authority for compliance checking. Permits should be renewed if currently not valid and schedule accordingly for other permits losing validity.	Tenant operational expenses
5.3 Natural disaster risk	**Potentially unstable slope behind waste storage**	Medium	Ensure slope protection for mountain west of the waste storage area (quay 7) to reduce the chance of landslides affecting the area and endangering personnel working there.	$ 80,000
	Storm surge risk	Medium	Develop an emergency evacuation procedure in case of typhoons and storm surges, to avoid material damage and ensure safety of personnel working on site. This includes shipping safety due to an increase in sea level and wave height.	$ 50,000
	Typhoons and earthquakes	Medium	Upgrade site assets to the latest Philippine building code to minimize the risk of typhoons and earthquakes causing significant asset damage.	$ 15,117,690
	On site flood risk	Medium	Ensure maintenance and cleaning of all drainage channels of the complete site, to assure water on the site will be drained in extreme precipitation or storm surge events.	Part of upgrade to Philippine building code
	Asset flood damage	Medium	Improve resiliency of the dockyard's lowest lying areas, by protecting vulnerable assets considering potential floods in case of storm surges (like substations and electrical facilities).	Part of upgrade to Philippine building code
5.8 Materials handling & storage	**Hazardous materials management**	Medium	Provide secondary containment pallets for all storage areas of hazardous materials, considering the chemical/paint storage and maintenance workshop and hazardous waste storage.	$ 100,000
	Spill prevention	Medium	Provide spill kits to locations where a potential spill might reach the stormwater drainage (e.g. gasoline station, open paint/chemical storage, waste storage).	$ 30,000
	Soil/groundwater contamination	Medium	Although the site is fully concreted, spill prevention procedures are in place and no previous spills were reported, the site does host industrial processes like painting, galvanizing, pre-treatment and a gasoline station with UST. Considering these items it is recommended to assess soil and groundwater quality if the site would be decommissioned or repurposed in the future. After consideration of the required areas to be assessed, these cost could range approximately between $ 25,000 and $ 400,000 USD.	TBD
	Inappropriate ventilation/fire hazard	Medium	Improve ventilation of closed chemical/paint storage area (building 72) and the storage areas near the piping pre-treatment and paint shop (building 79) and install explosion proof lighting in these area.	$ 67,900
5.9 Deleterious materials	**Ozone depleting substances**	Low	Replace AC unites with R22 refrigerant between 2020-2030, to comply to Philippines standards relating to the phasing out of R22 refrigerant.	$ 489,000
5.10 Fire Fighting Equipment	**Fire safety**	High	Improve fire suppression systems and fire alarms in the guest house, blasting & painting shop B, main office, blasting & painting shop C, blasting & painting shop D, Catering Center and Painting shop/Piping shelter.	$ 2,399,100

7. Annexes

ANNEX A

Permits & Certificates

Permit	Validity
Business Registration	1 year
Land Administration	one time permit
Hiring of personnel accreditation	
Certificate of Accreditation	6 mos/ 1 year
Gate Passes	6 mos- 1 year
Building Permit	1 time
Occupancy Permit	1 time
Environmental Permits	
Dive Permit	on the day of dive only
Project Covered by an EIS Report	no expiration
Project Covered by an IEER Report	no expiration
Project Covered by an EPRMP Report	no expiration
Project Covered by an IEEC Report	no expiration
Certificate of Non-Coverage (CNC)	no expiration
Permit to Operate a Pollution Control Device and/or Discharge Permit	1-year for air; 5-years for wastewater
Health & Sanitation permits	
Sanitary Clearance	1-year
PHSD Clearance for SBMA Accreditation	1-year
Hazardous Operation Permit	**contract dependent**
Import/Export permits	
Direct Trader Input Accreditation (Import/Export)	1-year
Admission Permit (Import/Export)	1-year
Single Administrative Document (Import/Export)	1-year
Export Clearance	1-year
Approval of List of Importables to Etaps	1-year
Client Profile Registration and Customs Client Number	1-year

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Permit	Validity
Transportation Accreditation (privately-owned vehicles)	1-year
Seaport permits	
Vessel Entry Clearance	24 hrs
Vessel Exit Clearance	24 hrs
Gate pass and sub-gate pass	max. 1-month
Bring-in permit	1-month
Local/Foreign Transshipment Declaration	1-month
Temporary Transfer permit	1-month
Clearance for Cargos Exiting Tipo	n/a
Certificate of Ownership of Leasehold Rights: Mandatory Registration	contract dependent
Business Accreditation of Suppliers and Service Providers	1-year
Subic-Clark Visa	
Special Subic-Clark Working Visa (SS-CWV)	2-years
Special Subic-Clark Investor's Visa (SS-CIV)	contract dependent
Environmental Certificates	
Environmental Compliance Certificates (ECC) for shipbuilding and terminal facilities.	N/A
Hazardous waste generator permit	Until hazardous waste types are changed
Certificate of disposal for residual waste in landfill	N/A
Certificate of treatment for diesel with water	N/A
Hazardous waste haulers	N/A
Landfill compliance	N/A
Transport compliance	N/A
Residual and Recycling Compliance	N/A
Scrap materials compliance	N/A
Treatment storage and disposal compliance	N/A

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DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Site certificate No.:
55527CC2-2009-AE-KOR-KAB

Initial certification date:
19 June, 2006

Valid:
19 June, 2018 - 19 June, 2021

Belongs to Central Office Certificate No.:
55527-2009-AE-KOR-KAB

This is to certify that the management system of

HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.

HHIC-Phil Subic Ship Yard: Green Beach1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, 2200, Subic, Zambales, Philippines

has been found to conform to the Environmental Management System standard:
ISO 14001:2015, KS I ISO 14001:2015

This certificate is valid for the following scope:

Design and Manufacture of Steel Ship, Chemical Carrier, Refrigerated Carrier, Full Container Carrier, LNG/LPG Carrier, Special Purpose Ship (War Ship and Training Ship), Steel Structure for Ship and Power Generation Plant and Steel Bridge.

Place and date:
Seoul 07 June, 2018

KAB-EC-13
Accredited by Member of the IAF for EMS

For the issuing office:
DNV GL – Business Assurance
18F, Kyobo Bldg., 1, Jong-ro, Jongno-gu, Seoul, Korea

In-Kyoon Ahn
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
DNV GL Business Assurance Korea Ltd is accredited by Korea Accreditation Board (KAB) as an Environmental Management System certification body (Accreditation number: KAB-EC-13).
ACCREDITED UNIT: DNV GL Business Assurance Korea Ltd, 18F Kyobo Bldg., 1 Jong-ro, Jongno-gu, Seoul, Republic of Korea. TEL:+82 2 724 8413.
dnvgl.co.kr/assurance

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Site certificate No.:
31574CC2-2008-AHSO-KOR-KAB

Initial certification date:
19 June, 2006

Valid:
19 June, 2018 - 19 June, 2021

Belongs to Central Office Certificate No.:
31574-2008-AHSO-KOR-KAB

This is to certify that the management system of

HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.

HHIC-Phil Subic Ship Yard: Green Beach1, Redondo Peninsula, 2200, Subic, Zambales, Philippines

has been found to conform to the Occupational Health and Safety Management System standard:
OHSAS 18001:2007, K-OHSMS 18001:2007

This certificate is valid for the following scope:

Design and Manufacture of Steel Ship, Chemical Carrier, Refrigerated Carrier, Full Container Carrier, LNG/LPG Carrier, Special Purpose Ship (War Ship and Training Ship), Steel Structure for Ship and Power Generation Plant and Steel Bridge.

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Korea Accreditation Board
KAB
한국인정지원센터
KAB-OC-27

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dnvgl.kr/assurance

Republic of the Philippines
DEPARTMENT OF LABOR AND EMPLOYMENT
Regional Office No. III
Sugar Workers' Livelihood Center cor. Matalino & Mahusay Sts.,
Diosdado Macapagal Government Center, Brgy. Maimpis,
City of San Fernando, Pampanga

ISO 9001:2015 Certified

1st Indorsement
19 August 2019

Respectfully indorsed to **DR. MA. TERESITA S. CUCUECO, CESO III, Bureau of Working Conditions,** 3rd Floor, DOLE Building, Muralla cor. Gen. Luna Streets, Intramuros, Manila, for her appropriate action, the herein letter of Atty. Rosario S. Bernaldo, CPA, the Court-Appointed Rehabilitation Receiver of HHIC-PHILS INC., on SEC Case No. 19-001 regarding their request to postpone the annual inspection of heavy equipment units as well as renewal of permit to operate equipments of HHIC-PHILS. INC. until resumption of its shipbuilding activities.

MA. ZENAIDA A. ANGARA-CAMPITA
Regional Director

Cc: Atty. Rosario S. Bernaldo, CPA
Unit 1810 Cityland Condominium 10
Tower 1 6815 H.V. Dela Costa cor. Ayala Ave.
Makati City

Hanjin Heavy Industries and Construction Philippines, Inc.
Greenbeach 1, Redondo Peninsula, Sitio Agusuhin
Brgy. Cawag, Subic, Zambales

ATTY. ROSARIO S. BERNALDO, CPA
Unit 1810 Cityland Condominium 10
Tower 1 6815 H.V. Dela Costa corner Ayala Avenue, Makati City
Tel. No. 02-840-0535; Email address: rsbassoc@rsbernaldo.com

June 24, 2019

MA. ZENAIDA ANGARA- CAMPITA
Regional Director
Department of Labor and Employment–RO III
Diosdado Macapagal Regional Government Center
Barangay Maimpis, City of San Fernando, Pampanga



Subject: **Request for Indefinite Postponement of Compliance with Renewal of Permit to Operate Equipments and Inspection of Heavy Equipment in HHIC-Phil Inc. Subic Shipyard**

Dear Director Campita,

The undersigned is the court-appointed rehabilitation receiver of HHIC-Phil Inc. in SEC Case No. 19-001 (IN RE: PETITION FOR REHABILIATION, HHIC-PHIL, INC., Petitioner).

Please be informed that since February of this year, the entire 326-ha Subic shipyard of HHIC-Phil has ceased commercial operations. Save for the routine maintenance of the facilities manned by a handful of workers at the sprawling shipyard, vessel production including allied activities has been totally discontinued pending the approval of the Company's proposed rehabilitation plan by the rehabilitation court[1]. However, with no other viable source of income, HHIC-Phil has been in constraints to operate on a very tight cash flow for the upkeep of the idle Subic shipyard and its various support facilities.

While the undersigned receiver acknowledges DOLE's exercise of authority over HHIC-Phil on the matter of occupational health and safety requirements, it is my fervent wish through this humble representation that your good office will afford HHIC-Phil some leeway in its compliance with the above subject regulations taking into account the Company's peculiar circumstances surrounding its ongoing corporate rehabilitation.

In this light, I would like to respectfully request that HHIC-Phil's compliance with the annual inspection of heavy equipment units as well as the renewal of the Certificate of Permit to Operate Equipments be indefinitely postponed, as the rehabilitation court judiciously evaluates the viability of the Company's rehabilitation plan. Rest assured that the Company will strictly abide by these regulations with reasonable dispatch if and when its shipbuilding activities resume in the future.

Your positive response to this request will be highly appreciated.

Sincerely yours,

ATTY. ROSARIO S. BERNALDO, CPA
Rehabilitation Receiver of HHIC-Phil Inc.

Cc: HHIC-Phil Inc.

[1] Regional Trial Court Branch 72 of Olongapo City

Receiving Copy

ATTY. ROSARIO S. BERNALDO, CPA
Unit 1810 Cityland Condominium 10
Tower 1 6815 H.V. Dela Costa corner Ayala Avenue, Makati City
Tel. No. 02-840-0535; Email address: rsbassoc@rsbernaldo.com

June 24, 2019

DOLE R.O.III
IMSD RECORDS
RECEIVED
JUL 03 2019
SIGNATURE
TIME

MA. ZENAIDA ANGARA- CAMPITA
Regional Director
Department of Labor and Employment–RO III
Diosdado Macapagal Regional Government Center
Barangay Maimpis, City of San Fernando, Pampanga

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[1] Regional Trial Court Branch 72 of Olongapo City

Republic of the Philippines
Department of Environmental and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
Region III
Regional Office III, Turquoise St., RAMAR Village, San Agustin, City of San Fernando, Pampanga
Tel No: (045) 455-3080 Fax No: (045) 455 3316

Date: Apr 20, 2019 Permit No.: DP-R03-19-00994

WASTEWATER DISCHARGE PERMIT

Pursuant to Section 14, Article 2, of the RA 9275 otherwise known as the "Philippine Clean Water Act of 2004", this permit is hereby granted to **HHIC PHILS. INC.** with office address at GREENBEACH1, REDONDO PENINSULA, Cawag, Subic, Zambales for its establishment:

HHIC PHILS INC TIN No. 243-631-832-000	GREENBEACH1, REDONDO PENINSULA Cawag SUBIC

Permit Conditions

1. The permit holder shall discharge to **Agusuhin River,** for the period of one (1) year with effluent wastewater flow not exceeding **513 and 467 cubic meters per day** for STP 1 and STP 2 respectively and in conformity with DENR Department Administrative Order No. 2016-08 (Water Quality Guidelines and General Effluent Standards) and shall comply with the following Standards:

Parameters	Standards	Parameters	Standards
pH	6.0-9.0	Cyanide)	0.14 mg/L
COD	60 mg/L	Fluoride	2 mg/L
Total Suspended Solids	85 mg/L	Boron	2 mg/L
Ammonia	0.5 mg/L	Chromium	0.02 mg/L
Nitrate	14 mg/L	Iron	5 mg/L
Phosphate	1 mg/L	Nickel	0.2 mg/L
Sulfate	500 mg/L	Lead	0.02 mg/L
Oil and Grease	5 mg/L	Trichloroetylene	0.7 mg/L

2. The permit holder shall submit a quarterly Self-Monitoring Report on or before the 15th day after the end of every quarter.
3. The permit holder shall submit a Compliance Monitoring Report semi-annually to include:
   Proof of Compliance with RA 9003 (Ecological Solid Waste Management Act)
   - Photo of designated temporary storage area/MRF for recyclables, electronic wastes, BFLs, batteries and other special waste;
   - Copy of Contract/MOA with the LGU as hauler and with Contract/MOA with accredited Sanitary Landfill (SLF) for disposal of residual waste; and
   - Copy of Certificate of Disposal/ Treatment issued by accredited SLF and TSD Facility operators.

   Proof of Compliance with RA 9275 (Clean Water Act)
   - That domestic wastewater/septage generated shall be hauled/transported and treated by government (LGU, DOH, DENR-EMB) Licensed Hauler/Treater.
4. The Permit holder shall allow the entry of DENR-EMB Region 3 Personnel to subject establishment or facility for inspection or compliance monitoring by this Office.
5. Collection and analysis of effluent shall be exclusively conducted within two (2) months prior to expiry date of this Permit by a third-party DENR EMB- Acredited Laboratory and shall form part of the permit application including the photo documented chain of custody.
6. A flow measuring device shall be installed and maintained in good operating condition after the Wastewater Treatment Facility (WTF)
7. This permit shall be properly framed and posted in a conspicuous place at the plant or establishment.

This is a computer generated certificate. To verify the authenticity of this file, kindly scan the generated QR Code using your QR Code scanner/reader or visit the OPMS website for details.

8. Proper labeling and storage of hazardous waste shall be implemented.
9. This permit is the renewal of DP- 18B-03ZA-885 and shall be renewed at least one (1) month before the expiry date.

This permit is valid up to *Apr 20, 2020*, unless revoked or suspended by this Office in writing.

Non-compliance with the above conditions and/or any pertinent provisions of RA 9275 otherwise known as "Philippine Clean Water Act of 2004", a corresponding penalty in the amount of P10,000-P200,000 per violation shall be imposed.

Recommended by:

ENGR. DENNIS O. CELESTIAL
Chief, Clearance and Permitting Division

Approved by:

LORMELYN E. CLAUDIO, CESO IV
Regional Director

Filing Fee	: Php 55.00	O.R. No. :	2320446	Date :	Jan. 25, 2019
PD1856	: Php 10.00	O.R. No. :	2320446	Date :	Jan. 25, 2019
Documentary Stamp Tax	: Php 30.00	O.R. No. :	2320446	Date :	Jan. 25, 2019
Permit Fee	: Php 3300.00	O.R. No. :	2314530 / 2320750	Date :	March 4, 2019
Water Discharge Fee	: Php 26827.50	O.R. No. :	2314530 / 2320750	Date :	March 4, 2019

This is a computer generated certificate. To verify the authenticity of this file, kindly scan the generated QR Code using your QR Code scanner/reader or visit the OPMS website for details.

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olangapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

MAR 23 2016

ECC Ref. Code No. R03-1302-0067
HHIC PHILS., INC.
Brgy. Cawag, Subic
Zambales

Dear Sir/Madam,

This refers to your application for the amendment of the Environmental Compliance Certificate (ECC) for the **proposed expansion of the existing Shipbuilding Facility** located at Brgy. Cawag, Subic, Zambales.

After satisfying the requirements of the said application, this Office has decided to grant an amended Environmental Compliance Certificate (ECC) to the above-mentioned project.

In issuing this **CERTIFICATE**, it is expected that you will diligently secure pertinent PERMITS/CLEARANCES from all concerned government agencies.

With the issuance of this ECC, you are expected to implement the measures presented in the submitted Environmental Performance Report and Management Plan (EPRMP), intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project. You may proceed with project implementation, after securing all the necessary permits from the pertinent government agencies. This Office will be monitoring the project periodically to ensure your compliance with the stipulations cited in the attached ECC.

Please be guided accordingly.

Very truly yours,

LORMELYN E. CLAUDIO, CESO IV
Regional Director

cc: LGU-Subic, Zambales
Municipal Engineers Office
Department of Health
Department of Labor and Employment
Municipal Planning and Development Office
Philippine Ports Authority

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(Issued Under Presidential Decree 1586)

R03-1302-0067

Amended

THIS IS TO CERTIFY THAT THE **HHIC PHILS., INC.** is granted this Environmental Compliance Certificate (ECC) for the **proposed expansion of the existing Shipbuilding Facility** located at **Brgy. Cawag, Subic, Zambales** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

THIS IS SUBJECT to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have been provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover operation of Shipbuilding Facility (Group 3.8.1) covering an area from 303.46 hectares to 309.58 hectares with the following project component:

Existing Facilities covering 303.46 hectares

- Pre-treatment Shops, Hull Shops, Assembly Shops, Sub-Assembly Shop, Pre-Outfitting Shops, Blasting and Painting Shops, Material Store and Bond Shop, Guest House, Panel Shop, Outfitting Shop, Welding Shops, Main Office, Visitor Center (Information Center), Tool Shop, Catering Center, Production Distribution Center (PDC), Main Power Station, Air-Compressor Rooms, Sub-Station Areas, Main Gate 1 & 2, Generator Rooms, Pre-Erection Shelters, Steel Stock Yards, Maintenance Shop-A, Dry Dock Movable Shelters, Fire station, Gasoline Station, Paint Can Stock Area, Yard Toilets and Shower Areas, Hatch Cover Shelters, Helicopter Hangar, Field Offices, Piping Manufacture Shops, Distribution Shop, Waste Matter Stock, Scrap Iron Stock, T-BHD Shelters, Deck House Shelters, Watch Towers

Expansion Facilities covering 6.12 hectares

- Maintenance Shop-B, Canteen, Toilet, Recreation Room, Education Room, Sub-station, Locker room

Project Geographical Coordinates/Location:

		Existing	*Proposed*
North Latitude	-	$14^0$49'10.33"	$14^0$48'48.56"
East Longitude	-	$120^0$12'30.03"	$120^0$11'34.21"

"The Earth is the Lord's and all that is in it (Psalm 24:1)
... Let's be good stewards!"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or errors that may be found after issuance of this certificate.

Issued at City of San Fernando, Pampanga, this MAR 23 2016.

Recommending Approval:

DENNIS O. CELESTIAL
Chief, Clearance and Permitting Division

Approved by:

LORMELYN E. CLAUDIO, CESO IV
Regional Director

SWORN STATEMENT OF OWNER/AUTHORIZED REPRESENTATIVE

I IRENE I. LUMALI, proponent of this HHIC - Phil located in Brgy Cawag, Subic, Zambales takes full responsibility in complying with all conditions contained in this Environmental Compliance Commitment (Environmental Compliance Certificate or ECC).

Signature

TIN 243-631-837-000

Subscribed and sworn to before me this APR 01 2016 day of _____, 2016, the above-named affiant taking oath presenting Residence Certificate No. _____ issued on _____ 2016 at _____.

BIENVENIDO E. BACANI
Notary Public
Until December 31, 2017
PTR No. [illegible]
IBP No. 0993483 - 1/4/16
Roll No. 25657
MCLE No. IV-0008783

NOTARY PUBLIC

Doc. No. 618
Page No. 124
Book No. 26
Series of 2016

Annex A

I. CONDITIONS

A. ENVIRONMENTAL MANAGEMENT and MONITORING PLAN (EMMoP)

1. All mitigating measures in the submitted Environmental Performance Report and Management Plan (EPRMP) shall be implemented;

2. Implement waste minimization, segregation, re-use and other ecological waste management practices.

3. Planting of native tree species shall be undertaken either within the project site and/or in other areas as part of the proponent's social and environmental program. The proponent shall submit to this Office within thirty (30) days from the date of approval of this ECC the Tree/Vegetation Plantation Plan which includes quantities and plant species, area/location and planting strategy and management programs, etc.;

B. GENERAL CONDITIONS

4. The proponent shall comply with the requirements of other environmental laws, i.e. Republic Act (RA) 8749 or "The Clean Air Act of 1999", RA 6969 or "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990", RA 9003 or "Ecological Solid Waste Management Act of 2000" and RA 9275 or "Clean Water Act of 2004', among which are:

   - Secure Permit to Operate Air Pollution Source Control Installations (APSCI) and Discharge Permit Water Pollution Source/Facilities (WPSCF)
   - Designate Pollution Control Officer (PCO)
   - Submit quarterly Self Monitoring Report
   - Submit semi-annual Compliance Monitoring Report
   - Register as Hazardous Waste Generator

5. The proponent shall construct and operate a Septage Treatment Facility with appropriate impermeable high density linings to prevent groundwater contamination and to treat domestic wastewater pursuant to DENR Memorandum Order dated February 10, 2004, otherwise, individual multi-chambered septic tank with appropriate impermeable high density linings shall be properly constructed and septage shall be hauled/transported and treated by a third party Licensed Hauler and Treater.

6. Comply with RA 9003 (Ecological Solid Waste Management Act) in coordination with the Local Government Unit (LGU) by implementing the following:

   a. The proponent shall establish and institute an ecological solid wastes management system to ensure segregation at source, segregated, collection, temporary storage at the Materials Recovery Facility (MRF) and appropriate disposal of solid and hazardous wastes, waste minimization and other ecological waste management practices;

   b. Construct a Materials Recovery Facility (MRF) with composting system for biodegradable wastes, recyclables and temporary storage area for electronic wastes, busted fluorescent lamps (BFLs), batteries and other special/ hazardous wastes;

c. Ensure the proper disposal of solid wastes. As such, provide a copy of Contract/Memorandum of Agreement (MOA) with the Local Government Unit (LGU) as hauler and with Contract /MOA with an accredited Sanitary Landfill (SLF) for disposal of residual wastes;

d. Provide copy of Certificate of Disposal/Treatment issued by accredited Sanitary Landfill (SLF) and Treatment, Storage and Disposal (TSD) Facility operators;

7. The proponent shall ensure that the facility should be strong enough to withstand the major impact of hazards that could occur in the area related to ground shaking, storm surge, tsunami and debris flow/flooding and that the flow of sea current will not be impeded;

8. The proponent shall conduct semi-annual ambient air sampling tests for Total Suspended Particulates (TSP)and noise and quarterly stream (i.e. groundwater, marine water and surface water) sampling tests for parameters such as Biochemical Oxygen Demand (BOD), oil and grease, coliform, Total Suspended Solids (TSS), Heavy Metals and other applicable parameters (air and water) and results of which shall be submitted to EMB Region 3 as part of the Self Monitoring Report;

9. Provide spill boom and other form of contingency measures to address oil spills to the coastal area;

10. The proponent shall construct and operate its Wastewater Treatment Facility (WTF) effectively to ensure compliance with the effluent standards of the DENR. The WTF shall be installed/provided with appropriate non-permeable high density linings to treat wastewater with oil and other contaminants/sediments;

11. Implement appropriate chemical and hazardous waste storage and handling practices (e.g. labeling/placards and segregation according to compatibilities of hazard areas;

12. Legal easement on the riverbanks and other waterways shall be observed;

13. Copy of Environmental Compliance Certificate (ECC) shall be posted in a conspicuous area in the project site;

14. The proponent shall formulate and implement Information Education Campaign (IEC) programs incorporating recommended environmental management practices through but shall not be limited to various advertising media (i.e., posters, billboards, etc).

15. That should there be any complaint from the community related to marine pollution and environmental sanitation problem brought about by the project's operation, the proponent shall be held responsible to address such problem;

16. The proponent shall allow inspection or monitoring that will be conducted by this Office anytime in coordination with concerned groups;

17. The proponent shall set-up a Clustered Multipartite Monitoring Team (MMT) for HHIC Phil., Inc. projects with issued ECC composed of representatives from the proponent, concerned LGU, stakeholders and this Office within sixty (60) days from receipt of this Certificate. Likewise, an Environmental Monitoring Fund (EMF) to cover all costs attendant to the operation of the MMT and an Environmental Guarantee Fund (EGF) to cover compensation to damages shall be established;

18. The proponent shall submit to this Office an updated Marine Biodiversity Conservation and Quality Study and a Navigational Management Plan;

19. The fuel, oil and chemical storage area shall be provided with adequate secondary containment, availability of clean-up materials, fire safety measures, high density lining and leak detection system in place to prevent possible leakage, contamination of soil and groundwater and fire hazards;

20. An Engineering Geological and Geohazard Assessment Report (EGGAR) that is based on the Geological Site Scoping Report (GSSR) from the Mines and Geosciences Bureau (MGB) Region 3 particularly on earthquake, flooding, erosion, tsunami, etc. shall be submitted to this Office sixty (60) days from receipt of this Certificate. All recommendations in the submitted EGGAR shall be incorporated in the structural design and strictly implemented;

21. This Certificate shall supersede the ECC with Reference Code No. R03-1302-0067 dated September 20, 2013. Original copy of superseded ECC (R03-1302-0067) shall be surrendered within thirty (30) days upon receipt of this Certificate;

II. RESTRICTIONS

22. No cutting of trees shall be undertaken without first securing a Permit to Cut/ Earth Ball from the DENR-Forest Management Service (FMS), Region III. Any cutting of trees implemented without the necessary Permit approved by the FMS will render this Certificate cancelled or suspended;

23. Dust prevention and mitigating measures shall be strictly implemented during ship building/repair and sandblasting activities. Wind flow direction devices shall be installed in strategic locations;

24. Any expansion or modification of the approved project shall be subject to new EIA requirement; and

25. In case of transfer of ownership of this project, these same conditions and restrictions shall apply and the transferee shall be required to notify this Office within fifteen (15) days as regards to the transfer of ownership.

Non-compliance with any of the provisions of this certificate shall be a sufficient cause for the cancellation or suspension of this certificate and/or imposition of a fine in an amount not to exceed Fifty Thousand Pesos (50,000.00) for every violation thereof.

O.R. No. : 8017962
Proposed Fee : P1,200
Date : February 26, 2016

Annex B

PROJECT ASSESSMENT PLANNING TOOL

This is for the assistance of the Proponent and government agencies concerned in the management of the project and for better coordination in mitigation on the impact of the project on its surrounding areas and to the environment.

By way of recommendation, the following have been taken notice by the undersigned and are forwarding these recommendations to the parties and authorities concerned for proper appreciation and action.

RECOMMENDATIONS TO CONCERNED GOVERNMENT AGENCIES/LGUs		CONCERNED GOVERNMENT AGENCIES /ENTITIES
1. Provide drainage canal, concrete culverts, and other flood control measures to adequately receive and channel the run-off of silt-laden rain water to the nearby receiving body of water.		Municipal Engineers Office/SBMA/ Proponent
2. Provide segregation, collection, recycling, and disposal mechanism for solid waste.		LGU
3. Comply with the Sanitation Code of the Philippines, Labor Code of the Philippines including Occupational Health and Safety Standards and Building Code of the Philippines.		DOH, DOLE-Bureau of Working Condition and Municipal Planning & Devt. Office/LGU
4. Secure Permit		Philippine Ports Authority (PPA)
5. Secure Foreshore Lease Agreement		DENR
6. Secure necessary Permits		LGU Concerned
ENVIRONMENTAL PLANNING RECOMMENDATIONS FOR THE PROPONENT The following are recommendations for the Proponent for the protection of the project area and the affected environment. It is strongly recommended that the same be strictly complied by the Proponents.		
1. Undertake close monitoring of the project to maintain a high level of safety & efficiency and to immediately address any environmental hazards or change that may take place.		
2. Formulate and implement Emergency Preparedness, Contingency Plan and Preventive Maintenance to address possible case of flooding, landslide and other nuisance by the proponent and submitted to this Office and other concerned government agencies within thirty (30) days from receipt of this Certificate.		

For dissemination and proper action of the parties concerned.

DENNIS O. CELESTIAL
Chief, Clearance and Permitting Division

LORMELYN E. CLAUDIO, CESO IV
Regional Director

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

SEP 2 0 2013

ECC Ref. Code No. R03-1302-0067
HHIC PHILS., INC.
Brgy. Cawag, Subic
Zambales

Dear Sir/Madam,

This refers to your application for an Environmental Compliance Certificate (ECC) for the **existing Shipbuilding Facility** located at Brgy. Cawag, Subic, Zambales.

After satisfying the requirements of the said application, this Office has decided to grant an Environmental Compliance Certificate (ECC) to the above-mentioned project.

In issuing this **CERTIFICATE**, it should be understood that the same is a **PLANNING TOOL** and not a **PERMIT**. It is expected that you will diligently secure pertinent PERMITS/CLEARANCES from all concerned government agencies.

With the issuance of this ECC, you are expected to implement the measures presented in the Initial Environmental Examination (IEE), intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project. You may proceed with project implementation, after securing all the necessary permits from the pertinent government agencies. This Office will be monitoring the project periodically to ensure your compliance with the stipulations cited in the attached ECC.

Please be guided accordingly.

Very truly yours,

LORMELYN E. CLAUDIO
Regional Director

cc: LGU-Subic, Zambales
Municipal Engineers Office
Department of Health
Department of Labor and Employment
Philippine Ports Authority

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(Issued Under Presidential Decree 1586)

R03-1302-0067

THIS IS TO CERTIFY THAT **HHIC PHILS. INC.** is granted this Environmental Compliance Certificate (ECC) for the **existing Shipbuilding Facility** located at **Cawag, Subic, Zambales,** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

SUBJECT ONLY to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have been provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover the operation of a shipbuilding facility (Group II-P.3) covering an area of 303.46 hectares.

Project Geographical Coordinates/Location:
North Latitude - $14^0$49'10.33"
East Longitude - $120^0$12'30.03"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or errors that may be found after issuance of this certificate.

Issued at City of San Fernando, Pampanga this SEP 2 0 2013.

Recommending Approval:

DENNIS O. CELESTIAL
Chief, Environmental Impact Assessment
& Management Division

Approved by:

LORMELYN E. CLAUDIO
Regional Director

SWORN STATEMENT OF OWNER/AUTHORIZED REPRESENTATIVE

I Min Hwan Choi, proponent of this Shipbuilding Facility located in Brgy. Cawag, Subic, Zambales takes full responsibility in complying with all conditions contained in this Environmental Compliance Commitment (Environmental Compliance Certificate or ECC).

Signature

TIN _____

Subscribed and sworn to before me this NOV 12 2013 day of _____, 2013, the above-named affiant taking oath presenting Residence Certificate No. _____ issued on _____ 2013 at _____.

CONRADO T. DAMAN
Notary Public
Until December 31, 2013
PTR No. 3462925-1/2/13
IBP No. 903684-1/2/13
Pampanga
Roll No. 27347
MCLE No. IV-0010126

NOTARY PUBLIC

Doc. No. 90
Page No. 12
Book No. 12
Series of 2013

I. CONDITIONS

A. ENVIRONMENTAL MANAGEMENT and MONITORING PLAN (EMMoP)

1. All mitigating measures in the submitted Initial Environmental Examination (IEE) shall be implemented;

2. Implement waste minimization, segregation, re-use and other ecological waste management practices.

3. Planting of trees shall be undertaken either within the project site and/or in other areas as part of the proponent's social and environmental program. The proponent shall submit to this Office within thirty (30) days from the date of approval of this ECC the Tree/Vegetation Plantation Plan which includes quantities and plant species, area/location and planting strategy and management programs, etc.;

B. GENERAL CONDITIONS

4. The proponent shall comply with the requirements of other environmental laws, i.e. Republic Act (RA) 8749 or "The Clean Air Act of 1999", RA 6969 or "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990", RA 9003 or "Ecological Solid Waste Management Act of 2000" and RA 9275 or "Clean Water Act of 2004', among which are:

   - Secure Permit to Operate Air Pollution Source Control Installations (APSCI) and Discharge Permit Water Pollution Source/Facilities (WPSCF)
   - Designate Pollution Control Officer (PCO)
   - Submit quarterly Self Monitoring Report
   - Submit semi-annual Compliance Monitoring Report
   - Register as Hazardous Waste Generator

5. The proponent shall ensure that the facility should be strong enough to withstand the major impact of hazards that could occur in the area related to ground shaking, storm surge, tsunami and debris flow/flooding and that the flow of sea current will not be impeded;

6. The proponent shall conduct semi-annual ambient air sampling tests for Total Suspended Particulates (TSP) and noise and quarterly stream (i.e. groundwater, marine water and surface water) sampling tests for parameters such as Biochemical Oxygen Demand (BOD), oil and grease, coliform, Total Suspended Solids (TSS), Heavy Metals and other applicable parameters (Air and Water) and results of which shall be submitted to EMB Region 3 as part of the Self Monitoring Report;

7. Provide spill boom and other form of contingency measures to address oil spills to the coastal area;

8. The proponent shall construct and operate its Wastewater Treatment Facility (WTF) effectively to ensure compliance with the effluent standards of the DENR. The WTF shall be installed/provided with appropriate non-permeable high density linings to treat wastewater with oil and other contaminants/sediments;

9. Implement appropriate chemical and hazardous wastes storage and handling practices (e.g. labelling/placards and segregation according to compatibilities of hazard areas;

10. Ensure that a minimum clearance of 20 linear meter width based from the line reached by the highest tide must be reserved for public use;

11. Copy of Environmental Compliance Certificate (ECC) shall be posted in a conspicuous area in the project site;

12. The proponent shall formulate and implement Information Education Campaign (IEC) programs incorporating recommended environmental management practices through but shall not be limited to various advertising media (i.e., posters, billboards, etc).

13. That should there be any complaint from the community related to marine pollution and environmental sanitation problem brought about by the project's operation, the proponent shall be held responsible to address such problem;

14. The proponent shall allow inspection or monitoring that will be conducted by this Office anytime in coordination with concerned groups;

15. The proponent shall set-up a Multipartite Monitoring Team (MMT) composed of representatives from the proponent, concerned LGU, stakeholders and this Office within sixty (60) days from receipt of this Certificate. Likewise, an Environmental Monitoring Fund (EMF) to cover all costs attendant to the operation of the MMT and an Environmental Guarantee Fund (EGF) to cover compensation to damages shall be established;

16. In case an access road shall be constructed, a Road-Right of Way shall be secured subject to EIA requirements;

17. The proponent shall submit to this Office an updated Marine Biodiversity and Quality Study and a Navigational Management Plan within sixty (60) days from receipt of this Certificate;

18. The fuel, oil and chemical storage area shall be provided with adequate secondary containment, availability of clean-up materials, fire safety measures, high density lining and a leak detection system in place to prevent possible leakage, contamination of soil and groundwater and fire hazards;

19. An Engineering Geological and Geohazard Assessment Report (EGGAR) that is based on the Geological Site Scoping Report (GSSR) from the Mines and Geosciences Bureau (MGB) Region 3 particularly on earthquake, flooding, erosion, tsunami, storm surge, etc. shall be submitted to this Office sixty (60 days from receipt of this Certificate. All recommended measures in the submitted EGGAR shall be incorporated in the structural design and strictly implemented;

II. RESTRICTIONS

20. Dust prevention and mitigating measures shall be strictly implemented during ship building/repair and sandblasting activities. Wind flow direction devices shall be installed in strategic locations;

21. Any expansion or modification of the approved project shall be subject to new EIA requirement; and

22. In case of transfer of ownership of this project, these same conditions and restrictions shall apply and the transferee shall be required to notify this Office within fifteen (15) days as regards to the transfer of ownership.

Non-compliance with any of the provisions of this certificate shall be a sufficient cause for the cancellation or suspension of this certificate and/or imposition of a fine in an amount not to exceed Fifty Thousand Pesos (50,000.00) for every violation thereof.

O.R. No. : 7310673
Proposed Fee P4,000
Date : October 4, 2012

Annex B

PROJECT ASSESSMENT PLANNING TOOL

For the assistance of the Proponent and government agencies concerned in the management of the project and for better coordination in mitigation on the impact of the project on its surrounding areas and to the environment.

By way of recommendation, the following have been taken notice by the undersigned and are forwarding these recommendations to the parties and authorities concerned for proper appreciation and action.

RECOMMENDATIONS TO CONCERNED GOVERNMENT AGENCIES/LGUs		CONCERNED GOVERNMENT AGENCIES /ENTITIES
1. Provision of drainage canal, concrete culverts, and other flood control measures to adequately receive and channel the run-off of silt-laden rain water to the nearby receiving body of water.		Municipal Engineers Office/SBMA/ Proponent
2. Provision of segregation, collection, recycling, and disposal mechanism for solid waste.		LGU
3.Compliance with the Sanitation Code of the Philippines, Labor Code of the Philippines including Occupational Health and Safety Standards and Building Code of the Philippines.		DOH, DOLE-Bureau of Working Condition and Municipal Planning & Devt. Office/LGU
4. Secure Permit		Philippine Ports Authority
5. Secure Foreshore Lease Agreement		DENR
6. Secure necessary Permits		LGU Concerned
ENVIRONMENTAL PLANNING RECOMMENDATIONS FOR THE PROPONENT The following are recommendations for the Proponent for the protection of the project area and the affected environment. It is strongly recommended that the same be strictly complied by the Proponents.		
1. Close monitoring by the proponent to maintain a high level of safety & efficiency and to immediately address any environmental hazards or change that may take place.		
2. Emergency Preparedness, Contingency Plan and Preventive Maintenance to address possible case of flooding, landslide and other nuisance shall be formulated by the proponent and submitted to this Office and other concerned government agencies within thirty (30) days from receipt of this Certificate.		

For dissemination and proper action of the parties concerned.

DENNIS O. CELESTIAL
Chief, EIAMD

LORMELYN E. CLAUDIO
Regional Director

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

SEP 2 0 2013

ECC Ref. Code No. R03-1302-0065
HHIC PHILS., INC.
Sitio Agusuhin, Redondo Peninsula
Subic, Zambales

Dear Sir/Madam,

This refers to your application for an Environmental Compliance Certificate (ECC) for the **existing Terminal Facility Operation** located at Sitio Agusuhin, Redondo Peninsula, Subic, Zambales.

After satisfying the requirements of the said application, this Office has decided to grant an Environmental Compliance Certificate (ECC) to the above-mentioned project.

In issuing this **CERTIFICATE**, it should be understood that the same is a **PLANNING TOOL** and not a **PERMIT**. It is expected that you will diligently secure pertinent PERMITS/CLEARANCES from all concerned government agencies.

With the issuance of this ECC, you are expected to implement the measures presented in the Initial Environmental Examination (IEE), intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project. You may proceed with project implementation, after securing all the necessary permits from the pertinent government agencies. This Office will be monitoring the project periodically to ensure your compliance with the stipulations cited in the attached ECC.

Please be guided accordingly.

Very truly yours,

LORMELYN E. CLAUDIO
Regional Director

cc: LGU-Subic, Zambales
Municipal Engineers Office
Department of Health
Department of Labor and Employment
Philippine Ports Authority

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(Issued Under Presidential Decree 1586)

R03-1302-0065

THIS IS TO CERTIFY THAT **HHIC PHILS. INC.** is granted this Environmental Compliance Certificate (ECC) for the **existing Terminal Facility Operation** located at **Sitio Agusuhin, Redondo Peninsula, Subic, Zambales,** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

SUBJECT ONLY to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have been provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover the operation of a terminal facility (Group II-P.3) covering an area of 501.84 square meters located along Argonaut Highway at the back of Asia International Auctioneers, Inc. and at the Staging Facility at HHIC Phil Inc. Ship Building Project at So. Agusuhin, Redondo Peninsula.

Project Geographical Coordinates/Location:
North Latitude - $14^0$49'38.77"
East Longitude - $120^0$12'52.46"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or errors that may be found after issuance of this certificate.

Issued at City of San Fernando, Pampanga this SEP 2 0 2013,

Recommending Approval:

DENNIS O. CELESTIAL
Chief, Environmental Impact Assessment
& Management Division

Approved by:

LORMELYN E. CLAUDIO
Regional Director

SWORN STATEMENT OF OWNER/AUTHORIZED REPRESENTATIVE

I Min Hwan Choi, proponent of this Terminal Facility Operation located in Sitio Agusuhin, Redondo Peninsula, Subic, Zambales takes full responsibility in complying with all conditions contained in this Environmental Compliance Commitment (Environmental Compliance Certificate or ECC).

Signature

TIN _____

Subscribed and sworn to before me this NOV 12 2013 day of _____, 2013, the above-named affiant taking oath presenting Residence Certificate No. _____ issued on _____ 2013 at _____.

CONRADO T. DANAN
NOTARY PUBLIC
Until December 31, 2013
PTR No. 3462925-1/2/13
IBP No. 903854-1/2/13
Pampanga
Roll No. 27347
MCLE No. IV-0010725

Doc. No. 899
Page No. 20
Book No. 2
Series of 2013

I. CONDITIONS

A. ENVIRONMENTAL MANAGEMENT and MONITORING PLAN (EMMoP)

1. All mitigating measures in the submitted Initial Environmental Examination (IEE) shall be implemented;

2. Implement waste minimization, segregation, re-use and other ecological waste management practices.

3. Planting of trees shall be undertaken either within the project site and/or in other areas as part of the proponent's social and environmental program. The proponent shall submit to this Office within thirty (30) days from the date of approval of this ECC the Tree/Vegetation Plantation Plan which includes quantities and plant species, area/location and planting strategy and management programs, etc.;

B. GENERAL CONDITIONS

4. The proponent shall comply with the requirements of other environmental laws, i.e. Republic Act (RA) 8749 or "The Clean Air Act of 1999", RA 6969 or "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990", RA 9003 or "Ecological Solid Waste Management Act of 2000" and RA 9275 or "Clean Water Act of 2004', among which are:

   - Secure Permit to Operate Air Pollution Source Control Installations (APSCI) and Discharge Permit Water Pollution Source/Facilities (WPSCF)
   - Designate Pollution Control Officer (PCO)
   - Submit quarterly Self Monitoring Report
   - Submit semi-annual Compliance Monitoring Report
   - Register as Hazardous Waste Generator

5. The proponent shall ensure that the facility should be strong enough to withstand the major impact of hazards that could occur in the area related to ground shaking, storm surge, tsunami and debris flow/flooding and that the flow of sea current will not be impeded;

6. The proponent shall conduct semi-annual ambient air sampling tests for Total Suspended Particulates (TSP) and noise and quarterly stream (i.e. groundwater, marine water and surface water) sampling tests for parameters such as Biochemical Oxygen Demand (BOD), oil and grease, coliform, Total Suspended Solids (TSS), Heavy Metals and other applicable parameters (Air and Water) and results of which shall be submitted to EMB Region 3 as part of the Self Monitoring Report;

7. Provide spill boom and other form of contingency measures to address oil spills to the coastal area;

8. The proponent shall construct and operate its Wastewater Treatment Facility (WTF) effectively to ensure compliance with the effluent standards of the DENR. The WTF shall be installed/provided with appropriate non-permeable high density linings to treat wastewater with oil and other contaminants/sediments;

9. Implement appropriate chemical and hazardous wastes storage and handling practices (e.g. labelling/placards and segregation according to compatibilities of hazard areas;

10. Ensure that a minimum clearance of 20 linear meter width based from the line reached by the highest tide must be reserved for public use;

11. Copy of Environmental Compliance Certificate (ECC) shall be posted in a conspicuous area in the project site;

12. The proponent shall formulate and implement Information Education Campaign (IEC) programs incorporating recommended environmental management practices through but shall not be limited to various advertising media (i.e., posters, billboards, etc).

13. That should there be any complaint from the community related to marine pollution and environmental sanitation problem brought about by the project's operation, the proponent shall be held responsible to address such problem;

14. The proponent shall allow inspection or monitoring that will be conducted by this Office anytime in coordination with concerned groups;

15. The proponent shall set-up a Multipartite Monitoring Team (MMT) composed of representatives from the proponent, concerned LGU, stakeholders and this Office within sixty (60) days from receipt of this Certificate. Likewise, an Environmental Monitoring Fund (EMF) to cover all costs attendant to the operation of the MMT and an Environmental Guarantee Fund (EGF) to cover compensation to damages shall be established;

16. In case an access road shall be constructed, a Road-Right of Way shall be secured subject to EIA requirements;

17. The proponent shall submit to this Office an updated Marine Biodiversity and Quality Study and a Navigational Management Plan within sixty (60) days from receipt of this Certificate;

18. The fuel, oil and chemical storage area shall be provided with adequate secondary containment, availability of clean-up materials, fire safety measures, high density lining and a leak detection system in place to prevent possible leakage, contamination of soil and groundwater and fire hazards;

19. An Engineering Geological and Geohazard Assessment Report (EGGAR) that is based on the Geological Site Scoping Report (GSSR) from the Mines and Geosciences Bureau (MGB) Region 3 particularly on earthquake, flooding, erosion, tsunami, storm surge, etc. shall be submitted to this Office sixty (60 days from receipt of this Certificate. All recommended measures in the submitted EGGAR shall be incorporated in the structural design and strictly implemented;

II. RESTRICTIONS

20. Wind flow direction devices shall be installed in strategic locations;

21. Any expansion or modification of the approved project shall be subject to new EIA requirement; and

22. In case of transfer of ownership of this project, these same conditions and restrictions shall apply and the transferee shall be required to notify this Office within fifteen (15) days as regards to the transfer of ownership.

Non-compliance with any of the provisions of this certificate shall be a sufficient cause for the cancellation or suspension of this certificate and/or imposition of a fine in an amount not to exceed Fifty Thousand Pesos (50,000.00) for every violation thereof.

O.R. No. : 7310673
Proposed Fee P4,000
Date : October 4, 2012

Annex B

PROJECT ASSESSMENT PLANNING TOOL

For the assistance of the Proponent and government agencies concerned in the management of the project and for better coordination in mitigation on the impact of the project on its surrounding areas and to the environment.

By way of recommendation, the following have been taken notice by the undersigned and are forwarding these recommendations to the parties and authorities concerned for proper appreciation and action.

RECOMMENDATIONS TO CONCERNED GOVERNMENT AGENCIES/LGUs		CONCERNED GOVERNMENT AGENCIES /ENTITIES
1. Provision of drainage canal, concrete culverts, and other flood control measures to adequately receive and channel the run-off of silt-laden rain water to the nearby receiving body of water.		Municipal Engineers Office/SBMA/ Proponent
2. Provision of segregation, collection, recycling, and disposal mechanism for solid waste.		LGU
3.Compliance with the Sanitation Code of the Philippines, Labor Code of the Philippines including Occupational Health and Safety Standards and Building Code of the Philippines.		DOH, DOLE-Bureau of Working Condition and Municipal Planning & Devt. Office/LGU
4. Secure Permit		Philippine Ports Authority
5. Secure Foreshore Lease Agreement		DENR
6. Secure necessary Permits		LGU Concerned
ENVIRONMENTAL PLANNING RECOMMENDATIONS FOR THE PROPONENT The following are recommendations for the Proponent for the protection of the project area and the affected environment. It is strongly recommended that the same be strictly complied by the Proponents.		
1. Close monitoring by the proponent to maintain a high level of safety & efficiency and to immediately address any environmental hazards or change that may take place.		
2. Emergency Preparedness, Contingency Plan and Preventive Maintenance to address possible case of flooding, landslide and other nuisance shall be formulated by the proponent and submitted to this Office and other concerned government agencies within thirty (30) days from receipt of this Certificate.		

For dissemination and proper action of the parties concerned.

DENNIS O. CELESTIAL
Chief, EIAMD

LORMELYN E. CLAUDIO
Regional Director

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
Turquiose Street, Zone 2, Ramar Village, San Agustin, City of San Fernando, Pampanga
Telephone Nos.: (045) 961-52-03 | 961-52-06
Email: emb@emb.gov.ph
Visit us at http://www.emb.gov.ph

HW GENERATOR REGISTRATION CERTIFICATE

AMENDED on July 11, 2018

Pursuant to Chapter 3 of DENR Administrative Order (DAO) No. 2013-22, the Implementing Rules Act (RA) 6969, this Certificate is issued to:

Name of HW Generator : HHIC-PHILS., INC.

Facility Address : Redondo Peninsula, Cawag, Subic, Zambales

You are hereby assigned with the new *on-line registration no*:

GR-R3-71-00078

This certifies that the above-named Hazardous Wastes Generator generates the following types of wastes:

Waste Class	Waste Number
Hydrochloric acid	**B202**
Lead compounds	**D406**
Mercury and mercury compounds	**D407**
Inorganic pigments	**F602**
Grease wastes	**H802**
Used industrial oil including sludge	**I101**
Vegetable oil including sludge	**I102**
Oil-contaminated Materials	**I104**
Waste electrical and electronic equipment (WEEE)	***M506***

1. The above-named HW Generator shall comply with all the requirements of R.A.6969, its Implementing Rules and Regulation and the Procedural Manual for Hazardous Wastes Management.

2. Submission of the duly notarized self monitoring report shall be made within fifteen (15) days after the end of every reporting period using prescribed format.

3. Please refer to this number whenever you make transactions with EMB on matters pertaining to RA 6969.

AUTHORIZED NAME : LORMELYN E. CLAUDIO, CESO IV
DESIGNATION : REGIONAL DIRECTOR
DATE : January 4, 2018

THIS IS A COMPUTER GENERATED DOCUMENT

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III, Turquoise Street, Zone 2, Ramar Village, San Agustin
City of San Fernando, Pampanga
Tel. Nos. (045) 455-3316, 455-3080, 455-4340
402-5071, 402-5073, 402-5074

POA-19B-03ZA-885
Permit No
Date: 8 April 2019

PERMIT TO OPERATE
Air Pollution Source and Control Installations

Pursuant to PART VI, RULE XIX of the Implementing Rules and Regulations of R.A. 8749, authority is hereby granted to:

HHIC – PHIL. SUBIC SHIPYARD (Name of Firm, Individual, Owner etc.)

Bo. Cawag, Subic, Zambales (Address)

to operate the following;

1. BLASTING & PRINTING SHOP A consisting of blasting shop with blasting cables and painting shop: Four (4) units 3,250 CMM Dust Collector; two (2) units 300 CMM Dust collector; twenty-four (24) units 50 CMM Vacuum Recovery leading to four (4) units 1,800 CMM Ventilation System
2. BLASTING & PRINTING SHOP B consisting of blasting shop with blasting cables and painting shop: Two (2) units 4,250 CMM Dust Collector; one (1) unit 300 CMM Dust collector; eighteen (18) units 50 CMM Vacuum Recovery leading to four (4) units 1,800 CMM Ventilation System
3. BLASTING & PRINTING SHOP C consisting of blasting shop with blasting cables and painting shop: Two (2) units 4,250 CMM Dust Collector; one (1) unit 300 CMM Dust collector; twelve (12) units 50 CMM Vacuum Recovery leading to four (4) units 1,800 CMM Ventilation System
4. BLASTING & PRINTING SHOP D consisting of blasting shop with blasting cables and painting shop: Two (2) units 4,250 CMM Dust Collector; one (1) unit 300 CMM Dust collector; twelve (12) units 50 CMM Vacuum Recovery leading to four (4) units 1,800 CMM Ventilation System
5. BLASTING & PRINTING SHOP E consisting of blasting shop with blasting cables and painting shop: One (1) unit 4,250 CMM Dust Collector; one (1) unit 300 CMM Dust collector; two (2) units 50 CMM Vacuum Recovery leading to two (2) units 1,800 CMM Ventilation System
6. PRE-TREATMENT SHOP A consisting of blasting machine and painting machine: One (1) unit 900 CMM Dust Collector; one (1) unit 400 CMM Carbon Tower
7. PRE-TREATMENT SHOP B consisting of blasting machine and painting machine: One (1) unit 1,000 CMM Dust Collector; one (1) unit 400 CMM Carbon Tower
8. PIPING AND PRE-TREATMENT SHOP: One (1) unit 1,500 CMM Precipitator (AC Tower); two (2) units 500 CMM Wet Scrubber; one (1) unit 95.65 hp Miura Boiler
9. MAIN POWER STATION: Eight (8) units [(2x1,250kW "CUMMINS"),(1x2,000kW "CUMMINS"),(2x1,500kW "CUMMINS"), (2x400kW "CATERPILLAR") and (1x400kW "CUMMINS") Diesel-fired Generator Set each provided with smoke stack
10. CO_2 Plant: One (1) unit 1,000 kg/ac CO_2 Generator System (Boiler) with smokestack and exhaust system

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Permit to Operate Air	
Self Monitoring Report (SMR) submission schedule	April 13,14,15,16, 17, 2019	July 13,14,15,16, 17, 2019	October 12,13,14,15,16, 2019	January 11,12,13,14,15, 2020	Renewal	POA-18B-03ZA-885
					ECC No.	R03-1302-0067
					HWGI.D.	GR-R3-71-00078

Recommended by:

DENNIS O. CELESTIAL
Chief, Clearance & Permitting Division

Approved by:

LORMELYN E. CLAUDIO, CESO IV
Regional Director

Permit Conditions:

1. Application for renewal of this Permit must be filed at least 30 days before its expiry date. Result of Source Sampling Test as prescribed for Air Pollution Installations shall be done within three (3) months prior to expiry date and shall form part of the permit application.
2. The permit holder shall submit Compliance Monitoring Report semi-annually.
3. A wind direction device visible to the surrounding community/ies shall be installed and maintained in good operating condition. Recording of wind directions shall be done weekly by the PCO and shall form part of the Self Monitoring Report (SMR).
4. Emission from the operations of the above equipment shall strictly conform with DAO No. 2000-81, otherwise known as the Implementing Rules and Regulations of the Philippine Clean Air Act of 1999.

Unless sooner revoked, this permit is valid up to: 28 February 2020

"The Earth is the Lord's and all that is in it (Psalm 24:1) ...Let's be good stewards!"

5. That domestic wastewater/septage generated shall be hauled/transported and treated by government (LGU, DOH, DENR-EMB) Licensed Hauler/Treater.

6. Proof of Compliance with RA 9003 (Ecological Solid Waste Management Act)
   - Photo of designated temporary storage area/MRF for recyclables, electronic wastes, BFLs, batteries and other special wastes;
   - Photo of backyard composting area/facility (if applicable) or proof of collection of compostable/biodegradable wastes;
   - Copy of Contract/MOA with the LGU as hauler and with Contract/MOA with accredited Sanitary Landfill (SLF) for disposal of residual wastes; and
   - Copy of Certificate of Disposal/Treatment issued by accredited SLF and TSD Facility operators.

This operating Permit shall be posted in a conspicuous location near the equipment and shall be adequately framed or otherwise protected against damage. Failure to comply with the permit conditions and relevant laws, rules and regulations implemented by this Office maybe sufficient cause for the revocation/cancellation of this permit, or payment of penalty/fine by the Permittee as provided pursuant to DAO No. 2000-81, otherwise known as the Implementing Rules and Regulations of the Philippine Clean Air Act of 1999 & PAB Resolution No. 10-A.

O.R. No.	Fee		Date
2311309	Permit Fee	52,740.00	2/22/19
2311309	Filling Fee	600.00	2/22/19
2311845 Addtl. Permit Fee:		1,220.00	6/20/19

ZELCO
ZAMBALES ECO LANDFILL CORPORATION
Barangay Naugsol, Subic, Zambales

Telephone Numbers:
Office: 09958302852
Sales: 09958302852
Email: zelcolandfill@yahoo.com.ph

CERTIFICATION

This certifies that ZAMBALES ECO LANDFILL CORPORATION (ZELCO) has accepted/stored/disposed on its Ecological Facility 238,285 kilos of general garbage generated by HHIC-Phils., Inc. shipbuilding facilities in Redondo Peninsula, Barangay Cawag, Subic, Zambales for the period May 1-31, 2019.

Issued and signed this 5th day of August, 2019 at Subic, Zambales.

Mr. CIRILO O. GOLOSINO
President

RECEIVED
SEP 19 2019
BY: JULIE ANN SANTOS

CERTIFICATE OF TREATMENT

COT No: 18-013 MF No: HHIC-003

I. TREATER:

RMS PETROLEUM TECHNOLOGY & WASTE MANAGEMENT CORPORATION
Sta. Rosa 1, Marilao, Bulacan

Telephone	:	(02)7105660 / 710-5651
TSD	:	TR 03-14-0025
ECC No	:	RO3-1001-0004
Permit to Operate	:	POA-12K-03BU-1643

II. TRANSPORTER:

ARNIELLE TRADING
117 M. L. Quezon St., P-2, Lower Bicutan, Taguig City

III. GENERATOR:

HHIC-PHIL. INC. SUBIC SHIPYARD (GR 03-71-0119)
Green Beach 1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, SBFZ

IV. TRANSPORT DETAILS

PERMIT TO TRANSPORT	:	03-14-0418-1694
DATE ISSUED	:	April 3, 2018
VALIDITY	:	April 3, 2018 to October 3, 2018
QUANTITY APPROVED	:	1000 MT
QUANTITY PULLED-OUT	:	11.225 MT
DATE OF PULL-OUT	:	April 27, 2018
DATE OF TRANSPORT	:	April 27, 2018

V. TREATMENT DETAILS

TYPE OF WASTE	:	Water with Diesel
HW NO	:	I101
QUANTITY	:	11.225 MT
METHOD USED	:	Thermal & Recycling
COMPLETION OF TREATMENT	:	May 4, 2018



The undersigned CERTIFIES that the information provided in this Certification is true and accurate.

JOANNE MARIE A. MOCA
Pollution Control Officer

"PROTECTING THE ENVIRONMENT, PROTECTS PEOPLE"

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Avenue, Diliman Quezon City 1116
Telephone Nos.: (632) 927-1517, 928-3725; Fax No.: (632) 920-2258
Website: http://www.emb.gov.ph

TRANSPORTER REGISTRATION CERTIFICATE

Pursuant to Chapter 4 of DENR Administrative Order (DAO) No. 2013-22, the Implementing Rules and Regulations of Republic Act (RA) 6969, this Certificate is issued to:

Name of Transporter : **ADL WASTE MANAGEMENT**

Office Address : Sitio Binasak, Brgy. Mabiga, Hermosa, Bataan 2111

You are hereby assigned with the registration no:

TP-R3-08-00009

This registration shall apply and limited to the following type of wastes and vehicles:

Wastes with Cyanide (A101); Acid Wastes (B201-B299); Alkali Wastes (C301-C399); Wastes With Inorganic Chemicals (D401-D499); Inks / Dyes / Pigments / Paint / Resins / Latex / Adhesives / Organic Sludge (F601-F699); Waste Organic Solvents (G703 & G704); Organic Wastes (H802); Oil (I101-I104); Containers (J201); Stabilized Wastes (K301-K303); and Miscellaneous Wastes (M503 & M506)

Type	Plate No.	Net capacity, MT	Owned/Leased
ISUZU Dropside Canopy	UMM 240	1.90	Owned
ISUZU Cargo Tanker	RFX 497	13.625	Owned
INTERNATIONAL HARVESTER Tractor Head	UDB 989	4.0	Owned
ISUZU Tank Lorry	RGM 282	13.625	Owned
ISUZU Wing Van Truck	WIG 202	8.44	Owned
ISUZU Tractor Head	RDH 361	7.29	Owned
ISUZU Tanker Truck	RFM 344	11.0	Leased
FUSO Dropside	RGH 383	2.15	Leased
FUSO Dropside	RLC 253	12.0	Leased
FUSO Cargo Truck w/ Alum. Sidings	RMJ 920	12.0	Leased
ISUZU Tank Lorry	RER 865	10.0	Leased
SCANIA Tractor Head	ABB 4301	6.25	Leased
Trailer	NZA 505	13.5	Owned
Trailer	TUC 482	13.5	Owned
Trailer	CUR 359	10.0	Leased
Trailer	AUC 358	13.5	Leased

The above-named transporter shall comply with all applicable provisions of R.A. 6969 and its implementing rules and regulations.

This is not a permit to transport. A permit to transport must be secured from the proper Regional Office of this Bureau prior to any transport of hazardous wastes from the generator thereof to an authorized treatment, storage and disposal (TSD) facility.

The duly notarized manifest form attached with pictures of the actual loading and unloading of hazardous wastes, shall be submitted to the concerned Regional Office copy furnished this Office within seven (7) days of each completed transport.
The conveyance(s) transporting hazardous wastes including vessels, containers and tanks shall be properly labeled and shall contain the symbols as required in Chapter 6 Section 6.3 of DAO 2013-22.

Protect the environment... Protect life...

Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
Office of the Director

TRC TP-R3-08-00009
18.08.09•09:33:57•000003

The transporter shall ensure that all its personnel directly involved in the handling of hazardous wastes have received adequate training and provided with the appropriate Personnel Protective Equipment (PPE).

This certificate is valid and will expire one (1) year from approved date unless sooner revoked or suspended for cause by this Bureau. The application for renewal hereof should be filed with this Bureau at least one (1) month prior to the date of expiration.

AUTHORIZED SIGNATURE	:	
AUTHORIZED NAME	:	**ENGR. METODIO U. TURBELLA**
DESIGNATION	:	Director
DATE	:	AUG 0 9 2018

Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
Office of the Director

TRC TP-R3-08-00009
18.08.09*09:34:11*000003

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olangapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(Issued Under Presidential Decree 1586)

R03-03092016-3845

THIS IS TO CERTIFY THAT THE **ZAMBALES ECO LANDFILL CORPORATION** is granted this Environmental Compliance Certificate (ECC) for the **proposed Zambales Ecological Facility** to be located at **Brgy. Naugsol, Subic, Zambales** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

THIS IS SUBJECT to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have been provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover the development of a Sanitary Landfill, Materials Recovery Facility and Composting Facility (Group 3.8.1) with a capacity of not to exceed 165 tons per day covering an area of 11.3779 hectares the boundary of which is defined under TCT Nos. 009-2011003958, 009-2011008846, 009-2011008847, 009-2012008519 and N-192125 with the following project components:

- Two (2) units Solid Waste Sanitary Landfill Cell with a High density Polyethylene (HDPE) clay liner of at least 60 cm thickness of compacted clay material with a permeability of not more than $1x10^{-5}$ cm/sec otherwise, as may be applicable, an equivalent replacement would be a composite liner consisting of at least 1.5mm thick High density Polyethylene (HDPE) membrane pursuant to Section 48 of RA 9003 otherwise known as Ecological Solid Waste Management Act of 2000, provided a separation of at least 2.0 meters shall be maintained between the top of the liner system and underlying groundwater as prescribed by DENR Administrative Order No. 10 Series of 2006 or the Guidelines on the Categorized Final Disposal Facilities (Sanitary Landfill)
- One (1) set of Leachate Treatment Facility with Leachate Recirculation Scheme with clay liner by at least 60 cm thickness of compacted clay materials with a permeability of not more than $1x10^{-5}$ cm/sec, otherwise, as may be applicable, an equivalent replacement would be a composite liner pursuant to Section 48 of RA 9003 consisting of at least 1.5mm thick High density Polyethylene membrane provided a separation of at least 2.0 meters shall be maintained between the top of the liner system and underlying groundwater as prescribed by DENR Administrative Order No. 10 Series of 2006
- Materials Recovery Facility

Project Geographical Coordinates/Location:
North Latitude - $14^0$53'19.21"
East Longitude - $120^0$16'01.18"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or errors that may be found after issuance of this certificate.

Issued at City of San Fernando, Pampanga, this MAR 11 2016.

Recommending Approval:

DENNIS O. CELESTIAL
Chief, Clearance and Permitting Division

Approved by:

LORMELYN E. CLAUDIO, CESO IV
Regional Director

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

SEP 16 2015

ECC Ref. Code No. R03-1507-0313
ZAMBALES ECO LANDFILL CORPORATION
Brgy. Naugsol, Subic
Zambales

Dear Sir/Madam,

This refers to your application for an Environmental Compliance Certificate (ECC) for the **proposed Materials Recovery Facility** to be located at Brgy. Naugsol, Subic, Zambales.

After satisfying the requirements of the said application, this Office has decided to grant an Environmental Compliance Certificate (ECC) to the above-mentioned project.

In issuing this **CERTIFICATE**, it should be understood that the same is a **PLANNING TOOL** and not a **PERMIT**. It is expected that you will diligently secure pertinent PERMITS/CLEARANCES from all concerned government agencies.

With the issuance of this ECC, you are expected to implement the measures presented in the Initial Environmental Examination (IEE), intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project. You may proceed with project implementation, after securing all the necessary permits from the pertinent government agencies. This Office will be monitoring the project periodically to ensure your compliance with the stipulations cited in the attached ECC.

Please be guided accordingly.

Very truly yours,

LORMELYN E. CLAUDIO, CESO IV
Regional Director

cc: LGU-Subic, Zambales
Municipal Engineers Office
Department of Health
Department of Labor and Employment
Municipal Planning and Development Office

"The Earth is the Lord's and all that is in it" (Psalm 24:1)
... Let's be good stewards!"

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(Issued Under Presidential Decree 1586)

R03-1507-0313

THIS IS TO CERTIFY THAT **ZAMBALES ECO LANDFILL CORPORATION** is granted this Environmental Compliance Certificate (ECC) for the **proposed Materials Recovery Facility** to be located at **Brgy. Naugsol, Subic, Zambales,** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

SUBJECT ONLY to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have been provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover the operation of a Materials Recovery Facility (Group 3.8.4) with a capacity of 10 tons of plastic pellets per day covering a lot area of 46,571 square meters.

Project Geographical Coordinates/Location:

		Start	End
North Latitude	-	14^0 53'13.23"	14^0 53'10.50"
East Longitude	-	120^{0}16'02.37	120^{0}16'02.09"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or errors that may be found after issuance of this certificate.

Issued at City of San Fernando, Pampanga, this SEP 16 2015.

Recommending Approval:

DENNIS O. CELESTIAL
Chief, Clearance and Permitting Division

Approved by:

LORMELYN E. CLAUDIO, CESO IV
Regional Director

"The Earth is the Lord's and all that is in it" (Psalm 24:1)
...Let's be good stewards!"

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

03 May 2016

Mr. CIRILO O. GOLOSINO
President
Zambales Eco Landfill Corporation
Brgy. Naugsol, Subic, Zambales

Dear Mr. Golosino,

This refers to your letter requesting this Office to allow your company to accept nonhazardous wastes generated by your clients, to segregate the same and to store the residual wastes temporarily in an area within your facility since your Solid Waste Sanitary Landfill Cell and Leachate Treatment Facility are still under construction.

This Office hereby grants your request; however, you are reminded to abide with the minimum criteria for the establishment of sanitary landfills as stated under Section 41 of the Republic Act (RA) 9003, otherwise known as the Ecological Solid Waste Management Act of 2000. Some of the applicable criteria are as follows:

- That there should be a system of clay layers and/or geosynthetic membranes used to contain leachate and reduce or prevent contaminant flow to groundwater;
- Installation of pipes at the low areas of the liner to collect leachate for storage and eventual treatment and discharge;
- Presence of series of vertical wells or horizontal trenches containing permeable materials and perforated piping placed in the landfill to collect gas for treatment or productive use as an energy source;
- That there should be a groundwater monitoring well system placed at an appropriate location and depth for taking water samples that are representative of groundwater quality;
- A daily cover placed over the waste at the close of each day's operations

In addition, under Rule XIV, Section 1, letter p of the Implementing Rules and Regulations (IRR) of RA 9003, a temporary impoundment for drainage runoff shall be provided with a retention time sufficient for sediment removal and/or reduction, prior to its discharge.

Failure on your part to conform to the conditions stated above shall subject you to penalties imposed by Republic Act 9003 and its IRR.

Very truly yours,

LORMELYN E. CLAUDIO, CESO IV
Regional Director

CERTIFIED PHOTO COPY

"The Earth is the Lord's and all that is in it (Psalm 24:1)
... Let's be good stewards!"

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III, Turquoise Street, Zone 2, Ramar Village, San Agustin
City of San Fernando, Pampanga
Tel. Nos. (045) 455-3316, 455-3080, 455-4340
402-5071, 402-5073, 402-5074

PERMIT TO TRANSPORT

Pursuant to Chapter 3 of DENR Administrative Order (DAO) No. 2013-22, the Implementing Rules and Regulations of Republic Act (RA) 6969, this Certificate is issued to:

Name of Treater : RMS PETROLEUM TECHNOLOGY AND WASTE MANAGEMENT CORPORATION

Registration Number : TR-R3-14-00057

Facility Address : 0822 Brgy. Sta. Rosa 1, Marilao, Bulacan

M-PTT-R3-14-2018-01072

For the transport of hazardous waste(s) which will be valid for six (6) months from the date of issuance subject to the following conditions:

1. That this Permit shall be limited only for the transport of:

Class and Description of Waste	Waste No.	Quantity (MT)	Treatment Process
Used Oil	I 101	373.516 MT	Recycling Constituting Disposal

Generated by HHIC.-PHIL. INC. SUBIC HIPYARD (*GR-R3-71-00078*) [Generator] located at Brgy. Cawag, Subic, Zambales for treatment and disposal at Permitee's facility;

2. That the following registered hazardous waste vehicle(s) of Arnielle Trading with Registration ID No. of TP-NCR-76-00020 shall be used to transport the wastes:

Type	Plate No.	Net capacity, MT	Owned/Leased
Tank Lorry	TUD 281	13.625	Owned
Dongfeng Dump Truck	OM-0358	7.90	Owned
Dongfeng Dump Truck	UOR-024	12.50	Owned
Dongfeng Dump Truck	OM-0345	12.50	Owned
Hino Tank Lorry	RHT 472	11.50	Owned
Hino Tank Lorry	CTV 846	15.00	Owned
Hyundai Dump Truck	ABF 8642	10.00	Owned
Isuzu Dump Truck	UEF 981	10.00	Owned
Isuzu Dump Truck	CTR 844	10.00	Owned
Isuzu Tank Lorry	CGK 679	15.00	Owned
Isuzu Dump Truck	ACO-1110	5.00	Owned
Isuzu Tank Lorry	GPB 247	8.00	Owned
Isuzu Dump Truck	AAT 2250	2.10	Owned
Isuzu Closed-Type Flat Body	UCP 700	2.40	Owned
Isuzu Closed-Type Flat Body	UJA 720	2.40	Owned
Isuzu Closed-Type Flat Body	RKJ 256	4.25	Owned
Isuzu Tank Lorry	THT 102	10.00	Owned
Isuzu Tank Lorry	RHB 519	4.25	Owned
Mitsubishi Type Flat Body	AAP 3476	0.345	Owned
Mitsubishi Type Flat Body	UIH 704	1.60	Owned
Rebuilt Tank Lorry	234733376	7.50	Owned
Tanker Tank Lorry	PUU 802	15.00	Owned

"The Earth is the Lord's and all that is in it (Psalm 24:1)
...Let's be good stewards!"

Type	Plate No.	Net capacity, MT	Owned/Leased
Dongfeng Trailer	OM-0232	4.75	Owned
Isuzu Trailer	WBQ 390	10.290	Owned
Rebuilt Trailer	RLH 686	12.00	Owned

3. That proper handling, labelling and storage of the wastes shall be observed;

4. That the personnel involved in the transport shall carry official documents identifying the contents of hazardous wastes on board including emergency and contingency equipment for accidents and/or spills;

5. That the Hazardous Waste Manifest Form shall be prepared for every transport and a copy of which shall be submitted to this Office and/or EMB Regional Office having jurisdiction over the HW Generator within seven (7) days of each completed transport;

6. That all the waste shall be treated within the TSD facility and the corresponding Certificate of Treatment (COT) shall be issued to the Generator and a copy of which shall be submitted to this Office and/or EMB Regional Office having jurisdiction over the HW Generator;

7. No transport or treatment of hazardous wastes shall be undertaken in the event that the Transporter, TSD Registration or Memorandum of Agreement (Transporter, TSD and Generator) has expired within the validity of this Permit, until renewal of the same has been approved;

8. That the Permitee, Transporter and Generator shall be jointly and severally liable for any misdeclaration in all the documents submitted to this Office and for any accident/damage to persons, property and the environment that may arise on the occasion or in relation to the transport/export of the wastes.

Any violation(s) of the conditions in this Permit is punishable under R.A. 6969.

Issued this _____day of _____, 2018 in City of San Fernando, Pampanga.

AUTHORIZED SIGNATURE :
AUTHORIZED NAME : LORMELYN E. CLAUDIO, CESO IV
DESIGNATION : REGIONAL DIRECTOR
DATE : NOV 07 2018

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III, 4/F Mel-Vi Bldg., Olongapo-Gapan Rd.,
Dolores, City of San Fernando, Pampanga
Telefax No. (045) 861-2631 * (045) 961-5203 * (045) 961-5206

ENVIRONMENTAL COMPLIANCE CERTIFICATE
(Issued Under Presidential Decree 1586)
R03-1209-0162

THIS IS TO CERTIFY THAT **PRIME ENVIRONMENTAL & INTEGRATED TECHNOLOGIES SOLUTIONS, INC.** is granted this Environmental Compliance Certificate (ECC) for the **Residual and Scrap Recycling Facility** located at **Bantay Bayan, Sitio Masingit, Brgy San Isidro, Subic, Zambales.**, by the Department of Environmental and Natural Resources (DENR), through the Environmental Management Bureau, Region III.

SUBJECT ONLY to the conditions and restrictions set-out in this ECC and in the attached document labeled as Annex A. Recommendations have provided in Annex B as guidance to concerned government agencies and local government units for consideration in their decision making.

It shall cover the operation of residual and scrap recycling facility in an area of three thousand eight hundred thirty one (3,440) square meters with the following components and output capacity:

Type of Residual and Scrap	Operation Capacity per day @16 hrs
All Scrap material not containing hazardous waste for recycling	45.00 tons

Project Geographical Coordinate/Locations
North Latitude - 14°52'15.50"
East Longitude - 120°56'46.06"

This certification is issued in compliance to the requirements of Presidential Decree No. 1586, in accordance to Department Administrative Order No. 30-2003. The Bureau, however, is not precluded from reevaluating, adding, removing, and correcting any deficiencies or error that may found after issuance of this certificate.

Issued at City of San Fernando, Pampanga, this SEP 18 2012.

Recommending Approval:

DENNIS O CELESTIAL
OIC, Chief, Environmental Impact Assessment
& Management Division

Approved By:

LORMELYN E. CLAUDIO
Regional Director

SWORN STATEMENT OF OWNER/AUTHORIZED REPRESENTATIVE

I Melquiades Pamintuan Jr. proponent of this Residual and scrap Recycling Facility located in Sitio Masinit, Brgy. San-Isidro, Subic, Zamb takes full responsibility in complying with all contained in this Environmental Compliance Commitment (Environmental Compliance or ECC).

Signature

TIN 134-486-492

Subscribed and sworn to before me this _____ day of _____, 2012, the above-named affiant oath presenting Residence Certificate No. 134-486-492 issued on _____ 2012 at _____.

SEP 18 2012

Atty. ROGELIO J. BOLIVAR
Notary Public
Commission No. NP-029 (Expires on Dec. 2011-2012)
IBP No. [illegible] 2010-12/Q.C.
PTR No. 6037943-B/ Jan. 4, 2012/Q.C.
Attorney's Roll No. 33832
TIN No. 129-871-009-000
MCLE 3 No. 0012100 / 4-13-10

NOTARY PUBLIC

Doc. No. 282
Page No. 57
Book No. XIX
Series of 2012

I. CONDITIONS

A. ENVIRONMENTAL MANAGEMENT and MONITORING PLAN (EMMoP)

1. All mitigating measures in the Initial Environmental Examination (IEE) shall be implemented;

2. Implement waste minimization, segregation, re-use and other ecological waste management practices;

3. The proponent shall conduct quarterly ambient air sampling and result shall be submitted as part of the Self Monitoring Report;

4. Implement appropriate storage practices, i.e. labeling/placards and segregation according to compatibilities.

5. Planting of trees shall be undertaken either within the project site and/or in other areas as part of the proponent's social and environmental program;

B. GENERAL CONDITIONS

6. The proponent shall comply with the requirements of other environmental laws, i.e. Republic Act (RA) 8749 or "The Clean Air Act of 1999", RA 6969 or "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990", RA 9003 or "Ecological Solid Waste Management Act of 2000" and RA 9275 or "Clean Water Act of 2004", among which are:

    - Secure Air Pollution Source Control Installations (APSCI) and Discharge Permit Water Pollution Source /Control Facilities (WPSCF)
    - Designate Pollution Control Officer (PCO)
    - Submit Self Monitoring Report
    - Register as Hazardous Waste Generator

7. An Abandoned Plan shall be submitted to this Office ninety (90) days prior to the projects abandoned. The plan shall include remediation, clean-up and rehabilitation measures of contaminated areas and proposed alternative project of activity suitable in the area.

8. The proponent shall formulate and implement Information Education Campaign (IEC) programs incorporating recommended environmental management practices through but shall not be limited to various advertising media (i.e., posters billboards, etc).

9. That at least a 2' x 4' billboard dimension containing this message: "Notice to the Public, This project (title of the project) of (Name of the Proponent) has been issued an Environmental Compliance Certificate (ECC Number) by the Environmental Management Bureau of the Department of Environment and Natural Resources, Region III, on (date)" shall be posted/installed in a conspicuous area;

10. That should there be any complaint from the community related to environmental sanitation problem brought about by the plant's operation, the proponent shall be held responsible to address such problem;

11. On the spot inspection or monitoring may be conducted by this Office anytime in coordination with concerned groups;

II. RESTRICTIONS

12. Any expansion or modification of the approved project shall be subject to new EIA requirement; and

13. In case of transfer of ownership of this project, these same conditions and restrictions shall apply and the transferee shall be required to notify this Office within fifteen (15) days as regards to the transfer of ownership

Non-compliance with any of the provisions of this certificate shall be a sufficient cause for the cancellation or suspension of the certificate and/or imposition of a fine in an amount not to exceed Fifty Thousand Pesos (50,000.00) for every violation thereof.

OR No. : 7310281
Proposed fee : P4,000
Date : September 6, 2012

Annex B

PROJECT ASSESSMENT PLANNING TOOL

For the assistance of the Proponent and government agencies concerned in the management of the project and for better coordination in mitigation on the impact of the project on its surrounding areas and to the environment.

By way of recommendation, the following have been taken notice by the undersigned and re forwarding these recommendations to the parties and authorities concerned for proper appreciation and action

RECOMMENDATIONS TO CONCERNED GOVERNMENT AGENCY/LGUs		CONCERNED GOVERNMENT AGENCIES/ENTITIES
1. Need for the provision of a segregation, collection, recycling, and disposal mechanism for solid waste.		LGU/Proponent
2. That the regulation/occupation health and safety standards be complied with prior acquisition of a Permit to Operate.		DOLE/Proponent
3. Secure Environmental Technology Verification Certificate		DOST
4. Provision of personal protective equipment for the workers is needed such as protective mask and other devices		DOLE/Proponent
5. Provision of fire fighting equipment.		BFD
ENVIRONMENT PLANNING RECOMMENDATIONS FOR THE PROPONENT The following are recommendations for the Proponent for the protection of the project area and the affected environment. It is strongly recommended that the same be strictly complied by the Proponents.		
1. Emergency Preparedness, Contingency Plan and Preventive Maintenance to address possible case explosion, fire, accidental spill of dangerous goods/hazardous waste while in transit and during production and other nuisance shall be formulated by the proponent.		
2. Close monitoring by the project should be undertaken by the proponent to maintain a high level of safety and efficiency and immediately address any environmental hazard that may take place		

For dissemination and proper action of the parties concerned.

DENNIS O CELESTIAL
OIC, Chief, EIAM Division

LORMELYN E. CLAUDIO
Regional Director

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU
Regional Office No. III 4/F Mel-Vi Bldg., Olongapo-Gapan Road
Dolores, City of San Fernando, Pampanga
Telefax Nos. (045) 961-5203; 961-5206; 861-2361

IN ACCORDANCE WITH THE REVISED PROCEDURAL MANUAL FOR DENR ADMINISTRATIVE ORDER NO. 30, SERIES OF 2003 OF PRESIDENTIAL DECREE NO. 1586, THIS

CERTIFICATE OF NON-COVERAGE

No. **CNC-R03-1301-0011**

IS ISSUED TO

YGA JUNK SHOP

Brgy. Del Pilar, Castillejos, Zambales

ON

1/5/2013
(Date of Issuance)

FOR ITS PROJECT

BUYING AND SELLING OF NON-HAZARDOUS SCRAP MATERIALS COVERING AN AREA OF 5,000 SQUARE METERS

Located at Brgy. Del Pilar, Castillejos, Zambales, R03 (Waste Management Projects; Receiving facilities,paper,plastic and other materials recycling; (Not Applicable); (Not Applicable); involves manual or mechanical sorting only. Subject to the conditions in the attached document labeled as Annex A.)

THE ISSUANCE OF THIS CERTIFICATE SHALL NOT EXEMPT THE GRANTEE FROM COMPLIANCE WITH APPLICABLE ENVIRONMENTAL LAWS, RULES AND REGULATIONS INCLUDING THE PERMITTING REQUIREMENTS OF OTHER GOVERNMENT AGENCIES. MOREOVER, ANY EXPANSION AND/OR MODIFICATION OTHER THAN SPECIFIED ABOVE MAY BE CONSIDERED AS A VIOLATION OF P.D. 1586 (EIA SYSTEM) AND SHALL BE SUBJECTED TO IMPOSITION OF FINES/PENALTIES AMOUNTING TO PHP50,000.00.

Recommending Approval:

DENNIS O. CELESTIAL
OIC, EIAMD

Approved:

LORMELYN E. CLAUDIO
Regional Director

CNC-R03-1301-0011

Annex A

This Certificate of Non-Coverage is being issued subject to the following conditions:

1. Measures to address odor nuisance shall always be observed.

2. No storage of hazardous substances shall be undertaken in the project area.

3. Implement waste minimization, segregation, reuse and other ecological waste management practices; and

4. That should there be any complaint from the community related to environmental pollution, nuisance and sanitation problem brought about by the project's operation, the proponent shall be held responsible to address such problem.

Recommending Approval

DENNIS O. CELESTIAL
Chief, EIAMD

Approved:

LORMELYN E. CLAUDIO
Regional Director

Conforme:

_____
Applicant
YGA JUNK SHOP

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Avenue, Diliman, Quezon City 1116
Telephone Nos.: 927-15-17, 928-20-96
Email: emb@emb.gov.ph
Visit us at http://www.emb.gov.ph

TSD REGISTRATION CERTIFICATE

Pursuant to Republic Act 6969, "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990: and its Implementing Rules and Regulations (DENR Administrative Orders [DAOs] 1992-29 and 2013-22), the applicant:

Company Name : RMS PETROLEUM TECHNOLOGY AND WASTE MANAGEMENT CORPORATION

Facility Address : 0822 Brgy. Sta. Rosa 1, Marilao, Bulacan

has submitted information to the satisfaction of the Environmental Management Bureau, Department of Environmental and Natural Resources with regards to the Hazardous Wastes Treatment Storage and Disposal (TSD) facility registration requriements and is therefore assigned with the new on-line registration no:

TR-R3-14-00057

This hereby permits **RMS PETROLEUM TECHNOLOGY AND WASTE MANAGEMENT CORPORATION** to maintain/operate a Category D Treatment, Storage, and Disposal (TSD) Facility for the following wastes:

Category	Type of Wastes	Treatment Method
D	Oil (I101)	Recycling Constituting Disposal

subject to the following conditions:

1. The TSD facility shall comply with all the requirements of R.A. 6969, its Implementing Rules and Regulations and the Procedural Manual for Hazardous Wastes Management.

2. The TSD facility shall not exceed the capacity indicated in the Environmental Compliance Certificate (ECC), as such the subject wastes shall be treated within six (6) months from the date of transport as indicated in the Hazardous Waste Manifest Form.

3. All residues generated shall be disposed of in a third party TSD Facility for further treatment or disposal.

4. Non-compliance to the above stipulations shall be subject to the penalty provisions as provided under Section 41 of DAO 92-29 and Chapter 11 of DAO 2013-22.

5. This certificate is valid and will expire one (1) year from approved date of HW On-line System unless sooner revoked or suspended for cause by this Bureau. The application for renewal hereof should be filed with this Bureau at least one (1) month prior to the date of expiration.

AUTHORIZED NAME : ENGR. METODIO U. TURBELLA
DESIGNATION : DIRECTOR, ENVIRONMENTAL MANAGEMENT BUREAU (EMB)
DATE : February 18, 2018

THIS IS A COMPUTER GENERATED DOCUMENT

Mayor's Permits/Business Permits, including ancillary permits (i.e., building/occupancy permits, sanitary permits, fire and safety inspection permits, etc.), for the Company's head office and branches.

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay Freeport

BPSD – CO – 07 – 010

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Air Compressed Room 1 located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 6th *of* Nov. 2008

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 007

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

for AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. – Philippines newly constructed Assembly Shop "A" and Shelter located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 6th *of* Nov. 2008

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 051

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Assembly Shop B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 055

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009
Date of Inspection

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Assembly Shop C located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 066

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Rydondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

March 25, 2009

The construction of the above-described buildings/structureshave been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliance with the remaining requirements are not complied.

AMETHYA P. DELA LLANAKOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R., JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Blasting & Painting Shop D located at Greenbeach1, Rydondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 028

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Blasting and Painting Shop B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 164

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described buildings/structureshave been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliance with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Blasting & Painting Shop C and Sub Station # 23 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain these buildings/structures to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 025

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10, 2007
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Blasting Shop A located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 067

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

September 02, 2008 / July 15, 2009
Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Catering Center located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 20th day of October 2009.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 069

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009 / May 07, 2009
Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed D - House Shelter located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 5th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 078

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

April 29, 2009 / April 29, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL

Ecology Center

RANNY D. MAGNO

Fire Department

SOLOMON R. JACALNE, MD. MOH

Public Health & Safety Department

*This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed **Distribution Shop** located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 25th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO

Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 163

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 29, 2009
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Dock Shelter #5 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-008

Certificate of Occupancy

Hanjin Heavy Industries and Construction Corporation LTD. - Philippines
Name of Applicant

Greenbeach 1, Redondo Peninsula , Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

September 4, 2008 / January 21, 2009
Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. – Philippines - constructed Field Office #1 located at Greenbeach 1, Redondo Peninsula, Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-009

Certificate of Occupancy

Hanjin Heavy Industries and Construction Corporation LTD. - Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula, Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

September 4, 2008 / January 21, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

DANNY G. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. - Philippines constructed Field Office #2 located at Greenbeach 1, Redondo Peninsula, Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD-CO-L-09-010

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation LTD. - Philippines
Name of Applicant

Greenbeach 1, Redondo Peninsula Sitio Agusuhin, Brgy., Cawag, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

September 4, 2008 / January 21, 2009
Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY B. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. – Philippines constructed FIELD OFFICE #3 located at Greenbeach 1, Redondo Peninsula Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-011

Certificate of Occupancy

Hanjin Heavy Industries and Construction Corporation LTD. - Philippines

Name of Applicant

Greenbeach 1 , Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

September 4, 2008 / January 21, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY C. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. - Philippines newly constructed FIELD OFFICE #4 located at Greenbeach 1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 076

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office #4a located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-012

Certificate of Occupancy

Hanjin Heavy Industries and Construction Corporation LTD. - Philippines

Name of Applicant

Greenbeach 1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

September 4, 2008 / January 21, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY DAMAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. – Philippines constructed FIELD OFFICE #5 located at Greenbeach 1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 077

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD, MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office #5a located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-013

Certificate of Occupancy

Hanjin Heavy Industries and Construction Corporation LTD. - Philippines
Name of Applicant

Greenbeach 1, Redondo Peninsula, Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

September 4, 2008 / January 21, 2009
Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. – Philippines constructed FIELD OFFICE #6 located at Greenbeach 1, Redondo Peninsula Sitio Agusuhin Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 073

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 7 (Assembly Shop B) located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 074

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 8 (Assembly Shop B) located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 057

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 9 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 063

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been fou to be substantially complete and hereby recommended for a tempora occupancy certificate subject to cancellation if compliace with t remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office #10 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 043

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 11A located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 044

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 11B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 045

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Office # 12 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD-CO-L-09-014

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation LTD. - Philippines

Name of Applicant

Greenbeach 1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

October 10, 2007 / January 21, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure had been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries and Construction Co. Ltd. – Philippines constructed FIRE STATION located at Greenbeach 1, Redondo Peninsula,Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 7TH *day of* APRIL *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD - 02 - 16 - 009

Certificate of Occupancy

HHIC - Phil Inc.
Name of Applicant

Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

COMMERCIAL
Use or Type of Occupancy

This certifies that ***HANJIN HEAVY INDUSTRIES & CONSTRUCTION COMPANY (HHIC) PHILS., INC.'s*** *renovated* ***Galva Shop*** *located at* ***Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone*** *have been inspected and found to be in conformity with the approved plans and specifications and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations. These buildings/facilities therefore may now be occupied.*

The owner shall properly maintain these buildings/structures to enhance its architectural well- being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2016.*

Issued by:

JOSELITO D. BAKUTEZA
Officer-In-Charge BPSD

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA DELA LLANA KOVAL
Ecology Center
Feb. 02, 2016/ Feb. 02, 2016
Date of Inspection/ date of Compliance

RANNY D. MAGNO
Fire Department
Feb. 02, 2016 /April 05, 2016
Date of Inspection/Date of Compliance

CARLITO B. FAUSTINO
Land and Asset Management Dept.
Feb. 02, 2016 / Feb. 02, 2016
Date of Inspection/ Date of Compliance

SOLOMON R. JACALNE, MD., MOH
Public Health & Safety Department
Feb. 02, 2016/Nov. 02, 2016
Date of Inspection/ Date of Compliance

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official BPSD.15911

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 032

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

October 10 2007 / May 07, 2009

Date of Initial Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R., JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Gasoline Station located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 20th *day of* October *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay Freeport

BPSD – CO – 09 – 041

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10 2007
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Guest House located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 072

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

April 22, 2009 / May 07, 2009

Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Hatch Cover Shelter located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 5th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY
METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT ZONE

BPSD – CO – L - 08 – 009

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

FEBRUARY 13, 2008

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. APAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Helicopter Hangar located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 24th *of* March *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 006

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Hull Shop "A" located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 6th *of* Nov. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 047

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Hull Shop B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 039

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

April 22, 2009 / July 24, 2009

Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Main Gate 2 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 4th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 042

Hanjin Heavy Industries & Construction Corporation Ltd . - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

OCTOBER 11, 2007 / SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Main Gate Building 1*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th of November 2008.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 159

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Main Generator Room located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 038

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Main Office Annex located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 044

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

OCTOBER 11, 2007 / SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Main Office Building*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th *of* November *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay Freeport Zone

BPSD – CO – 09 – 029

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Maintenance Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 033

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

November 27, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Material Stores and Bond Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 024

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10, 2007
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Outfitting Shop A located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

"paint can stock depot"

Certificate of Occupancy

BPSD – CO – L - 08 – 043

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

NOVEMBER 27, 2007 / SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY B. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed **Paint Can Stock** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* February *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 027

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 10, 2007
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Painting Shop A located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 054

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNIE D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Panel Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 023

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Production Center/ Welfare Center located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD - 09 - 16 - 014

Certificate of Occupancy

HHIC - Phil Inc.
Name of Applicant

Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

COMMERCIAL
Use or Type of Occupancy

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA DELA LLANA KOVAL
Ecology Center
Feb. 04, 2016/ Feb. 04, 2016
Date of Inspection/ date of Compliance

RANNY D. MAGNO
Fire Department
Feb. 04, 2016 / April 06, 2016
Date of Inspection/Date of Compliance

CARLITO B. FAUSTINO
Land and Asset Management Dept.
Feb. 04, 2016 /Feb. 04, 2016

SOLOMON R. JACALNE, MD., MOH
Public Health & Safety Department
Feb. 04, 2016/Nov. 02, 2016

This certifies that ***HANJIN HEAVY INDUSTRIES & CONSTRUCTION COMPANY (HHIC) PHILS., INC.'s*** *renovated* ***Piping Manufacturing A&B*** *located at* ***Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone*** *have been inspected and found to be in conformity with the approved plans and specifications and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations. These buildings/facilities therefore may now be occupied.*

The owner shall properly maintain these buildings/structures to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2016.*

Issued by:

JOSELITO D. BAKUTEZA
Officer-In-Charge BPSD

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

BPSD – CO – 07 – 011

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY B. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Power Station located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 6th *of* Nov. *2008*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 070

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Pre – Erection Shelter B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 030

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

November 27, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Pre Erection Shelter located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD - 00 - 16 : 010

Certificate of Occupancy

HHIC - Phil Inc.
Name of Applicant

Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

COMMERCIAL
Use or Type of Occupancy

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA DELA LLANA KOVAL
Ecology Center
Feb. 02, 2016/ Feb. 02, 2016
Date of Inspection/ date of Compliance

RANNY D. MAGNO
Fire Department
Feb. 02, 2016 / April 05, 2016
Date of Inspection/Date of Compliance

CARLITO B. FAUSTINO
Land and Asset Management Dept.
Feb. 02, 2016 /Feb. 02, 2016
Date of Inspection/ Date of Compliance

SOLOMON R. JACALNE, MD., MOH
Public Health & Safety Department
Feb. 02, 2016/ Dec. 06, 2016
Date of Inspection/ Date of Compliance

This certifies that **HANJIN HEAVY INDUSTRIES & CONSTRUCTION COMPANY (HHIC) PHILS., INC.'s** *renovated* **Pre Treatment Shop** *located at* **Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone** *have been inspected and found to be in conformity with the approved plans and specifications and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations. These buildings/facilities therefore may now be occupied.*

The owner shall properly maintain these buildings/structures to enhance its architectural well- being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2016.*

Issued by:

JOSELITO D. BAKUTEZA
Officer-In-Charge BPSD

Note: A certified copy hereof shall be posted within the premises of the building and shall not be [illegible]

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 -- 026

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

October 10 2007 / July 15, 2009

Date of Initial Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Pre- Outfitting Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 22nd *day of* December *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 052

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Pre Outfitting Shop B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 008

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Pre – Treatment Shop located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 6th *of* Nov. *2007*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 157

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

March 11, 2009

Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Pre - Treatment Shop B located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 031

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008 / July 15, 2009
Date of Initial Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Reception Building located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 22nd *day of* December *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD - 00 = 16 - 017

Certificate of Occupancy

HHIC - Phil Inc.
Name of Applicant

Sitio Cawag, Redondo Peninsula, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

COMMERCIAL
Use or Type of Occupancy

This certifies that ***HANJIN HEAVY INDUSTRIES & CONSTRUCTION COMPANY (HHIC) PHILS., INC.'s*** *renovated* ***Romanian/ Korean Staff House*** *located at* ***Sitio Cawag, Redondo Peninsula , Subic Bay Freeport Zone*** *have been inspected and found to be in conformity with the approved plans and specifications and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations. These buildings/facilities therefore may now be occupied.*

The owner shall properly maintain these buildings/structures to enhance its architectural well- being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2016.*

Issued by:

JOSELITO D. BAKUTEZA
Officer-In-Charge BPSD

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA DELA LLANA KOVAL
Ecology Center
Feb. 04, 2016/ Feb. 04, 2016
Date of Inspection/ date of Compliance

RANNY D. MAGNO
Fire Department
Feb. 04, 2016 / April 05, 2016
Date of Inspection/Date of Compliance

CARLITO B. FAUSTINO
Land and Asset Management Dept.
Feb. 04, 2016 / Feb. 04, 2016

SOLOMON R. JACALNE, MD., MOH
Public Health & Safety Department
Feb. 04, 2016/Dec. 06, 2016

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official BPSD 15911

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 037

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

July 18, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Scrap Iron Stock located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 071

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009 / May 07, 2009
Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Steel Stock Yard Extension located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 5th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 009

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

for AMETHYA P. DELA LLANA-KOVAL
Ecology Center

KANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Steel Stock Yard located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Jan. 2008

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 021

Certificate of Occupancy

HANJIN HEAVY INDUSTRIES AND CONST. CORP. LTD. PHILS.
Name of Applicant

Greenbeach1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

January 28, 2009 / April 24, 2009
Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sewage Treatment Plant Building 1 & 2 located at Greenbeach1, Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 5th *day of* May *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 049

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

March 11, 2009

Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Assembly Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

1992-2008

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 045

Hanjin Heavy Industries & Construction Corporation Ltd . - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 4, 2008 / OCTOBER 6, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY B. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed Sub Station #3, located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th of November 2008.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 034

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

November 27, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 9 & 31 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 047

Hanjin Heavy Industries & Construction Corporation Ltd . - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 4, 2008 / OCTOBER 6, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Sub Station #10*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th *of* November *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 007A

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the ***Hanjin Heavy Industries & Construction Corporation Ltd. – Philippines*** *newly constructed* ***Assembly Shop"A" and Shelter (Sub Facility) Sub Station #11*** *located at* ***Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone*** *had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Jan. 2008

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 059

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 12 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 048

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 2, 2008 / OCTOBER 6, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed **Sub Station #14** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th *of* November *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 006A

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

JULY 18, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the **Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines** *newly constructed* **Hull Shop"A" (Sub Facility) Sub Station #15** *located at* **Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone** *had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 2nd *of* January 2008.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 046

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 4, 2008 / OCTOBER 6, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed **Sub Station #17** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th *of* November *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 050

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 18, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 20 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 048

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 21 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 065

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 25, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 23 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 068

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 25, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 24 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 058

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station #25 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 053

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 26 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 09 – 046

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

October 21, 2008
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 30 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 -- 160

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

March 11, 2009
Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 32 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 036

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY DOMAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Sub-station #12*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 29th *of* January *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 035

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Sub-station #13*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* February *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 034

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

SEPTEMBER 2, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY DIMAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines constructed ***Sub-station #16*** *located at Greenbeach, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* February 2008.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 056

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

March 11, 2009

Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Sub Station # 22 & # 22-1 located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 075

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 29, 2009 / May 07, 2009
Date of Inspection / Date of Compliance

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed T-BHD Shelter located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 5th *day of* November *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 035

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

February 05, 2009
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Tool Shop located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Subic Bay FREEPORT

BPSD – CO – 09 – 040

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

November 27, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Waste Matter Stock located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Certificate of Occupancy

BPSD – CO – L – 09 – 006

HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO. LTD.

Name of Applicant

Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

January 29, 2009 / February 03, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO. LTD. (Donghae Environment Co. Ltd. Corp.) Water Treatment Plant Phase 1-1 located at Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 13th *day of* February *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

Certificate of Occupancy

BPSD – CO – L – 09 – 007

HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO. LTD.

Name of Applicant

Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

January 29, 2009 / February 03, 2009

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO. LTD. (Donghae Environment Co. Ltd. Corp.) Water Treatment Plant Phase 1-2 located at Redondo Peninsula, Sitio Agusuhin, Brgy. Cawag Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 13th *day of* February *2009.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 162

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines
Name of Applicant

Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

April 22, 2009
Date

The construction of the above-described buildings/structureshave been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliance with the remaining requirements are not complied.

AMETHYA P. DELA LLANAKOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Yard Toilets located at Greenbeach1, Redondo Peninsula District, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain these buildings/structures to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 013

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Building No.1 - Lecture Rooms** *located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* October *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 014

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Building No.2 - Lecture Rooms and Office located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* October *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 028

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84, Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase-1, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Dining Area located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 166

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Argonaut Highway corner, Efficiency Avenue, Subic Bay Industrial Park Phase 1, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

February 04, 2009

Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied .

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Field Training School located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 021

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY B. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Gas Station** *located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* Oct *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

BUILDING PERMIT & SAFETY DEPARTMENT

REGULATORY GROUP

BPSD – CO – 09 – 165

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. Philippines

Name of Applicant

Argonaut Highway corner, Efficiency Avenue, Subic Bay Industrial Park Phase 1, Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

February 04, 2009

Date

The construction of the above-described building/structure has been found to be substantially complete and hereby recommended for a temporary occupancy certificate subject to cancellation if compliace with the remaining requirements are not complied.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R.. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that HANJIN HEAVY INDUSTRIES AND CONSTRUCTION CORPORATION LIMITED PHILIPPINES constructed Piping and Painting Training School located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 19th *day of* January *2010.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without

SUBIC BAY METROPOLITAN AUTHORITY
BUILDING PERMIT & SAFETY DEPARTMENT
REGULATORY GROUP

BPSD – CO – 15 - 030

Certificate of Occupancy

HHIC – Phil., Inc.
Name of Applicant

SBIP-1,
Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

This certifies that HHIC- PHIL., INC.'s renovated Skills Development Center (SDC) located at SBIP-1, Subic Bay Freeport Zone have been inspected and found to be in conformity with the approved plans and specifications and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations. These buildings/facilities therefore may now be occupied.

The owner shall properly maintain these buildings/structures to enhance its architectural well- being, structural stability, sanitation and fire protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 12th *day of* August *2015.*

Signed by:

JOSELITO D. BAKUTEZA
Officer-in-Charge BPSD

The construction of the above-described buildings/structures has been found to be in order and hereby recommended for occupancy.

RUEL JOHN T. KABIGTING
OIC Ecology Center
Nov. 20, 2014/ Nov. 20, 2014
Date of Inspection/ date of Compliance

RANNY D. MAGNO
Fire Department
Nov. 20, 2014 / June 17, 2015
Date of Inspection/Date of Compliance

CARLITO B. FAUSTINO
Land and Asset Management Dept.
Nov. 20, 2014/
Date of Inspection/ Date of Compliance

SOLOMON R. JACALNE, MD., MOH
Public Health & Safety Department
Nov. 20, 2014/ June 23, 2015
Date of Inspection/ Date of Compliance

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official BPSD 12746

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 027

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84 Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Training Gate** *located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* Oct *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 024

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84 Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding No.2 located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT ZONE

BPSD – CO – 07 – 020

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

SOLOMON R. JACALNE, MD. MOH
Public Health & Safety Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Utility Facility** *located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 10th *of* Oct *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 025

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84 Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding No.3 located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

BPSD – CO – 07 – 025

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84 Argonaut Highway corner Efficiency Avenue Subic Bay Industrial Park, Phase-1 Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding No.3 located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 026

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Lots 83 & 84 Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding No.3-1 located at Lots 83 & 84 Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

RC

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 015

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding Training Building No.4 located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 016

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding Training Building No.5 located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department
REGULATORY GROUP
Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 017

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines
Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

INDUSTRIAL
Use or Type of Occupancy

AUGUST 30, 2007
Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Welding Training Building No.6** *located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 018

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed Welding Training Building No.7 located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* October 2008.

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Subic Bay FREEPORT

BPSD – CO – 07 – 019

Certificate of Occupancy

Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines

Name of Applicant

Argonaut Highway corner Efficiency Avenue
Subic Bay Industrial Park, Phase-1
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

INDUSTRIAL

Use or Type of Occupancy

AUGUST 30, 2007

Date of Inspection

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the Hanjin Heavy Industries & Construction Corporation Ltd. - Philippines newly constructed **Welding Training Building No.8** *located at Argonaut Highway corner Efficiency Avenue, Subic Bay Industrial Park, Phase 1, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 9th *of* Oct. *2007.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

1992 - 2008

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 026

HHIC – Philippines, Inc.

Name of Applicant

Subic Apex, Upper Cubi
Subic Bay Freeport Zone

Location of Construction

V

Type of Construction

RESIDENTIAL

Use or Type of Occupancy

JUNE 2, 2008 / AUGUST 12, 2008

Date of Inspection / Date of Compliance

This certifies that the HHIC – Philippines, Inc.'s constructed Apartment Complex No. 1 located at Subic Apex, Upper Cubi, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 15th *of* August *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L - 08 – 027

HHIC – Philippines, Inc.
Name of Applicant

Subic Apex, Upper Cubi
Subic Bay Freeport Zone
Location of Construction

IV
Type of Construction

RESIDENTIAL
Use or Type of Occupancy

JUNE 2, 2008 / AUGUST 12, 2008
Date of Inspection / Date of Compliance

This certifies that the HHIC – Philippines, Inc.'s constructed Apartment Complex No. 2 located at Subic Apex, Upper Cubi, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 15th *of* August *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

1992-2008

SUBIC BAY METROPOLITAN AUTHORITY

SUBIC BAY METROPOLITAN AUTHORITY

Building Permit & Safety Department

REGULATORY GROUP

Subic Bay Freeport Zone

Certificate of Occupancy

BPSD – CO – L-08 – 028

HHIC – Philippines, Inc.

Name of Applicant

Subic Apex, Upper Cubi
Subic Bay Freeport Zone

Location of Construction

IV

Type of Construction

RESIDENTIAL

Use or Type of Occupancy

JUNE 2, 2008 / AUGUST 12, 2008

Date of Inspection / Date of Compliance

The construction of the above-described building/structure has been found to be in order and hereby recommended for occupancy.

AMETHYA P. DELA LLANA-KOVAL
Ecology Center

RANNY D. MAGNO
Fire Department

This certifies that the HHIC – Philippines, Inc.'s constructed ***Ancillary Structures*** *(Swimming Pool and Facilities and Guardhouse and Sewage Treatment Plant) located at Subic Apex, Upper Cubi, Subic Bay Freeport Zone had been inspected and found to be in conformity with the approved plans and specifications on file in this Office and the provisions of the "National Building Code of the Philippines" (PD 1096) and its Implementing Rules and Regulations and, therefore, the building/facility may now be occupied.*

The owner shall properly maintain this building/structure to enhance its architectural well-being, structural stability, sanitation and fire-protection properties and shall not be occupied or used for purpose other than its intended use as stated above.

This certificate is issued in accordance with Section 309, Chapter 3 of PD 1096.

Signed this 15th *of* August *2008.*

Issued by:

MARCO A. ESTABILLO
Officer-In-Charge

Note: A certified copy hereof shall be posted within the premises of the building and shall not be removed without authority from the Building Official

3F, Unit-C16, Banawe De Sta Rosa Building
City Of Sta Rosa, Laguna

www.kaizenasia.com.ph
sales@kaizenasia.com.ph

KAIZEN ASIA
SAFETY MANAGEMENT & TESTING COMPANY

DOLE R. J III
IMSD - RECORDS
RECEIVED
AUG 30 2018 REF NO.
SIGNATURE TIME 7:36

To : Department Of Labor & Employment R.O III

Subject : Completion Report for the Testing & Certification of various heavy equipment (Hanjin Heavy Industries & Construction Philippines)

Date : August 30, 2018

Good day! We are Kaizen Asia Safety Management & Testing Company, A duly accredited company of the Department Of Labor & Employment with accreditation number 1410-17020517-0024.

We would like to politely inform your good office that the project "Testing & Certification of Various Heavy Equipment" conducted at Hanjin Heavy Industries & Construction Philippines has been fully completed.

Attached herewith is the summary of report and list of equipment tested & certified by our company. Thank you so much and more power.

Prepared By:

Mr. Windell Christian H. Tababa
Operations Manager

Approved By:

Mr. Bobby D. Arellano
General Manager

Noted By:

Mr. Paul D. Arellano
President / C.E.O

3F, Unit-C16, Banawe De Sta Rosa Building
City Of Sta Rosa, Laguna

www.kaizenasia.com.ph
sales@kaizenasia.com.ph

KAIZEN ASIA
SAFETY MANAGEMENT & TESTING COMPANY

To : SUBIC BAY MEROPOLITAN AUTHORITY

Subject : Completion Report for the Testing & Certification of various heavy equipment (Hanjin Heavy Industries & Construction Philippines)

Date : August 30, 2018

Good day! We are Kaizen Asia Safety Management & Testing Company, A duly accredited company of the Department Of Labor & Employment with accreditation number 1410-17020517-0024.

We would like to politely inform your good office that the project "Testing & Certification of Various Heavy Equipment" conducted at Hanjin Heavy Industries & Construction Philippines has been fully completed.

Attached herewith is the summary of report and list of equipment tested & certified by our company. Thank you so much and more power.

Prepared By:

Mr. Windell Christian H. Tababa
Operations Manager

Approved By:

Mr. Bobby D. Arellano
General Manager

Noted By:

Mr. Paul D. Arellano
President / C.E.O

Public Health & Safety
Dept - Subic
RECEIVED
8/30/18
10:15

3F, Unit-C16, Banawe De Sta Rosa Building
City Of Sta Rosa, Laguna

www.kaizenasia.com.ph
sales@kaizenasia.com.ph

KAIZEN ASIA
SAFETY MANAGEMENT & TESTING COMPANY

To : Hanjin Heavy Industries & Construction Philippines

Subject : Completion Report for the Testing & Certification of various heavy equipment

Date : August 30, 2018

Good day! We are Kaizen Asia Safety Management & Testing Company, A duly accredited company of the Department Of Labor & Employment with accreditation number 1410-17020517-0024.

We would like to politely inform your good office that the project "Testing & Certification of Various Heavy Equipment" conducted at Hanjin Heavy Industries & Construction Philippines has been fully completed.

Attached herewith is the summary of report, certificate (Passed & Failed), Soft copy (CD) and list of equipment tested & certified by our company. Thank you so much and more power.

Prepared By:

Mr. Windell Christian H. Tababa
Operations Manager

Approved By:

Mr. Bobby D. Arellano
General Manager

Noted By:

Mr. Paul D. Arellano
President / C.E.O

KAIZEN ASIA
SAFETY MANAGEMENT & TESTING COMPANY
3F, Unit C16 Banawe De Sta. Rosa Bldg.
Km. 40 Sr O F. Reyes Rd., Purok 6
City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037
Certificate Control No. V2R0KA - 1308

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 23th day of JULY 2018. This is to certify that equipment (GOLIATH CRANE) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: WIA
Model No.: No Data Available
Serial No.: No Data Available
Equipment No.: GOC-202
Bridge Length: 216 m
Issuance Date: July 23, 2018

Sticker No.: 4395
Power: ELECTRIC
Capacity: 600 TON
Location: DOCK 6
Bridge Height: No Data Available
Expiration Date: July 22, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

Kaizen Asia Safety Management And Testing Company, a duly accredited company of Department Of Labor & Employment with accreditation no. 1410-17020517-0024

Heart of Quality Safety

Website: www.kaizenasia.com.ph
Email: info@kaizenasia.com.ph
sales@kaizenasia.com.ph

V.2 R.0 2017

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SAFETY MANAGEMENT & TESTING COMPANY
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Km. 40 Sr O F. Reyes Rd., Purok 6
City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037

Certificate Control No. V2ROKA - 1250

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 20th day of JULY 2018. This is to certify that equipment (JIB CRANE) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: LIEBHERR
Model No.: BDS 6000-60
Capacity: 60 Tons/5 Tons
Power: Electric
Serial No.: JCD-101
Issuance Date: July 20, 2018

Sticker No.: 4236
Jib Height: No Data Available
Jib Length: No Data Available
Location: Dock 5 Portside
Type: Rail Mounted Crane
Expiration Date: July 19, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

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City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037
Certificate Control No. V2R0KA -0938

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 18th day of JULY 2018. This is to certify that equipment (OVERHEAD TRAVELING CRANE) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: No Data Available
Model No.: No Data Available
Type: No Data Available
Capacity: 60(60/10+30) TON
Power: ELECTRIC
Issuance Date: July 18, 2018

Sticker No.: 4060
Serial No.: OHA-229
Bridge Length: 26 M
Bridge Height: 19.49 M
Location: 27(A)BAY
Expiration Date: July 17, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

Kaizen Asia Safety Management And Testing Company, a duly accredited company of Department Of Labor & Employment with accreditation no. 1410-17020517-0024

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Km. 40 Sr O F. Reyes Rd., Purok 6
City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037

Certificate Control No. V2R0KA --1498

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 17th day of JULY 2018. This is to certify that equipment (OVERHEAD TRAVELING CRANE) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: No Data Available
Model No.: No Data Available
Type: Double Girder
Capacity: 100 TON
Power: Electric
Issuance Date: July 17, 2018

Sticker No.: 4448
Serial No.: OHA-255
Bridge Length: 26.11 M
Bridge Height: 9.66 M
Location: 32 - BAY
Expiration Date: July 16, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

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Km. 40 Sr O F. Reyes Rd., Purok 6
City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037

Certificate Control No. V2ROKA - 1569

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 20th day of JULY 2018. This is to certify that equipment (TRANSPORTER) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer:	KAMAG	Sticker No.:	4302
Model No.:	U140922HH58E	Serial No.:	201-02228
Capacity:	700 tons	Year:	No Data Available
Equipment No.:	TPX-301-H	Location:	Internal Operating
Type:	TRANSPORTER	Power:	DIESEL
Issuance Date:	July 20, 2018	***Expiration Date:***	July 19, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

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KAIZEN ASIA
SAFETY MANAGEMENT & TESTING COMPANY
3F, Unit C16 Banawe De Sta. Rosa Bldg.
Km. 40 Sr O F. Reyes Rd., Purok 6
City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037
Certificate Control No. V2R0KA - 1256

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILPPINES this 20th day of JULY 2018. This is to certify that equipment (MANLIFT) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: JUNJIN
Model No.: TJ-420
Type: Cherry Picker
Serial No.: HLX313
Capacity: No Data Available
Issuance Date: July 20, 2018

Sticker No.: 3939
Equipment No.: *No Data Available*
Power: Diesel
No.of Section: 3 Folds
Location: SAMANDRA
Expiration Date: July 19, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

Kaizen Asia Safety Management And Testing Company, a duly accredited company of Department Of Labor & Employment with accreditation no. 1410-17020517-0024

Heart of Quality Safety

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Email: info@kaizenasia.com.ph
sales@kaizenasia.com.ph

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SAFETY MANAGEMENT & TESTING COMPANY
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City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037

Certificate Control No. V2ROKA - 1743

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 16th day of JULY 2018. This is to certify that equipment (TRACTOR HEAD) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer: VOLVO
Year: No Data Available
Plate No.: 25571
Power: Diesel
Type: Tractor Head
Issuance Date: July 16, 2018

Sticker No.: 4290
Capacity: 21,000 Kg
Chassis No.: YV21SG0098A70216
Equipment No.: TTX-201H
Location: INTERNAL OPERATING
Expiration Date: July 15, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No : 074208

Department of Labor & Employment

Kaizen Asia Safety Management And Testing Company, a duly accredited company of Department Of Labor & Employment with accreditation no. 1410-17020517-0024

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SAFETY MANAGEMENT & TESTING COMPANY
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City of Sta. Rosa, Laguna, 4029
Tel. No. (049) - 572 - 2304 & (049) - 574 - 3037

Certificate Control No. V2R0KA - 0738

Certificate Of Inspection

This certificate of inspection is awarded to HANJIN HEAVY INDUSTRIES AND CONSTRUCTION PHILIPPINES this 16th day of JULY 2018. This is to certify that equipment (FORKLIFT) with specifications below has passed all the necessary testing conducted by Kaizen Asia Safety Management & Testing Company and is proven to be SAFE for use.

EQUIPMENT TESTING SUMMARY REPORT

Manufacturer:	HYUNDAI	Sticker No.:	3720
Model No.:	160D-7E	Equipment No.:	FLX-280-H
Serial No.:	HHIHFT08VA0000180	Maximum Height:	3.613 M
Power:	Diesel	Capacity:	16 TON
Type:	Counter Balance	Location:	FABRICATION
Fork Capacity:	16,000 Kg.	Fork Length:	2.021 M
Issuance Date:	July 16, 2018	***Expiration Date:***	July 15, 2019

Mr. Paul D. Arellano
C.E.O. / President

Eng'r. Angelito C. Longos Sr.
Professional Mechanical Engineer
P.T.R No. : 074208

Department of Labor & Employment

Kaizen Asia Safety Management And Testing Company, a duly accredited company of Department Of Labor & Employment with accreditation no. 1410-17020517-0024

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Email: info@kaizenasia.com.ph
sales@kaizenasia.com.ph

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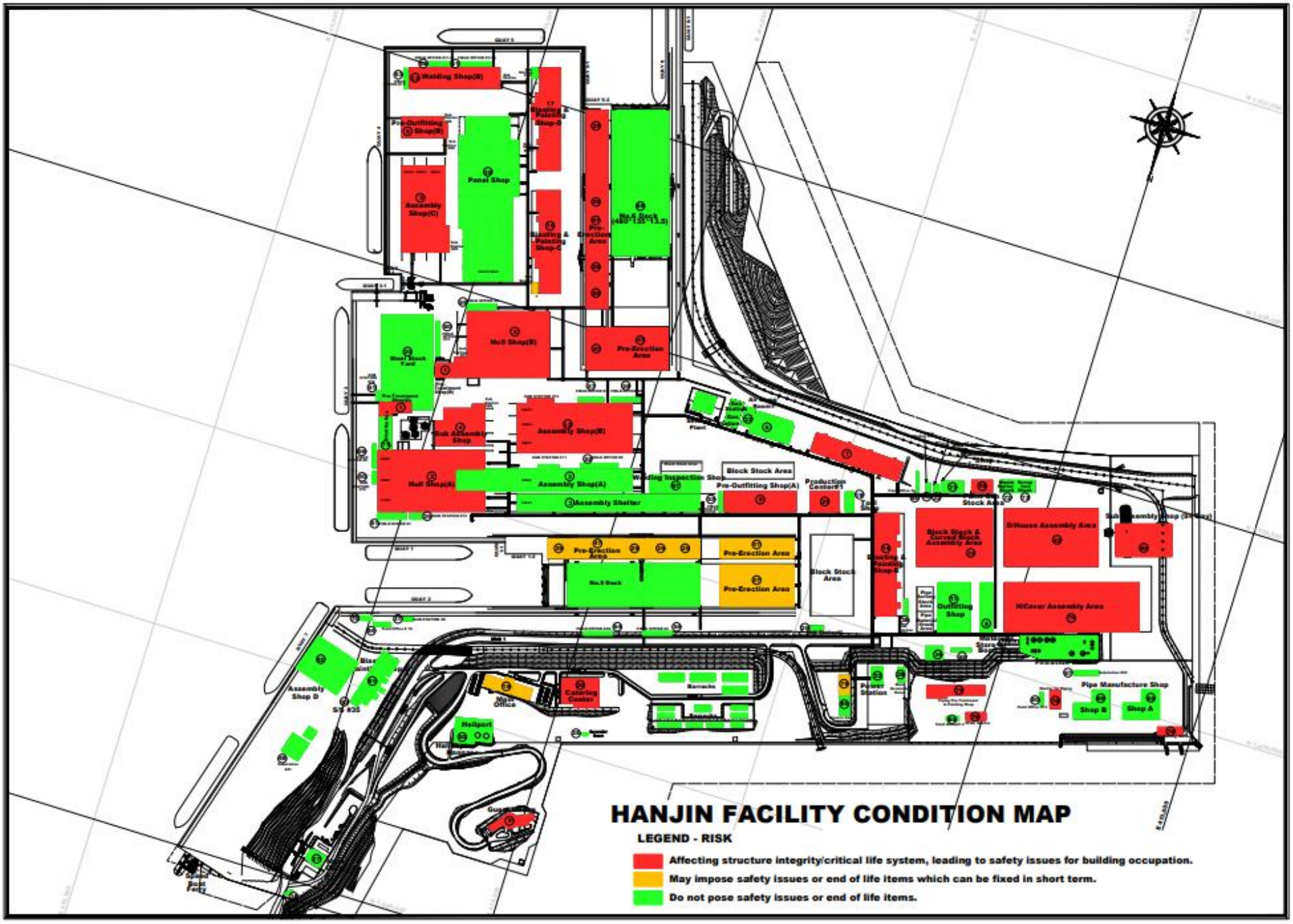
ANNEX B

Facility Condition Map

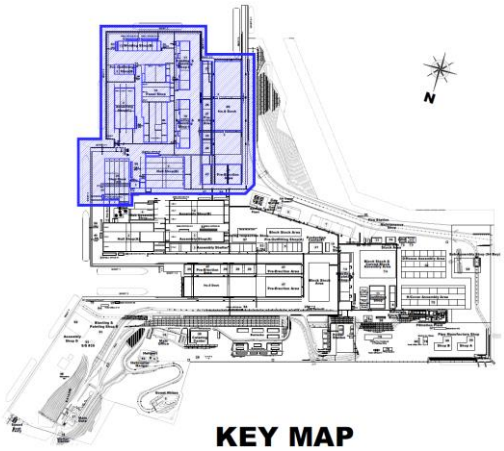

Welding Shop(B)
Pre-Outfitting Shop(B)
Panel Shop
Assembly Shop(C)
Blasting & Painting Shop-C
Pre-Erection Area
No.4 Dock
Hull Shop(B)
Steel Stock Yard
Sub Assembly Shop
Assembly Shop(B)
Hull Shop(A)
Assembly Shop(A)
Assembly Shelter
Welding Inspection Shop
Block Stock Area
Pre-Outfitting Shop(A)
Production Center#1
Block Stock & Curved Block Assembly Area
D/House Assembly Area
H/Cover Assembly Area
Outfitting Shop
Blasting & Painting Shop-B
Pre-Erection Area
No.5 Dock
Assembly Shop D
Main Office
Catering Center
Barracks
Power Station
Heliport
Pipe Manufacture Shop
Shop B
Shop A
HANJIN FACILITY CONDITION MAP
LEGEND - RISK
Affecting structure integrity/critical life system, leading to safety issues for building occupation.
May impose safety issues or end of life items which can be fixed in short term.
Do not pose safety issues or end of life items.

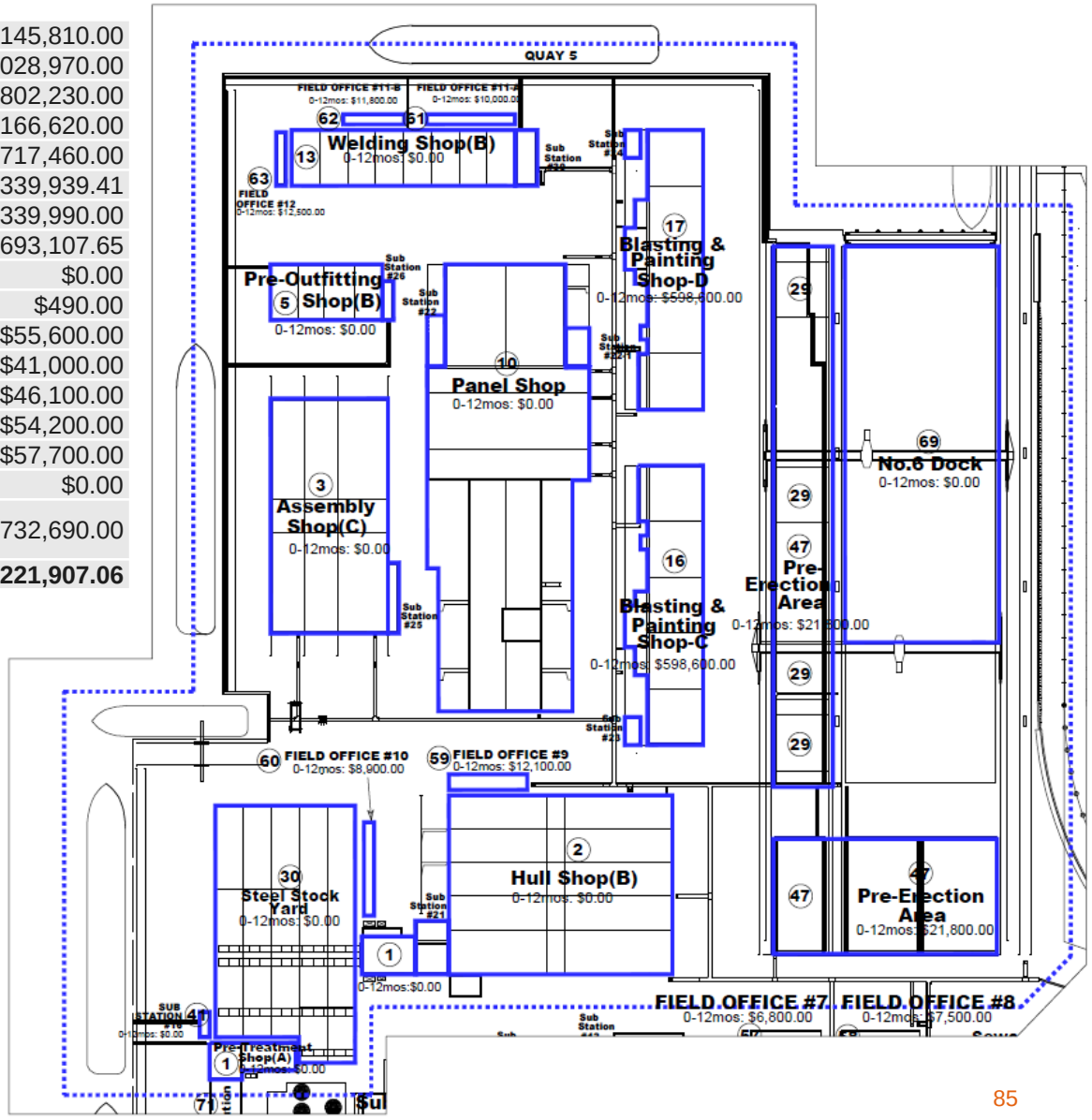
ANNEX C

Investment in building improvements

Overall CAPEX – Dock 6 Zone

1	Pre Treatment Shop A & B	R	$145,810.00
2	Hull Shop (B)	R	$1,028,970.00
3	Assembly Shop (C)	R	$802,230.00
5	Pre-Outfitting Shop (B)	R	$166,620.00
10	Panel Shop	G	$2,717,460.00
13	Welding Shop (B)	R	$339,939.41
16	Blasting & Painting Shop C	R	$1,339,990.00
17	Blasting & Painting Shop D	R	$1,693,107.65
30	Steel Stock Yard	G	$0.00
41	Sub Station #16	N/A	$490.00
59	Field Office 9	G	$55,600.00
60	Field Office 10	G	$41,000.00
61	Field Office 11A	G	$46,100.00
62	Field Office 11B	G	$54,200.00
63	Field Office 12	G	$57,700.00
69	No. 6 Dock (Dry)	N/A	$0.00
29/47	Pre-Erection Area - Dock 6 (Pre-Erection Shelter A, B)	R	$732,690.00
	Total for Dock 6 Zone (USD)		**$9,221,907.06**





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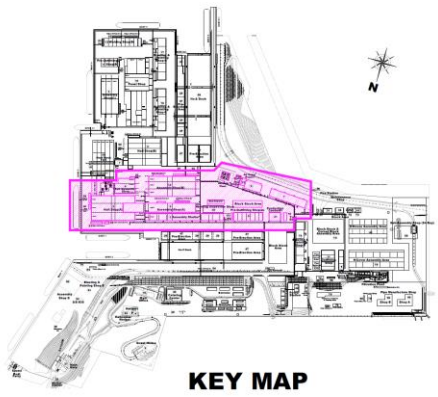
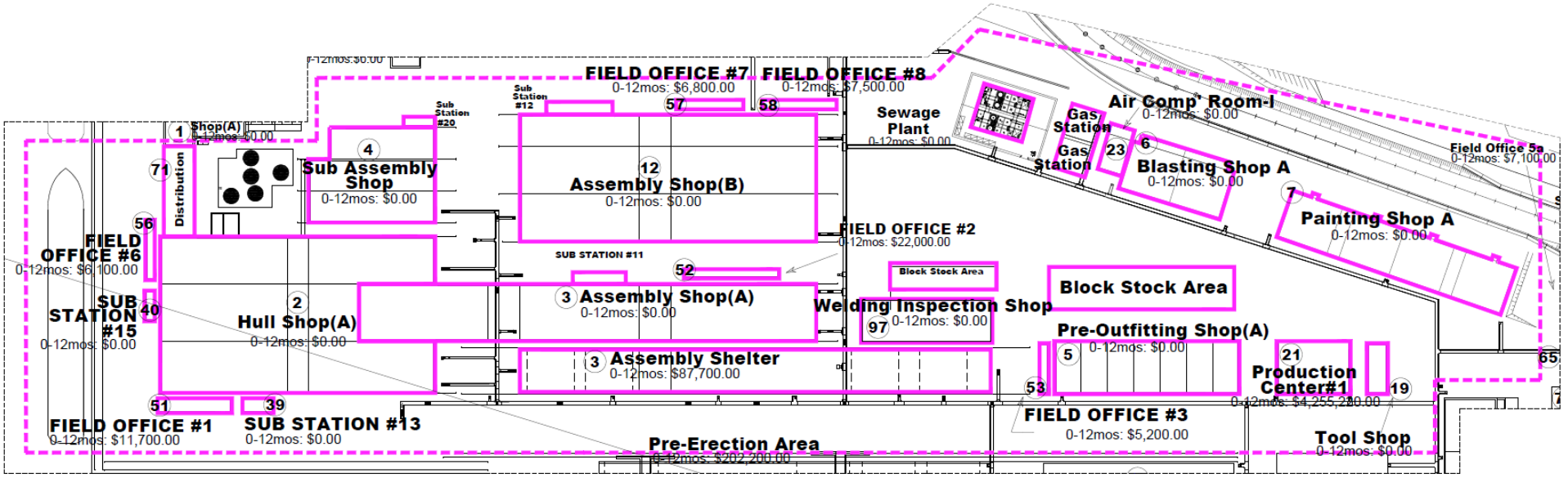
Overall CAPEX – Dock 5 Zone



2	Hull Shop (A)	R	$1,100,970.00
3	Assembly shelter (6 nos)	G	$87,700.00
3	Assembly shop (A)	G	$151,060.00
4	Sub Assembly Shop	R	$224,480.00
5	Pre-Outfitting Shop (A)	R	$163,300.00
6	Blasting Shop A	G	$7,420.00
7	Painting Shop A	R	$784,660.00
12	Assembly shop (B)	R	$393,380.00
19	Tool Shop	G	$0.00
21	Production Center 1/Hospital Building	R	$5,332,720.00
23	Air Compressed Room - 1	G	$77,770.00
39	Sub Station #13	G	$490.00

40	Sub Station #15	G	$490.00
51	Field Office 1	G	$53,700.00
52	Field Office 6a	G	$56,700.00
53	Field Office 3	G	$23,700.00
56	Field Office 6	G	$15,700.00
57	Field Office 7	G	$31,300.00
58	Field Office 8	G	$34,500.00
94	Sub Station #36	G	$490.00
95	Sub Station #37	G	$490.00
97	Welding Inspection Shop	G	$0.00
102	Painting Shop A Ext.	G	$127,890.00
	Total for Dock 5 Zone (USD)		**$8,668,910.00**



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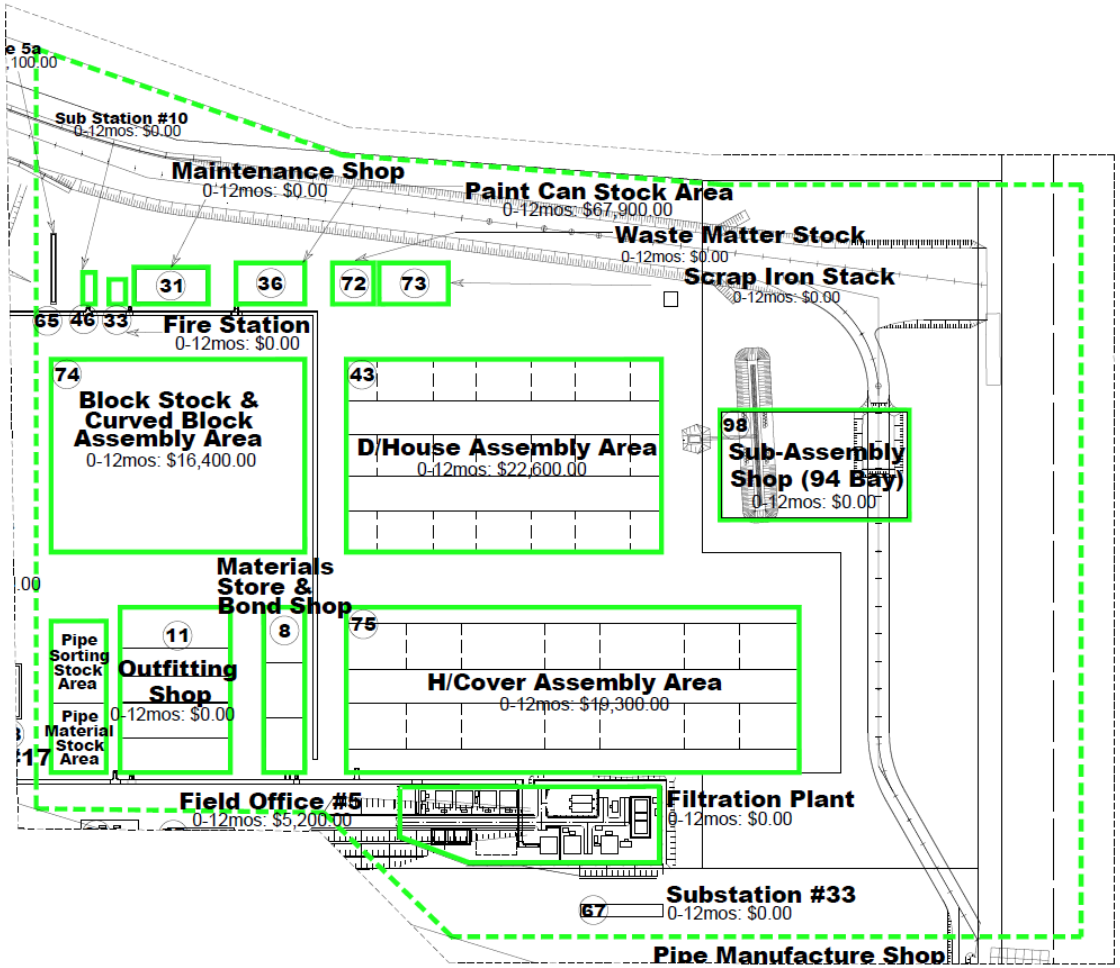
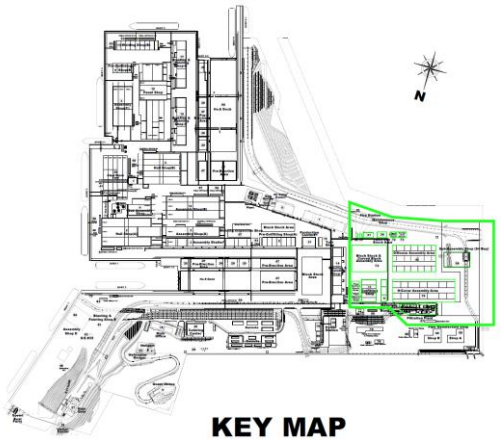
Overall CAPEX – Support Zone



0	Filtration Plant	G	$8,900.00
11	Outfitting Shop	G	$0.00
31	Maintenance Shop	G	$0.00
36	Paint Can Stock Area	R	$67,900.00
38	Sub Station #17	G	$490.00
43	Hatch cover Shelter	R	$809,730.00
46	Sub Station #10	G	$490.00
49	Sub Station #32	G	$490.00
65	Field Office 5A	G	$32,500.00
72	Waste Matter Stock	G	$0.00
73	Scrap Iron Stock	G	$0.00
74	T-BHD Shelter	R	$698,030.00
75	Dhouse Shelter	R	$694,040.00
96	Sub Station #38	G	$490.00
98	Sub-Assembly Shop (94 bay)	R	$376,760.00
	Total for Support Zone (USD)		**$2,689,820.00**



KEY MAP

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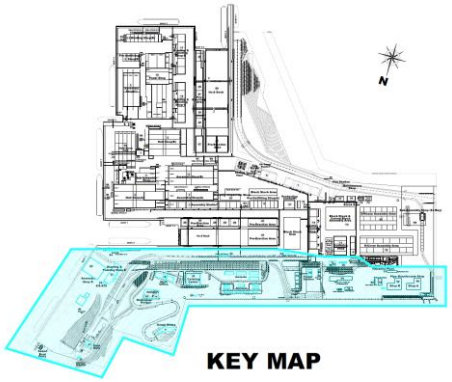
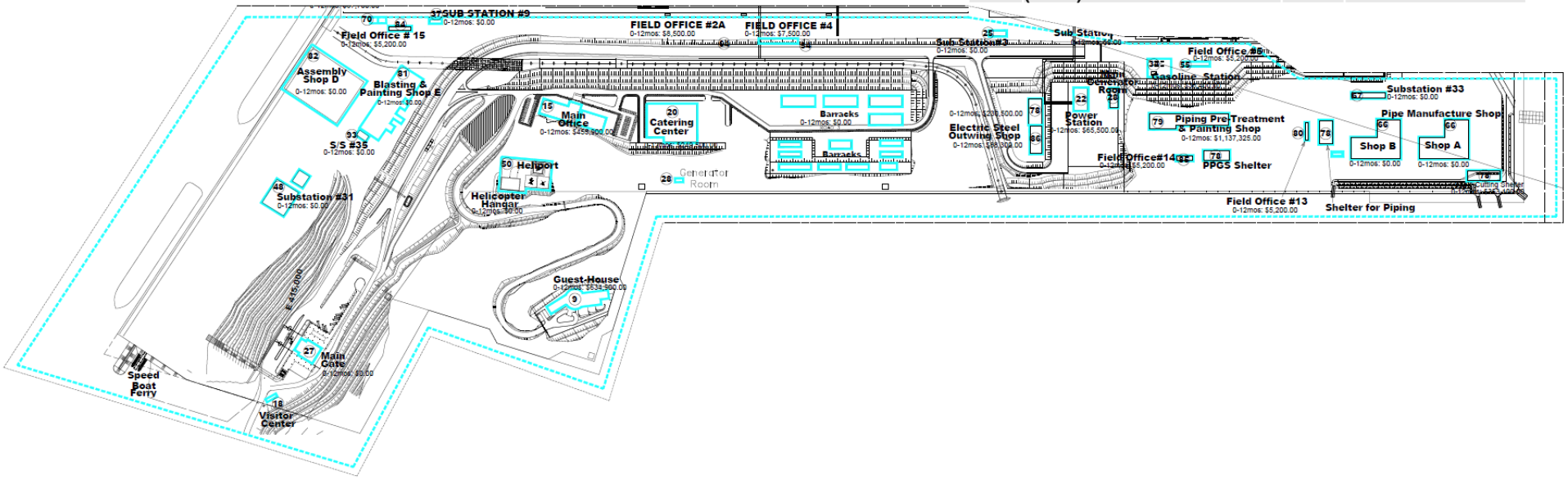
Overall CAPEX – Naval Zone



0	Convenience Store building	G	$63,100.00
86/78	Electric Steel Outfitting Shop (Building at the back)	R	$230,500.00
0	Shelter 712	G	$12,700.00
9	Guest House	R	$1,105,520.00
15	Main Office	A	$2,432,100.00
25	Sub Station #3	G	$490.00
27	Main Gate	G	$0.00
37	Sub Station #9	G	$490.00
48	Sub Station #31	G	$490.00
50	Helicopter Hangar	G	$0.00
50	Helipad	G	$0.00
55	Field Office 5	G	$23,700.00
66	Pipe Manufacture Shop A	G	$50,300.00
66	Pipe Manufacture Shop B	G	$50,300.00
66	Pipe Manufacture Shop A&B	R	$260,304.71

67	Sub Station #33	G	$490.00
70	Air Compressed Room - 2,3	G	$137,890.00
78	Painting shop/Piping Shelter	R	$447,390.00
79	Piping Pre-treatment building Galva	R	$1,282,925.00
80	Field Office 13	G	$23,700.00
81	Blasting & Painting Shop E	G	$284,280.00
82	Assembly Shop (D)	G	$73,150.00
84	Field Office 15	G	$23,700.00
85	Field Office 14	G	$23,700.00
92	Sub Station #34	G	$490.00
93	Sub Station #35	G	$490.00
86/78	Electric Steel Outfitting Shop	G	$91,030.00
0	Barracks	G	$495,790.00
	Total for Naval Zone (USD)		**$7,115,019.71**



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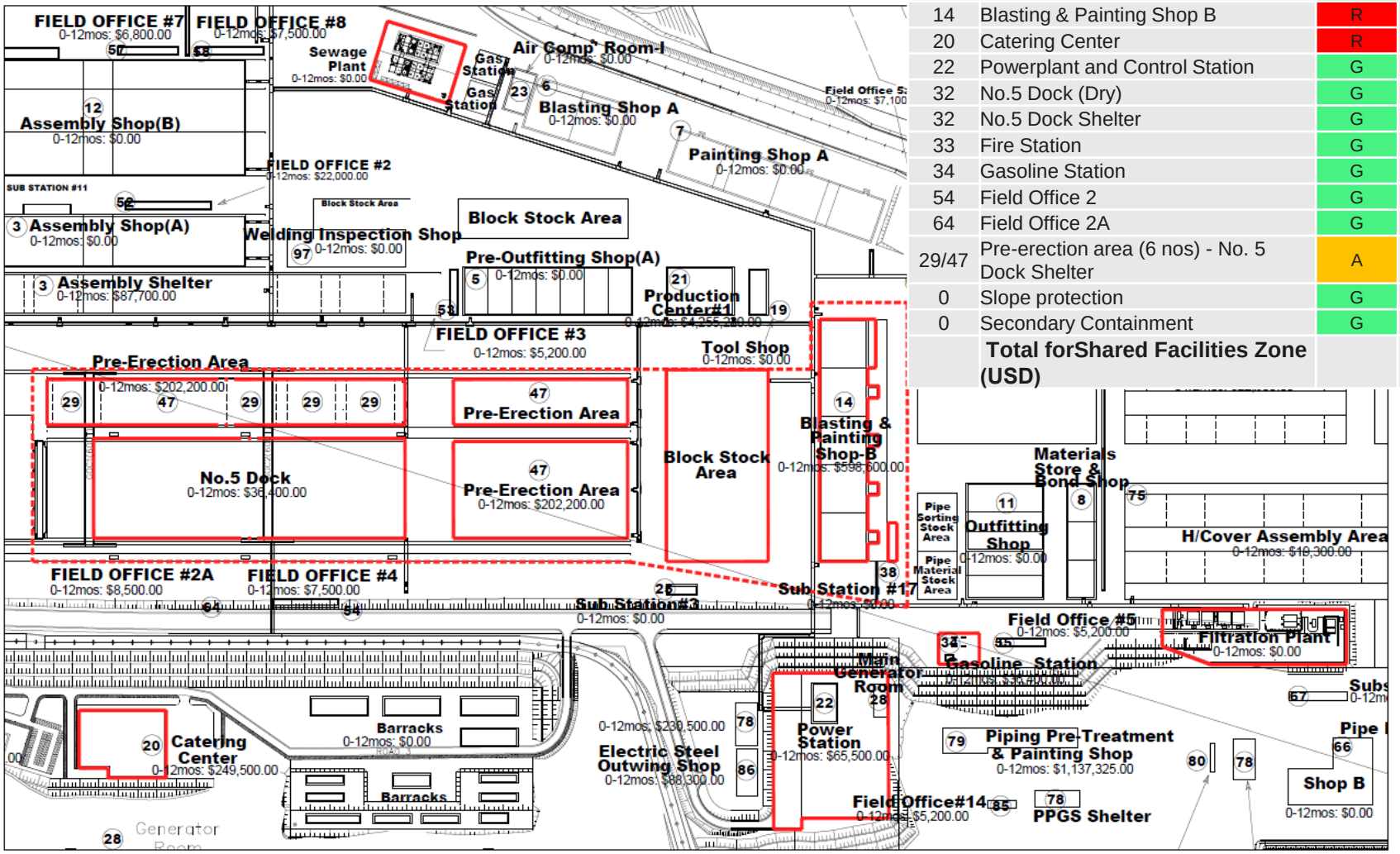
Overall CAPEX – Shared Facilities Zone

0	Overall Site Facilities	G	$0.00
0	Sewage Treatment Plant	G	$0.00
14	Blasting & Painting Shop B	R	$598,600.00
20	Catering Center	R	$1,548,240.00
22	Powerplant and Control Station	G	$184,110.00
32	No.5 Dock (Dry)	G	$0.00
32	No.5 Dock Shelter	G	$86,240.00
33	Fire Station	G	$0.00
34	Gasoline Station	G	$1,470.00
54	Field Office 2	G	$34,500.00
64	Field Office 2A	G	$39,000.00
29/47	Pre-erection area (6 nos) - No. 5 Dock Shelter	A	$215,990.00
0	Slope protection	G	$80,000.00
0	Secondary Containment	G	$50,000.00
	Total forShared Facilities Zone (USD)		**$2,838,150.00**



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ANNEX D

Water Quality Limits and Monitoring Records

Water Body Classification - Philippines

Water body Classification and Usage of Marine Waters Classification Intended Beneficial use

Class SA

- 1) Protected Waters- Waters designated as national or local marine parks, reserves, sanctuaries, and other areas established by law (presidential Proclamation 1801 and other existing laws) and/or declared as such by appropriate government agency, LGUs, etc.
- 2) Fishery Water Class 1 – Suitable for shellfish harvesting for direct human consumption.

Class SB

- 1) Fishery Water Class 11- Water suitable for commercial propagation of shellfish and intended as spawning areas for milkfish (Chanos chanos) and simmila species
- 2) Tourism Zones – For ecotourism and recreational activities
- 3) Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, skin diving, etc)

Class SC

- 1) Fishery Water Class 1II -(For the propagation and growth of fish and other aquatic resources and intended for Commercial and sustenance fishing

  2) Recreational water Class 11- For boating. Fishing, or similar activities

  3) Marshy and /or mangrove areas declared as fish and wildlife sanctuaries

Class SD Navigable Waters

Subic Bay is classified as Class SB

Effluent Standards – Philippines – Marine (review SB as applicable for the Subic Bay)

Parameter	Unit	SA	SB	SC	SD
Ammonia as NH3-N	mg/L	NDA	0.5	0.5	7.5
BOD	mg/L	NDA	30	100	150
COD	mg/L	NDA	2	20	80
Color	TCU	NDA	100	150	300
Flouride	mg/L	NDA	3	3	6
Nitrate as NO3-N	mg/L	NDA	20	20	30
pH(Range)		NDA	6.5-9.0	6.0-9	5.5-9.5
Phospate	mg/L	NDA	1	1	10
Surfactants (MBAS)	mg/L	NDA	3	15	30
Total Suspended Solids	mg/L	NDA	70	100	150
Oil and Grease	mg/L	NDA	5	10	15

STP Effluent Specified Parameters

1. The permit holder shall discharge to **Agusuhin River,** for the period of one (1) year with effluent wastewater flow not exceeding **513 and 467 cubic meters per day** for STP 1 and STP 2 respectively and in conformity with DENR Department Administrative Order No. 2016-08 (Water Quality Guidelines and General Effluent Standards) and shall comply with the following Standards:

Parameters	Standards	Parameters	Standards
pH	6.0-9.0	Cyanide)	0.14 mg/L
COD	60 mg/L	Fluoride	2 mg/L
Total Suspended Solids	85 mg/L	Boron	2 mg/L
Ammonia	0.5 mg/L	Chromium	0.02 mg/L
Nitrate	14 mg/L	Iron	5 mg/L
Phosphate	1 mg/L	Nickel	0.2 mg/L
Sulfate	500 mg/L	Lead	0.02 mg/L
Oil and Grease	5 mg/L	Trichloroetylene	0.7 mg/L

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PAB ACCREDITED TESTING LABORATORY
PNS ISO/IEC 17025:2005
LA-1997-017F (Chemical)
LA-2002-044E (Biological)

DENR Recognized Laboratory with C.R No. 011/2018

CERTIFICATE OF ANALYSIS

- [x] Original Issue
- [ ] Duplicate issue by request
- [ ] Revision Copy

Customer : HHIC-PHILS., INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Zambales

Attention : MS. IRENE ISIP

CAN : **114717**
Date of Issue : 8/22/2019
RAN : 122163
INVOICE # : 32737
Date Received: 8/9/2019
Date Sampled: 8/9/2019
Date Analyzed: 8/9-19/2019

RESULTS OF ANALYSIS

Sample Descriptions	Parameters	Results	Units	Methods	DAO 2016-08 Effluent Standards, Class C
Effluent STP 1-1	pH	7.5	-	Electrometric	6.0-9.5
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric	-
1003H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test	50
	Total Suspended Solids (TSS)	17	mg/L	Gravimetric, dried at 103-105 °C	100
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric	5
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS	15
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric	0.02
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)	0.2
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS	0.04
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame	0.01
	Chromium (Cr)	<0.02	mg/L	Direct Air-Acetylene Flame	-
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame	0.1
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS	0.004
	Total Coliform	22	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique	10,000

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Sample Descriptions	Parameters	Results	Units	Methods	DAO 2016-08 Effluent Standards, Class C
Effluent STP 1-2	pH	7.4	-	Electrometric	6.0-9.5
Temp 28°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric	-
0926H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test	50
	Total Suspended Solids (TSS)	25	mg/L	Gravimetric, dried at 103-105 °C	100
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric	5
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS	15
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric	0.02
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)	0.2
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS	0.04
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame	0.01
	Chromium (Cr)	<0.02	mg/L	Direct Air-Acetylene Flame	-
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame	0.1
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS	0.004
	Total Coliform	49	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique	10,000

Note : The customer is given 7 days upon receipt to raise questions or clarification on any part or content of the certificate, otherwise the result(s) is/are deemed accepted.

Total No. of Samples : 2 **Total Analysis :** 28

Sample Submission : Sampled by the OMLI staff

Reference : Standard Methods for the Examination of Water and Wastewater, 23rd ed.

Remarks : Results relate only to the items tested and received by the laboratory.

Certified Correct by:

CHRISTOPHER D. HERNANDEZ, RM
Microbiology Section Head

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:

ALVIN P. BASCO, RCh
PRC No. 0011786
Head of Operations

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PNS ISO/IEC 17025:2005
LA-1997-017F (Chemical)
LA-2002-044E (Biological)

DENR Recognized Laboratory with C.R No. 011/2018

Original Issue ☑
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CERTIFICATE OF ANALYSIS

Customer : HHIC-PHILS., INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Zambales

Attention : MS. IRENE ISIP

CAN : **114717A**
Date of Issue : 8/22/2019
RAN : 122163
INVOICE # : 32737
Date Received: 8/9/2019
Date Sampled: 8/9/2019
Date Analyzed: 8/9-19/2019

RESULTS OF ANALYSIS

Sample Descriptions	Parameters	Results	Units	Methods
Quay Wall	pH	7.1	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	7	mg/L	Iodometric
1043H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	3	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	130	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique
Agusuhin (Downstream)	pH	7.4	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1057H	Biochemical Oxygen Demand (BOD)	<1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	3	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	920	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique

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Sample Descriptions	Parameters	Results	Units	Methods
North Channel	pH	7.6	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1127H	Biochemical Oxygen Demand (BOD)	<1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	4	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	540	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique
South Channel	pH	7.5	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1142H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	2	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	350	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique

Note : The customer is given 7 days upon receipt to raise questions or clarification on any part or content of the certificate, otherwise the result(s) is/are deemed accepted.

Total No. of Samples : 4 **Total Analysis** : 52

Sample Submission : Sampled by the OMLI staff

Reference : Standard Methods for the Examination of Water and Wastewater, 23rd ed.

Remarks : Results relate only to the items tested and received by the laboratory.

Certified Correct by:

CHRISTOPHER D. HERNANDEZ, RM
Microbiology Section Head

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:

ALVIN P. BASCO, RCh
PRC No. 0011786
Head of Operations

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Email : customer.service@ostrealabs.com.ph

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DOH ACCREDITED Water Testing Laboratory Accreditation No. 04A-0001-18-LW-2

DENR Recognized Laboratory with C.R No. 011/2018

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CERTIFICATE OF ANALYSIS

Customer : HHIC-PHILS., INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Zambales

Attention : MS. IRENE ISIP

CAN : **114716**
Date of Issue : 8/22/2019
RAN : 122164
INVOICE # : 32737
Date Received: 8/9/2019
Date Sampled: 8/9/2019
Date Analyzed: 8/9-19/2019

RESULTS OF ANALYSIS

Sample Description	Parameters	Results	Units	Methods	PNS for Drinking Water 2017
Drinking	pH	7.1	-	Electrometric	6.5-8.5
Filtration Area	Color	<5	ACU	Visual Comparison	10
Temp 27°C	Turbidity	0.37	NTU	Nephelometric	5
1117H	Conductivity@24.8°C	217.7	µS/cm	Laboratory	-
	Total Solids (TS)	142	mg/L	Gravimetric, dried at 103-105 °C	-
	Chloride (Cl^-)	2.4	mg/L	Argentometric	250
	* Residual Chlorine (Cl_2)	**0.26**	mg/L	Chlorine Meter	0.3 min and 1.5 max
	Sulfate (SO_4^{2-})	5	mg/L	Turbidimetric	250
	Silica (SiO_2)	9.18	mg/L	Heteropoly Blue	-
	Aluminum (Al)	<0.10	mg/L	Direct Nitrous Oxide-Acetylene Flame	0.2
	Calcium (Ca)	20.05	mg/L	Direct Nitrous Oxide-Acetylene Flame	-
	Magnesium (Mg)	9.88	mg/L	Direct Air-Acetylene Flame	-
	Total Hardness as $CaCO_3$	90.76	mg/L	Direct Nitrous Oxide/Air-Acetylene Flame	300
	Total Coliform	**> 8.0**	MPN/100mL	Multiple Tube Fermentation	<1.1
	Thermotolerant Coliform	**4.6**	MPN/100mL	Multiple Tube Fermentation	<1.1
	Heterotrophic Plate Count (HPC)	**745**	CFU/mL	Pour Plate	<500

Note : * Parameter which is/are outside the laboratory's PNS ISO/IEC 17025:2005 scope of accreditation.
The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is /are deemed accepted.

Total No. of Sample : 1 **Total Analysis** : 16
Sample Submission : Sampled by the OMLI staff
Reference : Standard Methods for the Examination of Water and Wastewater, 23rd ed.
Remarks : Results relate only to the item tested and received by the laboratory.

Certified Correct by:

CHRISTOPHER D. HERNANDEZ, RM
Microbiology Section Head

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:

ALVIN P. BASCO, RCh
PRC No. 0011786
Head of Operations

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Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Zambales

Attention : MS. IRENE ISIP

CAN : **114716A**
Date of Issue : 8/22/2019
RAN : 122164
INVOICE # : 32737
Date Received: 8/9/2019
Date Sampled: 8/9/2019
Date Analyzed: 8/9-19/2019

RESULTS OF ANALYSIS

Sample Description	Parameters	Results	Units	Methods	PNS for Drinking Water 2017
Drinking	pH	7.0	-	Electrometric	6.5-8.5
Field Offices	Color	<5	ACU	Visual Comparison	10
Temp 28°C	Turbidity	0.17	NTU	Nephelometric	5
1024H	Conductivity@24.5°C	229.1	µS/cm	Laboratory	-
	Total Solids (TS)	143	mg/L	Gravimetric, dried at 103-105 °C	-
	Chloride (Cl^-)	2.2	mg/L	Argentometric	250
	* Residual Chlorine (Cl_2)	**0.07**	mg/L	Chlorine Meter	0.3 min and 1.5 max
	Sulfate (SO_4^{2-})	6	mg/L	Turbidimetric	250
	Silica (SiO_2)	3.18	mg/L	Heteropoly Blue	-
	Aluminum (Al)	<0.10	mg/L	Direct Nitrous Oxide-Acetylene Flame	0.2
	Calcium (Ca)	23.93	mg/L	Direct Nitrous Oxide-Acetylene Flame	-
	Magnesium (Mg)	10.43	mg/L	Direct Air-Acetylene Flame	-
	Total Hardness as $CaCO_3$	100.22	mg/L	Direct Nitrous Oxide/Air-Acetylene Flame	300
	Total Coliform	**> 8.0**	MPN/100mL	Multiple Tube Fermentation	<1.1
	Thermotolerant Coliform	**8.0**	MPN/100mL	Multiple Tube Fermentation	<1.1
	Heterotrophic Plate Count (HPC)	**680**	CFU/mL	Pour Plate	<500

Note : * Parameter which is/are outside the laboratory's PNS ISO/IEC 17025:2005 scope of accreditation.
The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is /are deemed accepted.

Total No. of Sample : 1 **Total Analysis** : 16
Sample Submission : Sampled by the OMLI staff
Reference : Standard Methods for the Examination of Water and Wastewater, 23rd ed.
Remarks : Results relate only to the item tested and received by the laboratory.

Certified Correct by:

CHRISTOPHER D. HERNANDEZ, RM
Microbiology Section Head

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:

ALVIN P. BASCO, RCh
PRC No. 0011786
Head of Operations

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Email : customer.service@ostrealabs.com.ph

PAB ACCREDITED TESTING LABORATORY
PNS ISO/IEC 17025:2005
LA-1997-017F (Chemical)
LA-2002-044E (Biological)

DENR Recognized Laboratory with C.R No. 011/2018

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Revision Copy ☐

CERTIFICATE OF ANALYSIS

Customer : HHIC-PHILS., INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Zambales

Attention : MS. IRENE ISIP

CAN : **114717A**
Date of Issue : 8/22/2019
RAN : 122163
INVOICE # : 32737
Date Received: 8/9/2019
Date Sampled: 8/9/2019
Date Analyzed: 8/9-19/2019

RESULTS OF ANALYSIS

Sample Descriptions	Parameters	Results	Units	Methods
Quay Wall	pH	7.1	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	7	mg/L	Iodometric
1043H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	3	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	130	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique
Agusuhin (Downstream)	pH	7.4	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1057H	Biochemical Oxygen Demand (BOD)	<1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	3	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	920	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique

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Sample Descriptions	Parameters	Results	Units	Methods
North Channel	pH	7.6	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1127H	Biochemical Oxygen Demand (BOD)	<1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	4	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	540	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique
South Channel	pH	7.5	-	Electrometric
Temp 27°C	Dissolved Oxygen (DO)	8	mg/L	Iodometric
1142H	Biochemical Oxygen Demand (BOD)	1	mg/L	5 - Day BOD Test
	Total Suspended Solids (TSS)	2	mg/L	Gravimetric, dried at 103-105 °C
	Oil and Grease	<1.0	mg/L	Liquid-Liquid, Partition - Gravimetric
	Surfactants (MBAS)	<0.10	mg/L	Anionic Surfactants as MBAS
	Hexavalent Chromium (Cr^{6+})	<0.01	mg/L	Colorimetric
	Cyanide (CN^-)	<0.05	mg/L	Cyanide - Selective Electrode (w/o distillation)
	Arsenic (As)	<0.001	mg/L	Manual Hydride Generation AAS
	Cadmium (Cd)	<0.003	mg/L	Direct Air-Acetylene Flame
	Lead (Pb)	<0.01	mg/L	Direct Air-Acetylene Flame
	Mercury (Hg)	<0.0001	mg/L	Cold Vapor AAS
	Total Coliform	350	MPN/100mL	Multiple Tube Fermentation Technique - Standard Total Coliform Fermentation Technique

Note : The customer is given 7 days upon receipt to raise questions or clarification on any part or content of the certificate, otherwise the result(s) is/are deemed accepted.

Total No. of Samples : 4 **Total Analysis** : 52

Sample Submission : Sampled by the OMLI staff

Reference : Standard Methods for the Examination of Water and Wastewater, 23rd ed.

Remarks : Results relate only to the items tested and received by the laboratory.

Certified Correct by:

CHRISTOPHER D. HERNANDEZ, RM
Microbiology Section Head

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:

ALVIN P. BASCO, RCh
PRC No. 0011786
Head of Operations

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CAN 114717A

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ANNEX E

Air Emissions Limits and Monitoring Data

Ambient Air Quality – Specified Parameter Limits according to Philippine regulations

Table 1
National Ambient Air Quality Guideline Values

Pollutants	Short Term[a]			Long Term[b]		
	µg/NCM	ppm	Averaging Time	µg/NCM	ppm	Averaging Time
Suspended Particulate Matter[c] –						
TSP	230[d]		24 hours	90		1 year[e]
PM-10	150[f]		24 hours	60		1 year[e]
Sulfur Dioxide[c]	180	0.07	24 hours	80	0.03	1 year
Nitrogen Dioxide	150	0.08	24 hours			
Photochemical Oxidants as Ozone	140	0.07	1 hour			
	60	0.03	8 hours			
Carbon Monoxide	35 mg/NCM	30	1 hour			
	10 mg/NCM	9	8 hours			
Lead[g]	1.5		3 months[g]	1.0		1 year

Source Specific – Specified Parameter Limits according to Philippine regulations

Table 2
National Emission Standards for Source Specific Air Pollutants (NESSAP)

POLLUTANT	STANDARD APPLICABLE TO SOURCE	MAXIMUM PERMISSIBLE LIMITS (mg/NCM)	METHOD OF SAMPLING[a]	METHOD OF ANALYSIS[a]
Antimony and its Cmpds.	Any source	10 as Sb	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Arsenic and its Cmpds.	Any source	10 as As	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Cadmium and its Cmpds.	Any source	10 as Cd	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Carbon Monoxide	Any industrial source	500 as CO	USEPA Method 3 or 10	Orsat Analysis or NDIR
Copper and its Cmpds.	Any industrial source	100 as Cu	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Hydrofluoric Acid and Fluoride Compounds	Any source other than manufacture of Aluminum from Alumina	50 as HF	USEPA Method 13 or 14 as appropriate	As per sampling method
Hydrogen Sulfide	i) Geothermal power plants ii) Geothermal Exploration And Well Testing iii) Any source other than (i) and (ii)	[c], [d] [e] 7 as H_2S	USEPA Method 11, 15 or 16 as appropriate	Cadmium Sulfide Method or per sampling method
Lead	Any trade, industry or process	10 as Pb	USEPA Methods 1 through 5or 12 or 29	AAS[b] or per sampling method
Mercury	Any source	5 as elemental Hg	USEPA Methods 1 through 5 or 29 or 101	AAS[b] / Cold-Vapor Technique or Hg Analyzer
Nickel and its Cmpds. Except Nickel Carbonyl[f]	Any source	20 as Ni	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method

POLLUTANT	STANDARD APPLICABLE TO SOURCE	MAXIMUM PERMISSIBLE LIMITS (mg/NCM)	METHOD OF SAMPLING[a]	METHOD OF ANALYSIS[a]
NO_x	1) Manufacture of Nitric Acid 2) Fuel burning steam generators a) Existing Source b) New Source i) Coal-fired ii) Oil-fired 3) Diesel-powered electricity generators 4) Any source other than (1), (2) and (3) a) Existing Source b) New Source	2,000 as acid & NO_2 calculated as NO_2 1,500 as NO_2 1,000 as NO_2 500 as NO_2 2,000 as NO_2 1,000 as NO_2 500 as NO_2	USEPA Methods 1 through 4 and Method 7	Phenol-disulfonic acid Method or per sampling method
Particulates	1) Fuel Burning Equipment a) Urban[g] and Industrial Area[h] b) Other Area[i] 2) Cement Plants (kilns, etc.) 3) Smelting Furnaces 4) Other Stationary Sources[j]	 150 200 150 150 200	USEPA Methods 1 through 5	Gravimetric per sampling method
Phosphorus Pentoxide[k]	Any source	200 as P_2O_5	USEPA Methods 1 through 5 or 29	Spectrophotometry or per sampling method
Sulfur Oxides	1) Existing Sources a) Manufacture of Sulfuric Acid and Sulf(on)ation Process b) Fuel Burning Equipment c) Other Stationary Sources[l] 2) New Sources a) Manufacture of Sulfuric Acid and Sulf(on)ation Process b) Fuel Burning Equipment c) Other Stationary Sources[l]	 2,000 as SO_3 1,500 as SO_2 1,000 as SO_3 1,500 as SO_3 700 as SO_2 200 as SO_3	USEPA Methods 1 through 4 and 6 or 8 as appropriate	As per sampling method
Zinc and its Compounds	Any source	100 as Zn	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method

Hanjin Specific (internal) emission limits as per their environmental procedure

4) Discharging pollutants acceptance standard level of HHIC-Phil is as follows.

Classification	Parameters	Standards	
Air Quality	NO_2 (ug/Ncm)	260	
	SO_2 (ug/Ncm)	340	
	TSP (ug/Ncm)	300	
	Noise (dB)	75	
Water Quality		Ambient water	Wastewater
	pH	6.5 – 8.5	6.5 – 9.0
	BOD (mg/L)	7(10)	50
	Color (PCU)	No abnormal discoloration	150
	DO (mg/L)	5.0 min	-----
	Temperature (℃)	3℃ max. rise	
	TSS (mg/L)	30 mg/L inc.	70
	Oil and Grease (mg/L)	2	5.0
	Total Coliforms (MPN/100mL)	5000	$1.0X10^4$

Ambient Air

To:	**MS. IRENE ISIP**	Email:	iaisip@hhic-phil.com
Company:	**HHIC PHILIPPINES, INC.**	Date:	16 May 2019
From:	**MR. ELLISON M. BALCE**	Page 1 of:	2
cc:	**MELANIE TOLENTINO**	BSI Project No:	PJ 19-147 P1

Special Instructions: ☐ Confidential ☐ Urgent ☑ Please reply ☑ For your information ☐ For follow-up

If you do not receive all pages or transmission is illegible, please contact the originator to re-send. Should the e-mail be sent to a wrong address, please notify BSI immediately and destroy this copy. Thank you.

Subject: Initial Report on Ambient Air Quality and Noise Level Monitoring

Dear Ms. Isip:

Please find below the results of the Ambient Air Quality and Noise Level Monitoring conducted on February 21, 2019 at your facility in Subic, Zambales.

Measured Ambient Air Quality Monitoring Results (µg/Ncm)

Station	Location	Time of Sampling (February 21, 2018)	TSP	SO_2	NO_2
A1	Downwind (Near Main Gate)	1118H-1218H	1.7	2.9	7.3
A2	Upwind (Near Swimming Pool Area)	1301H-1401H	3.5	7.4	9.8
DENR National Ambient Air Quality Standards for Source Specific Air Pollutants based on 60 minutes averaging time			**300**	**340**	**260**

Note: For the non-detected value, the detection limit in µg was divided by the total normal volume of air sampled.

Daytime Ambient Noise Level Monitoring Results (dBA)

Station	Location	Time of Sampling (February 21, 2018)	Noise Level*
N1	Downwind (Near Main Gate)	1108H-1118H	45
N2	Upwind (Near Swimming Pool Area)	1302H-1312H	43
The applicable NPCC standard (for Class B areas - a section or contiguous area which is primarily commercial area) for daytime measurement			**65**

** Median of seven highest recorded noise levels (NPCC, 1978).*

Observed Sources of Noise

Station	Location	Sources of Noise
N1	Downwind (Near Main Gate)	Sea waves and conversing people
N2	Upwind (Near Swimming Pool Area)	Passing light vehicles, motorcycles and trucks

The final report will be prepared as soon as we receive a scanned copy of this document with your signature. If we are unable to receive a response from you within three (3) working days upon receipt of this initial report, we will start preparing the final report.

If you have concerns, please do not hesitate to contact us.

Thank you and best regards.

ELLISON M. BALCE
Jr. Environmental Specialist

Noted by:

EMMANUEL R. ALTAREJOS
Executive Vice President

Conforme:

_____
HHIC PHILS., INC.

8CN51600PH/PPA1421776/[20190530-14:51:29]

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Assaying and Environmental Testing Specialist
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LA-1997-017E

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Source Emission Testing Firm
SAT № 2016 - 79
SAT № 2017 - 82 / 83 / 88

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983**
Date of Issue : 12/20/2018
RAN : 113839
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/13-19/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,250 kW Cummins Generator Set # 1 (Main Power Station)				
R1A	Nitrogen Dioxide (NO_2)	38.5	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	38.5	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	47.8	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	44.7	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	33.9	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	37.0	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	46.2	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	40.1	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	38.5	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No. 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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SAT № 2016 - 79
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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983A**
Date of Issue : 12/20/2018
RAN : 113839
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,250 kW Cummins Generator Set # 1				
(Main Power Station)				
R1	Carbon Monoxide (CO)	147.5	ppm	Non-Dispersive Infrared
R2	Carbon Monoxide (CO)	153.7	ppm	Non-Dispersive Infrared
R3	Carbon Monoxide (CO)	141.9	ppm	Non-Dispersive Infrared

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983B**
Date of Issue : 12/20/2018
RAN : 113840
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/13-19/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,250 kW Cummins Generator Set # 2 (Main Power Station)				
R1A	Nitrogen Dioxide (NO_2)	52.4	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	43.2	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	44.7	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	46.2	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	49.3	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	40.1	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	43.2	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	47.8	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	44.7	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983C**
Date of Issue : 12/20/2018
RAN : 113840
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,250 kW Cummins Generator Set # 2 (Main Power Station)				
R1	Carbon Monoxide (CO)	144.1	mg	Non-Dispersive Infrared
R2	Carbon Monoxide (CO)	227.4	mg	Non-Dispersive Infrared
R3	Carbon Monoxide (CO)	170.6	mg	Non-Dispersive Infrared

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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Email : customer.service@ostrealabs.com.ph

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983F**
Date of Issue : 12/20/2018
RAN : 113841
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/13-19/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,500 kW Cummins Generator Set # 4 (Main Power Station)				
R1A	Nitrogen Dioxide (NO_2)	32.4	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	38.5	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	35.4	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	41.6	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	29.3	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	24.7	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	35.4	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	30.8	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	30.8	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983G**
Date of Issue : 12/20/2018
RAN : 113841
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
1,500 kW Cummins Generator Set # 4 (Main Power Station)				
R1	Carbon Monoxide (CO)	327.0	ppm	Non-Dispersive Infrared
R2	Carbon Monoxide (CO)	357.1	ppm	Non-Dispersive Infrared
R3	Carbon Monoxide (CO)	348.1	ppm	Non-Dispersive Infrared

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983H**
Date of Issue : 12/20/2018
RAN : 113842
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/13-19/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
2,000 kW Cummins Generator Set # 5 (Main Power Station)				
R1A	Nitrogen Dioxide (NO_2)	103.3	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	83.2	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	89.4	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	81.7	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	78.6	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	78.6	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	80.1	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	77.1	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	86.3	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9

Sample Submission : Sampled by the OMLI staff

Reference : USEPA Method 7

Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983I**
Date of Issue : 12/20/2018
RAN : 113842
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/10/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
2,000 kW Cummins Generator Set # 5 (Main Power Station)				
R1	Carbon Monoxide (CO)	173.2	ppm	Non-Dispersive Infrared
R2	Carbon Monoxide (CO)	129.2	ppm	Non-Dispersive Infrared
R3	Carbon Monoxide (CO)	138.0	ppm	Non-Dispersive Infrared

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983J**
Date of Issue : 12/27/2018
RAN : 113920
INVOICE # :
Date Received: 12/13/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/17-22/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Cummins				
Generator Set # 1 (Sub-Station 6)				
R1A	Nitrogen Dioxide (NO_2)	373.1	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	398.1	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	383.4	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	393.7	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	383.4	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	390.7	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	396.6	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	399.5	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	390.7	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983K**
Date of Issue : 12/20/2018
RAN : 113843
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/14/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Cummins				
Generator Set # 1 (Sub-Station 6)				
R1	Carbon Monoxide (CO)	306.3	ppm	Non-Dispersive Infrared (NDIR)
R2	Carbon Monoxide (CO)	227.3	ppm	Non-Dispersive Infrared (NDIR)
R3	Carbon Monoxide (CO)	203.6	ppm	Non-Dispersive Infrared (NDIR)

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983L**
Date of Issue : 12/27/2018
RAN : 113921
INVOICE # :
Date Received: 12/13/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/17-22/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Caterpillar				
Generator Set # 1 (Sub-Generator)				
R1A	Nitrogen Dioxide (NO_2)	123.4	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	120.4	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	121.9	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	123.4	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	121.9	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	120.4	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	129.3	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	130.7	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	126.3	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983M**
Date of Issue : 12/20/2018
RAN : 113844
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/14/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Caterpillar				
Generator Set # 1 (Sub-Generator)				
R1	Carbon Monoxide (CO)	145.7	ppm	Non-Dispersive Infrared (NDIR)
R2	Carbon Monoxide (CO)	171.1	ppm	Non-Dispersive Infrared (NDIR)
R3	Carbon Monoxide (CO)	197.9	ppm	Non-Dispersive Infrared (NDIR)

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983N**
Date of Issue : 12/27/2018
RAN : 113922
INVOICE # :
Date Received: 12/13/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/17-22/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Caterpillar				
Generator Set # 2 (Sub-Generator)				
R1A	Nitrogen Dioxide (NO_2)	35.3	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	33.8	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	33.8	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	38.2	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	38.2	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	35.3	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	35.3	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	33.8	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	39.7	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
PRC No. 0007398
Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
PRC No. 0011786
Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawang, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983O**
Date of Issue : 12/20/2018
RAN : 113845
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
400 kW Caterpillar				
Generator Set # 2 (Sub-Generator)				
R1	Carbon Monoxide (CO)	193.2	ppm	Non-Dispersive Infrared (NDIR)
R2	Carbon Monoxide (CO)	166.0	ppm	Non-Dispersive Infrared (NDIR)
R3	Carbon Monoxide (CO)	152.1	ppm	Non-Dispersive Infrared (NDIR)

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
PRC No 0000885
Sampling Group Manager

Certified Correct by:
MARVIN ALBERT C. SIPIN, RCh
PRC No 0012144
Chemist

MA. CRISTINA F. REFERENTE, RCh
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Laboratory Head

Authorized by:
ALVIN P. BASCO, RCh
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Deputy Head of Operations

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983P**
Date of Issue : 12/26/2018
RAN : 113838
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/13-18/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
50 tons Miura Boiler (Galvanization Shop)				
R1	Particulate Matter (PM) with Acetone Wash	28.3	mg	Gravimetric
R2	Particulate Matter (PM) with Acetone Wash	48.2	mg	Gravimetric
R3	Particulate Matter (PM) with Acetone Wash	51.1	mg	Gravimetric

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 5
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
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CERTIFICATE OF ANALYSIS

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Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983Q**
Date of Issue : 12/26/2018
RAN : 113838
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/17/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
50 tons Miura Boiler (Galvanization Shop)				
R1	Sulfur Dioxide (SO_2)	6.4	mg	Barium Thorin Titration
R2	Sulfur Dioxide (SO_2)	6.4	mg	Barium Thorin Titration
R3	Sulfur Dioxide (SO_2)	6.4	mg	Barium Thorin Titration

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 6/8
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
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MA. CRISTINA F. REFERENTE, RCh
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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin Subic Bay Freeport Zone, Zambales

CAN **106983R**
Date of Issue : 1/2/2019
RAN : 113923
INVOICE # :
Date Received: 12/13/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/17-27/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
50 tons Miura Boiler (Galvanization Shop)				
R1A	Nitrogen Dioxide (NO_2)	27.5	µg	Phenoldisulfonic Acid
R1B	Nitrogen Dioxide (NO_2)	27.5	µg	Phenoldisulfonic Acid
R1C	Nitrogen Dioxide (NO_2)	28.9	µg	Phenoldisulfonic Acid
R2A	Nitrogen Dioxide (NO_2)	31.6	µg	Phenoldisulfonic Acid
R2B	Nitrogen Dioxide (NO_2)	31.6	µg	Phenoldisulfonic Acid
R2C	Nitrogen Dioxide (NO_2)	31.6	µg	Phenoldisulfonic Acid
R3A	Nitrogen Dioxide (NO_2)	28.9	µg	Phenoldisulfonic Acid
R3B	Nitrogen Dioxide (NO_2)	28.9	µg	Phenoldisulfonic Acid
R3C	Nitrogen Dioxide (NO_2)	30.3	µg	Phenoldisulfonic Acid

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 9 **Total Analysis:** 9
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 7
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
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Sampling Group Manager

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Chemist

MA. CRISTINA F. REFERENTE, RCh
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Laboratory Head

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CERTIFICATE OF ANALYSIS

Customer : HHIC - PHILIPPINES, INC.

Address : Greenbeach 1, Redondo Peninsula, Brgy. Cawag, Sitio Agusuhin
Subic Bay Freeport Zone, Zambales

CAN **106983S**
Date of Issue : 12/26/2018
RAN : 113838
INVOICE # :
Date Received: 12/12/2018
Date Sampled: 12/11/2018
Date Analyzed: 12/12/2018

RESULTS OF ANALYSIS

Sample Description	Parameter	Results	Unit	Method
50 tons Miura Boiler (Galvanization Shop)				
R1	Carbon Monoxide (CO)	28.5	ppm	Non-Dispersive Infrared
R2	Carbon Monoxide (CO)	22.0	ppm	Non-Dispersive Infrared
R3	Carbon Monoxide (CO)	25.6	ppm	Non-Dispersive Infrared

Note : The customer is given 7 days upon receipt to raise questions or clarifications on any part or content of the certificate, otherwise the result(s) is / are deemed accepted.

Total # of Sample : 3 **Total Analysis:** 3
Sample Submission : Sampled by the OMLI staff
Reference : USEPA Method 10
Remarks : Results relate only to the items tested and received by the laboratory

Approved Signatory:
VANESSA R. GARCIA, RChT
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ANNEX F

Marine & Aquatic Monitoring

2.6 Observation on Changes on the Benthic (Bottom) Ecology of the Shoreline

The overall soft bottom / benthic ecology along the Hanjin remained unchanged compared to the last sampling period November 2018 and all the previous sampling periods (since July 2012) as well. Normally, the polychaetes (Phylum Annelida) were the most dominant infaunal organisms found during all these survey periods in the soft bottom benthic habitat at the project site. Furthermore, the benthic or bottom ecology of the Hanjin area has already completely recovered from the previous physical disturbance (*i.e.*, landfilling / reclamation and dredging activities). The new recruits of hard coral species (mainly branching forms) were again observed to occur on the artificial hard substrate (rocks/boulders) of the sea bottom along the wharves / seawalls of the shipbuilding facility. This indicates that these hard substrate habitats are already assuming the role of an "artificial reef" within the project area. However, the seafeathers attached to the artificial hard substrate as noted during the last sampling period November 2018 have totally disappeared in the area. The reason for this disappearance is still unknown.

3. CONCLUDING REMARKS AND RECOMMENDATION

Below are some of the concluding remarks and recommendation to be drawn from this present monitoring period June 2019:

a) Currently, the on-going non-operational activity of the Hanjin Shipbuilding Facility at the project site showed no imminent adverse impact on the water column phytoplankton and zooplankton and soft bottom infaunal benthic communities. Changes in species composition, occurrence, density, relative abundance, and biomass of plankton and soft bottom benthos communities are related to the effects of seasonality and hydrological situation and weather differences (*e.g.* occurrence of long dry spell, heavy rains, passage of typhoon) at the time of sampling.

b) The inconsistent patterns in species richness and density of fish assemblages might be attributed to local environmental conditions at the sampling stations, particularly the complexity of the artificial bottom structures, water clarity, and current pattern. It can be noticed that different species dominated the sampling stations. To reiterate, the coastal structure at the Hanjin Facility provides additional space for different fish species. The occurrence of target species could be indicative of reduced fishing at the seawall structure.

c) The increase in total fish biomass in all three sampling stations (see **Figure 34**) was probably due to fishing restrictions at the Hanjin seawall that have protected the extraction of larger fish species by adjacent fishermen. Food availability and presence of larger habitat spaces might have also contributed to the improvement in fish biomass at the stations. However, the fluctuation in fish biomass may be expected due to the dominance of roving planktivorous and carnivorous fish species, which are relatively mobile. A gradual increase in fish biomass could be expected if fish aggregations shift to a more demersal target species-dominated fish community and the fishing restriction is persistently enforced.

d) Seasonal variation of the macrofouling communities in Hanjin seawalls is expected due its exposure to potential limiting factors for biofouling. But to see the pattern more clearly, the conduct of monitoring surveys should be sustained. It is apparent, however, that the seawalls

have provided space for the settlement of macro-invertebrates, which may serve as food for associated fishes and other commercially important species.

e) Only slight and negligible changes on the estimated covers were observed for all groups of fouling organisms. The currently observed condition of the fouling communities in all three stations was almost the same as that with the last sampling period in November 2018. Mean substrate cover of the three stations may suggest that 47.9 % of the seawall in Hanjin were already colonized by macrofoulers.

f) The fish assemblages at the sampling stations exhibited spatio-temporal variation in all the fish parameters. Most notable, however, is the increase in density and biomass of target species. Given the right environmental conditions and sustained protection from fishing and other forms of resource extraction, the seawall structures at the Hanjin facility can serve as important habitat not only to fishes but also to other sedentary and mobile marine organisms. While awaiting the turnover of ownership of the facility, the concerned authorities should deploy personnel who will secure the area from unsustainable fishing practices and other activities that will contribute to habitat degradation.

2.4 SUMMARY OF MAJOR FINDINGS

The following major findings can be drawn from the data presented on this present survey.

a) The phytoplankton community was as usual composed of 3 major taxonomic groups: diatoms, blue-green algae and dinoflagellates.

b) The phytoplankton was again dominated by the diatoms (58.01%) represented by 9 taxa/genera.

c) The next numerically abundant were the blue-green algae (only 30.75%) represented solely by *Trichodesmium*, while the least were the dinoflagellates (11.24%) represented by 5 taxa/genera.

d) The dominant phytoplankton organisms found were (in order of their relative abundances) the diatom *Thalassionema* (average 315,139 cells/m^3, or 40.75%), the blue-green alga *Trichodesmium* (average 237,847 cells/m^3, or 30.75%), the dinoflagellate *Ceratium* (average 36,930 cells/m^3, or 4.77%), the diatom *Hemialus* (average 33,632 cells/m^3, or 4.35%), and another diatom *Chaetoceros* (average 28,885 cells/m^3, or 3.73%). All the other forms were poorly represented.

e) The total phytoplankton numbers varied from 397,061 to 1,278,125 cells/m^3 with an average of 773,450 cells/m^3, which is much higher compared to that during the last sampling period May 2018 (range of 50,980 to 88,385 cells/m^3 with an average of 63,318 cells/m^3).

f) Once again, there were only three (3) major groups representing the present zooplankton population, dominated by the crustacean copepods (average 101,429 organisms/m^3, or 88.66%) followed by the appendicularians represented solely by *Oikopleura* (average 7,010 organisms/m^3, or 6.13%) and the least were the protozoan ciliates (average 5,956 organisms/m^3, or 5.21%).

g) Typically, the most dominant zooplanktonic organism found in the samples during this monitoring period was again the copepod nauplius larvae (average 83,422 organisms/m^3, or 72.92%).

h) The total zooplankton numbers varied from 73,530 to 140,625 organisms/m^3 with an average of 114,395 organisms/m^3, which is much higher compared to the last sampling period November 2019 (range of 18,294 to 48,781 organisms/m^3 with an average of 30,692 organisms/m^3) as well as during almost all the previous sampling periods .

i) The plankton communities within the study area during this sampling period June 2019 were again dominated by the phytoplankton (average 87.12% against 12.88% zooplankton).

j) The plankton biomass (wet displacement volume) ranged from 2.0 to 6.3 mL/m^3 with an average of 3.8 mL/m^3), which is higher compared to that in November 2018 (1.7 to 3.7 mL/m^3 with an average of 2.9 mL/m^3) and May 2018 (1.9 mL/m^3 to 3.8 mL/m^3 with an average of 2.6 mL/m^3).

3. SOFT BOTTOM INFAUNAL BENTHOS

3.1 INTRODUCTION

The soft bottom communities are one of the least studied biological components (Estacion and Onate, 1991). These fauna, which are associated with soft bottom substrate, constitute as one of the most abundant major components of the food habits of many benthic and demersal fishes on the sea. Industrialization and environmental perturbations influenced by anthropogenic activities such as pollution and siltation is proceeding at a very rapid rate in the Philippines. The benthic communities that are likely exposed to these perturbations include large mobile invertebrates such as polychaetes, crustaceans, echinoderms and mollusks.

One of the significant impacts of the Hanjin Shipbuilding Facility project concerns the established soft bottom benthic communities of the dredging and reclamation areas. The dredging and reclamation activities will not only disturb the existing benthic fauna but entail a complete smothering of all benthic organisms present in the dredging and reclamation areas.

There is no known remedy for this impact as the reclamation, which is deemed very important is permanent in the area. However, benthic organisms can easily re-colonize in undisturbed and unreclaimed areas. Benthic re-colonization should be quite rapid and occur within a few months after construction. Complete recovery could be attained within a year or two.

The survey was intended to evaluate the soft bottom infaunal benthic community in the area with respect to its composition, density, relative abundance and biomass. The study aims to contribute some baseline information to the general knowledge of the soft bottom benthos.

3.2 METHODOLOGY

Sediment samples for soft bottom infaunal benthos analysis were collected at each station using a Ekman bottom grab sampler with a mouth area of 0.0225 m^2 (**Plate 2a**). The samples were placed in plastic bag containers (**Plate 2b, c**) and fixed in 10%

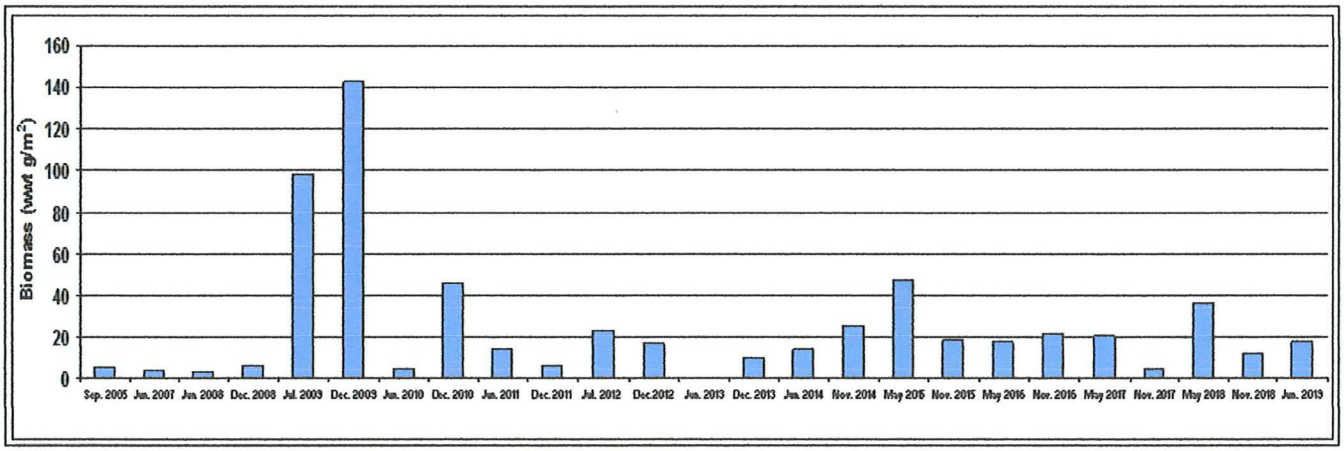


Figure 25 Mean biomasses of soft bottom benthic infauna at each sampling period

3.4 SUMMARY OF MAJOR FINDINGS

The following major findings can be drawn from the data presented on this study.

a) A total of 30 taxa were recorded in the present sampling period June 2019 which is higher compared to the last sampling period November 2019 (26 taxa) and during the previous sampling periods May 2018 (23 taxa) and November 2017 (18 taxa) as well.

b) The annelids (polychaetes) with 15 taxa were the most dominant benthic infaunal organisms (average 39.40%), followed by arthropods (average 27.71%), foraminiferans (average 17.11%), molluscs (average 6.60%), echinoderms (average 3.92%). sipunculids (average 2.58%), and nemerteans and nematodes (average 1.34% each).

c) Overall, the most abundant/dominant infaunal benthic organisms were the arthropod Order Tanaidacea (average 133 indv./m^2, or 11.85%) followed by the foraminiferan Family Peneroplidae (average 103 indv./m^2, 9.18%), arthropod Family Gammaridae (average 89 indv./m^2, 7.93%), and polychaete Family Capitellidae (average 88 indv./m^2, 7.84%).

d) The total abundance of soft bottom infauna ranged widely from 264 to 1,862 indv/m^2, with an average density of 1,122 indv/m^2, slightly lower compared to that during the last sampling period November 2018 (average 1,243 indv/m^2) but higher compared to the previous sampling period May 2018 (average 1,037 indv/m^2) as well as during the previous sampling periods November 2017, May 2017, November 2016, May 2016, and November 2015 .

e) Biomass of the benthic organisms also ranged widely from 1.33 to 48.89 wwt g/m^2, with an average of 17.55 wwt g/m^2 which is higher compared to that measured

during the last sampling period November 2018 (average 11.94 wwt g/m^2) but much lower compared to the previous sampling period May 2018 (average 36.30 wwt g/m^2).

4. FISHES AT THE WHARVES / SEAWALLS

4.1 INTRODUCTION

General Objective:

To survey and assess the condition of the fish assemblages at the three monitoring stations at the wharves/seawalls of the Hanjin Shipbuilding Facility.

Specific Objectives:

1. To characterize the fish assemblages at survey stations along the wharves/seawalls in terms of:

    a. species composition;
    b. the relative abundance of indicator, major and target species; and
    c. the relative biomass of indicator, major and target species.

2. To determine and evaluate changes in these fish parameters through time; and

3. To identify the possible factors that are impacting these communities and driving the observed changes.

4.2 METHODOLOGY

The daytime fish visual census technique described by English et al. (1994) was employed in the survey (**Plate 3**). Fish were surveyed along the entire vertical length (depth) of the pier from 0m (surface) to 10m (bottom). The observers then swam about 5-10m along the bottom and surveyed the fish from the bottom to the surface of another section of the pier. These two sections of the pier served as replicate samples and were approximately 5m wide. Fish surveys at each of the stations were completed in about 15 minutes. Fish observed within a 10 m x 10 m corridor along the pier were recorded. Fish were identified to the lowest possible taxon based on photographic references such as Allen *et al.*, 2003; Lieske and Myers, 2002; Randall *et al.*, 1997, and others. The total lengths of fish were estimated to the nearest centimeter, and their abundance determined by actual counts. For schooling and aggregating species, counts were estimated based on the sizes of the fish and the number of fish within a cluster of the aggregation or school. The biomass of each species was estimated using the formula $\mathbf{W = aL^b}$, where **W** is the weight (g), ***a*** the multiplicative factor, **L** the total length (cm), and ***b*** the exponent. The values used for the constants ***a*** and ***b*** were obtained from Kulbicki, *et al.* (1993), Letourneur (1998), Letourneur, *et al.* (1998), Gonzales *et al.* (2000) and those

4.4 SUMMARY OF MAJOR FINDINGS

a) The present monitoring survey is again able to cover all the three sampling stations. Over the past years S2 was inaccessible due to the busy shipbuilding activities.

b) The present survey recorded a total of 27 species belonging to 14 families at the three sampling stations. Highest number of species was observed at Station S3, followed by Stations S1 and S2. All the sampling stations were dominated by the target category, which was represented by 15 species. The species richness at Stations S1 and S3 had increased, while Station S2 showed the opposite.

c) Station S2 had the highest fish density with 94 individuals /100 m^{-2} while the lowest density was observed at Station S3 with 37 individuals/100/m^{-2}. The fish density at Station S3 was dominated by target species, while Stations S1 and S2 were co-dominated by target species and major families.

d) The density of fish individuals with a total length of 15 cm and above was relatively higher at Stations S2 and S3. A number of fish individuals with larger body sizes belonged to the target category. Because of this, 79% to 96% of the total fish biomass at the sampling stations was contributed by target species.

e) The highest biomass was recorded at Station S2 (9,803.35 g or 9.80 kg 100/m^{-2}), followed by Station S3 (3,366.34 g or 3.37 kg/100 m^{-2}) and Station S1 (2,561.74 or 2.56 kg/100 m^{-2}).

f) The diversity (H') of fish assemblages at the sampling stations ranged from 1.67 to 2.68. Station S3 was highly diverse, while species diversity at the other stations was moderate.

g) The fish communities across the sampling stations did not show significant separation based on the result of ANOSIM (R = 0.049; p = 0.023). This is expected because the sampling stations are located close to each other. However, the difference in local environmental conditions and biotic interactions could cause the spatial dissimilarity of fish communities. SIMPER revealed an overall dissimilarity of 80.09 %.

5. BIOFOULING ORGANISMS GROWING ON THE SHEET PILES OF THE WHARVES/SEAWALLS

5.1 INTRODUCTION

Submerged artificial hard structures such as the seawalls along the Hanjin ship-building facility are usually invaded by marine biofouling organisms. Marine biofouling refers to the attachment of an organism or organisms to a surface in contact with water for a period of

suggested that water temperature and salinity of water are the most important environmental factors controlling the temporal distribution of total fouling density in some harbors of Alexandria in Egypt where highest density and biomass coincides with warmer seasons and increase in salinity. Salinity was also cited in Swami and Udhayakumar (2010) as an important parameter that regulates settlement and distribution of macrofoulers.

5.4 SUMMARY OF MAJOR FINDINGS

Findings of the present monitoring period can be summarized as follows:

1. Eight (8) species of fouling macro-fauna were recorded from Station S1 while seven (7) species were recorded at Stations S2 and S3.

2. The species composition of fouling organisms in all three (3) stations remained the same compared with the previous survey period.

3. Mean substrate cover of the three sampling stations may suggest that 47.9 % of the seawall in Hanjin were already colonized by macrofoulers.

4. A slight increase in the cover of mollusks in all stations could be observed.

6. MARINE TURTLES

6.1 INTRODUCTION

This present marine turtle monitoring report provides information on species, occurrence, location, life stage, habitat use, sources of mortality / disturbance and conservation efforts along the 10-km western coastline of Subic Bay.

6.2 METHODOLOGY

The boat / beach-based survey [patterned after Diez and Ottenwalder (1999)] were implemented along the known nesting beaches of Sitios Naglatorre, Nagbayukan and Kinabuksan using a motorized boat.

6.3 RESULTS

Similar to the last sampling period November 2018 and previous sampling period May 2018 as well there has been no occurrence of a marine turtle nesting on the sandy beach areas under consideration.

In conclusion, with reference to the last sampling period November 2018, the overall benthic ecology along the Hanjin in the present survey June 2019 remained unchanged.

7.1 SUMMARY OF MAJOR FINDINGS

a) The overall benthic ecology along the Hanjin remained unchanged compared to the last sampling period November 2018 as well during all the previous sampling periods (since July 2012). Normally, the polychaetes (Phylum Annelida) were the most dominant infaunal organisms found during all these survey periods in the soft bottom benthic habitat at the project site.

b) The benthic or bottom ecology of the Hanjin area has already completely recovered from the previous physical disturbance (*i.e.*, landfilling / reclamation and dredging activities). The new recruits of hard coral species (mainly branching forms) were again observed to occur on the artificial hard substrate (rocks/boulders) of the sea bottom along the wharves / seawalls of the shipbuilding facility. This indicates that these hard substrate habitats are already assuming the role of an "artificial reef" within the project area.

c) The seafeathers attached to the artificial hard substrate as noted during the last sampling period November 2018 have totally disappeared in the area. The reason for this disappearance is still unknown.

8. CONCLUDING REMARKS AND RECOMMENDATION

Below are some of the concluding remarks and recommendation to be drawn from this present monitoring period June 2019:

a) Currently, the on-going non-operational activity of the Hanjin Shipbuilding Facility at the project site showed no imminent adverse impact on the water column phytoplankton and zooplankton and soft bottom infaunal benthic communities. Changes in species composition, occurrence, density, relative abundance, and biomass of plankton and soft bottom benthos communities are related to the effects of seasonality and hydrological situation and weather differences (*e.g.* occurrence of long dry spell, heavy rains, passage of typhoon) at the time of sampling.

b) The inconsistent patterns in species richness and density of fish assemblages might be attributed to local environmental conditions at the sampling stations, particularly the complexity of the artificial bottom structures, water clarity, and current pattern. It can be noticed that different species dominated the sampling stations. To reiterate, the coastal structure at the Hanjin Facility provides additional space for different fish species. The occurrence of target species could be indicative of reduced fishing at the seawall structure.

c) The increase in total fish biomass in all three sampling stations (see **Figure 34**) was probably due to fishing restrictions at the Hanjin seawall that have protected the extraction of larger fish species by adjacent fishermen. Food availability and presence of larger habitat spaces might have also contributed to the improvement in fish biomass at the stations. However, the fluctuation in fish biomass may be expected due to the dominance of roving planktivorous and carnivorous fish species, which are relatively mobile. A gradual increase in fish biomass could be expected if fish aggregations shift to a more demersal target species-dominated fish community and the fishing restriction is persistently enforced.

d) Seasonal variation of the macrofouling communities in Hanjin seawalls is expected due its exposure to potential limiting factors for biofouling. But to see the pattern more clearly, the conduct of monitoring surveys should be sustained. It is apparent, however, that the seawalls have provided space for the settlement of macro-invertebrates, which may serve as food for associated fishes and other commercially important species.

e) Only slight and negligible changes on the estimated covers were observed for all groups of fouling organisms. The currently observed condition of the fouling communities in all three stations was almost the same as that with the last sampling period in November 2018. Mean substrate cover of the three stations may suggest that 47.9 % of the seawall in Hanjin were already colonized by macrofoulers.

f) The fish assemblages at the sampling stations exhibited spatio-temporal variation in all the fish parameters. Most notable, however, is the increase in density and biomass of target species. Given the right environmental conditions and sustained protection from fishing and other forms of resource extraction, the seawall structures at the Hanjin facility can serve as important habitat not only to fishes but also to other sedentary and mobile marine organisms. While awaiting the turnover of ownership of the facility, the concerned authorities should deploy personnel who will secure the area from unsustainable fishing practices and other activities that will contribute to habitat degradation.

9. REFERENCES

Abarzua S. and S. Jakubowski. 1995. Biotechnological investigation for the prevention of biofouling. I. Biological and biochemical principles for the prevention of biofouling. Marine Ecological Progress Series. 123:301-312.

Ahlstrom, E.H. 1976. Maintenance of quality of fish eggs and larvae collected during the plankton hauls. pp. 313-332 in H.F. Steedman (ed.) Zooplankton Fixation and Preservations. Monog. Oceanog. Method.

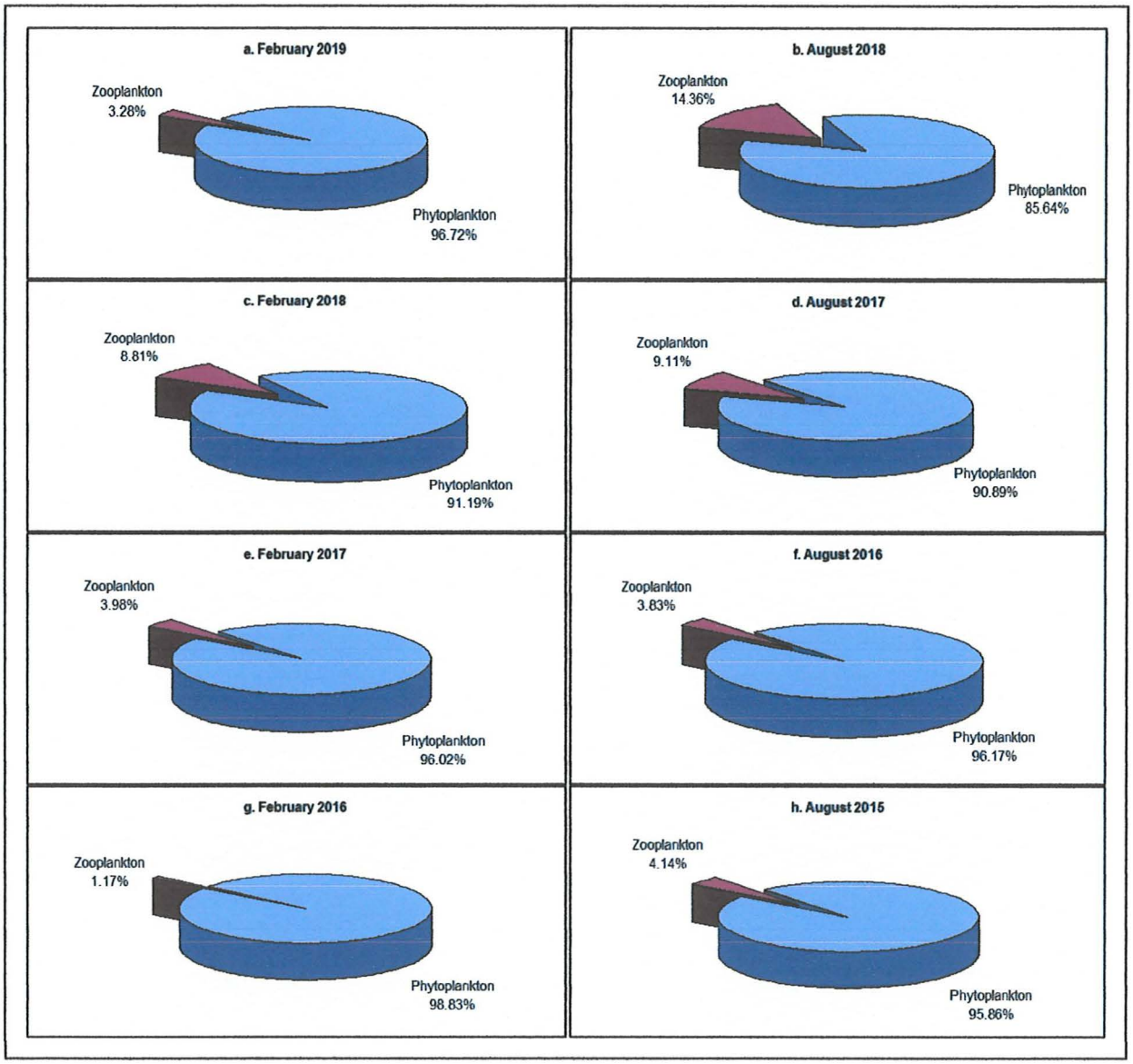


Figure 13 Mean Relative Abundance of Major Plankton Groups **a**. February 2019, **b.** August 2018, **c**. February 2018, **d**. August 2017, **e.** February 2017, **f**. August 2016, **g**. February 2016, and **h**. August 2015

2.4 SUMMARY OF MAJOR FINDINGS

The following major findings can be drawn from the data presented on this study.

a) Phytoplankton population was typically composed of 3 major phytoplankton groups, namely (in descending order) : diatoms (Bacillariophyceae, average 72.20%), green algae (Chlorophyceae, (average 17.97%), and the least were the green algae (average 9.83%).

b) Overall, the most abundant phytoplankton organisms were the diatoms *Navicula* (average 8,333 cells/L or 42.37%) and *Gyrosigma* (average 3,400 cells/L or 17.29%), the blue green alga *Microcystis* (average 2,867 cells/L or 14.58%), and the green alga

Microspora (average 1,333 cells/L or 6.78%). Other phytoplankton forms were poorly represented.

c) Estimates of total phytoplankton ranged from 13,400 to 27.200 cells/L, with an average of 19,667 cells/L. This was higher compared to the last sampling period August 2018 (average 10,333 cells/L) as well as during the previous sampling periods February 2018 (11, 732 cells/L) and August 2017 (only 1,986 cells/L).

d) Zooplankton component was composed of only three (3) major groups, namely (in descending order): copepod (average 69.97%), phytoflagellate (average 19.97%), and ciliate (10.06%).

e) The most abundant zooplankton organisms were the copepod nauplius larvae (average 333 organisms/L or 50%), followed by the ciliate *Euglena* (average 133 organisms/L or 19.97%), the adult calanoid copepod (also average 133 organisms/L or 19.97%), and the ciliate *Paramecium* (average 67 organisms/L or 10.06 %).

f) Estimates of total zooplankton ranged from 600 to 800 organisms/L, with an average of 666 organisms/L which was lower compared to the last sampling period August 2018 (1,733 organisms/L) as well as during the previous sampling period February 2018 (1,133 organisms/L).

3. SOFT BOTTOM INFAUNAL BENTHOS

3.1 INTRODUCTION

Benthos is a community of organisms living on the bottom of a body of water. Benthic **epifauna** are organisms that live on the riverbed or upon bottom objects, whereas benthic **infauna** are organisms that live within the surface sediments.

The literature on the benthos of running waters has been reviewed by Hynes (1970) who concluded that similar elements of the fauna of hard substrates are common to streams and rivers all over the world. The benthic fauna of hard, stony runs and riffles is richer than that of silty reaches and pools of the rhithron in both number of species and in total biomass.

The present survey was intended to evaluate the soft bottom infaunal benthic community with respect to its composition, density and relative abundance. The study aims to contribute some baseline information to the general knowledge of the benthic ecology of the diverted/re-channeled Agusuhin River within the Hanjin Subic Project's Shipbuilding Facility.

3.2 METHODOLOGY

Sediment samples were collected using a hand trowel and a metal quadrat (area of 0.022 sq. m) (**Figure 14**) at three sampling sites, Stations 1, 2 and 3 (see **Figure 3**). The sediments collected within the designated sampling area were then placed in plastic bag containers,

The CPUE for Station 3 (Downstream) was computed to be 14,314.3 grams/hr (or 14.43 kg/hr), very much higher compared to the CPUE of Station 2 (only 1.6 kg/hr). A slight increase in term of CPUE when compared to the last sampling in August 2918 was also observed at this station (see **Figure 24**).

Table 5 Number of Individuals Caught per Species, Size Range, Mean Weight, Total Weight of Catch and Catch per Unit Effort (CPUE) at the Two Sampling Stations along Agusuhin River (February 2019)

FISH SPECIES	STATION 2				STATION 3			
	n	Mean Length (cm)	Mean Weight (g)	Total Weight (g)	n	Mean Length (cm)	Mean Weight (g)	Total Weight (g)
Sarotherodon melanotheron	5	20.2	121.0	605.0	143	17.44	100.1	14,314.3
Liza macrolepis	5	22.6	130.0	650.0	0	0	0	0
Caranx sexfaciatus	2	13.0	25.0	50.0	0	0	0	0
Kuhlia rupestris	4	18.0	82.5	330.0	0	0	0	0
Lutjanus argentimaculatus	1	15.0	45.0	45.0	0	0	0	0
Total	**14**			**1,680.0**	**143**			**14,314.3**
Fishing time (hour)				**1.0**				**1.0**
CPUE (g/hr)				**1,680.0**				**14,314.3**
CPUE (kg/hr)				**1.68**				**14.43**

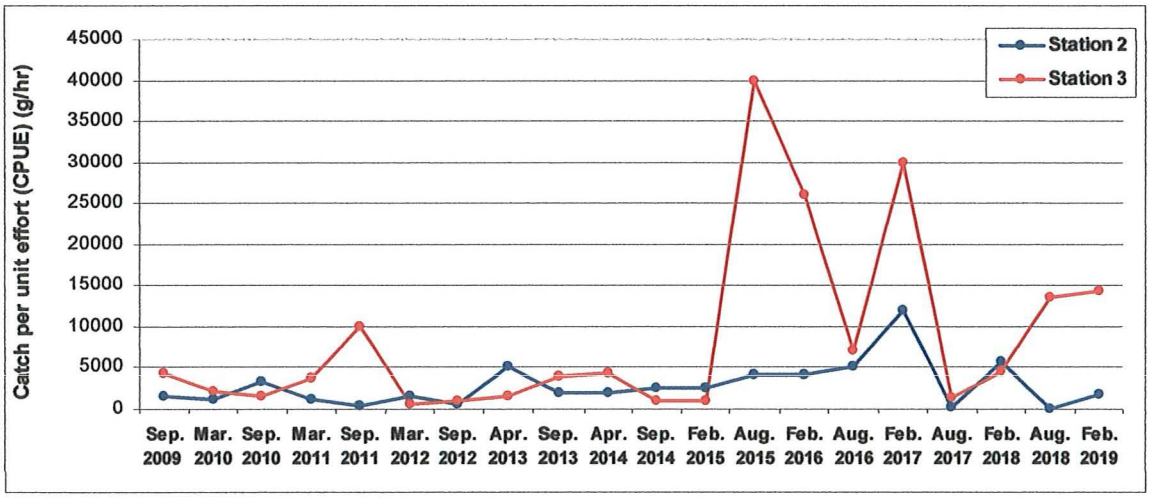


Figure 24 Catch per Unit Effort (CPUE) from the Two Sampling Stations during the Twenty Monitoring Periods

4.4 SUMMARY OF MAJOR FINDINGS

The following major findings can be drawn from the data presented on this present survey.

a) Actual test fishing was done only at Station 2 (Midstream) and Station 3 (Downstream) because the water level at Station 1 (Upstream) is consistently too shallow for fishing.

b) Station 2 (Mid-stream) recorded five (5) species belonging to five (5) families while Station 3 recorded only one (1) species belonging to only one (1) family.

c) The invasive black-chin tilapia *Sarotherodon melanotheron* was once more the most dominant catch particularly at Station 3 (Downstream).

d) A much higher catch was observed at Station 3 (Downstream) with 143 individuals and a total weight of 14,314.3 grams. However, only the invasive black-chin tilapia *Sarotherodon melanotheron* was caught from this station.

e) In contrast, a much lower catch was observed at Station 2 (Mid-stream) with only 14 individuals and a total weight of only 1,680 grams. However, five different species of fish were caught from this station. These were *Sarotherodon melanotheron*, *Liza macrolepis*, *Caranx sexfaciatus*, *Kuhlia rupestris* and *Lutjanus argentimaculatus*.

f) The CPUE for Station 2 was computed to be 1,680.0 grams/hr (or 1.68 kg/hr), much lower compared to the CPUE of Station 3 (14,314.3 grams/hr, or 14.43 kg/hr). However both stations showed a slight increase in term of CPUE when compared to the last sampling period August 2918.

5. CONCLUDING REMARKS

The differences or changes observed (in terms of species composition, density and relative abundance) of plankton and soft bottom benthos communities between all the previous sampling periods and the present sampling period February 2019 does not necessarily mean that the existing shipbuilding operation in the area had caused such changes. These changes may be attributed to several factors such as the effects of seasonality, hydrological situation and weather differences or disturbances (*e.g.*, storm related impacts) at the time of sampling.

6. REFERENCES

A Guide to Fisheries Invertebrate Animals, pp. 1-117 (Unknown author and year).

BS1. 2011a. River ecology monitoring report (Agusuhin River), March 2011. Prepared for Hanjin Subic Project by Berkman Systems, Inc.

BS1. 2011b. River ecology monitoring report (Agusuhin River), October 2011. Prepared for Hanjin Subic Project by Berkman Systems, Inc.

BS1. 2012a. River ecology monitoring report (Agusuhin River), April 2012. Prepared for Hanjin Subic Project by Berkman Systems, Inc.

BS1. 2012b. River ecology monitoring report (Agusuhin River), September 2012. Prepared for Hanjin Subic Project by Berkman Systems, Inc.

4. RESULTS

Marine Sediment Metals – 08 June 2019 Sampling

Results of the analysis of marine sediment sample analyzed for some selected heavy metals are presented in **Appendix 1.**

The concentrations of the 6 heavy metals such as Arsenic (As), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), and Silver (Ag) found in the marine sediment sample in Station F/B1 on 08 June 2019 are summarized in **Table 3**.

A closer examination of the data obtained (**Table 4**) revealed that the concentrations of the six heavy metals analyzed from the sediment sample collected were all at detectable levels except mercury (not detectable) (**Figures 2, 3, 4, 5, 6** and **7**).

For Arsenic (As), a significant decrease in concentration was observed from the last sampling period in November 2018 (3.8 mg/Kg) to the present sampling period in June 2019 (see **Figure 2**).

There was again an increase in the concentration of Cadmium (Cd) from November 2018 (1.2 mg/Kg) to the last sampling period in June 2019 (2.2 mg/Kg) (see **Figure 3**).

In contrast, there was again a decrease in the concentration of Chromium (Cr) from the last sampling period in November 2018 (22.0 mg/Kg) to the present sampling period in June 2019 (13.0 mg/Kg) (**Figure 4**).

In the case of Mercury (Hg), a decrease from 0.3 mg/Kg in November 2018 to not detectable level in June 2019 was observed (**Figure 5**).

For Lead (Pb), again a significant increase from 1.9 mg/Kg in November 2018 to 21.0 mg/Kg in June 2019 was observed (see **Figure 6**).

Similarly, there was an increase in the concentration of Silver (Ag) from 0.9 mg/Kg in November 2018 to 2.0 mg/Kg in June 2019 (see **Figure 7**).

Table 3. Metal Concentration for Hanjin Nearshore Marine Bottom Sediment (Station F/B1 – 08 June 2019)

Metal Element	Station F/B 1 (mg/Kg)	Reporting Limit
1. Arsenic (As)	**1.4**	0.4
2. Cadmium (Cd)	**2.3**	0.2
3. Chromium (Cr)	**13.0**	0.4
4. Mercury (Hg)	**ND**	0.1
5. Lead (Pb)	**21.0**	1.0
6. Silver (Ag)	**2.0**	0.4

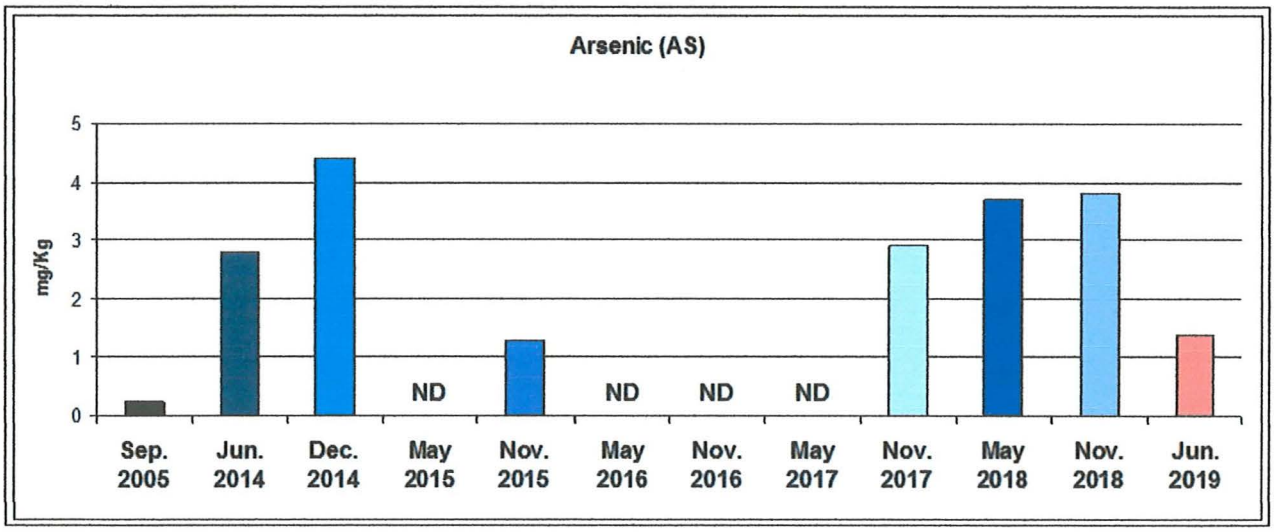


Figure 2. Arsenic, As (ND = Not Detected or Below Reporting Limit of 0.4 mg/Kg)

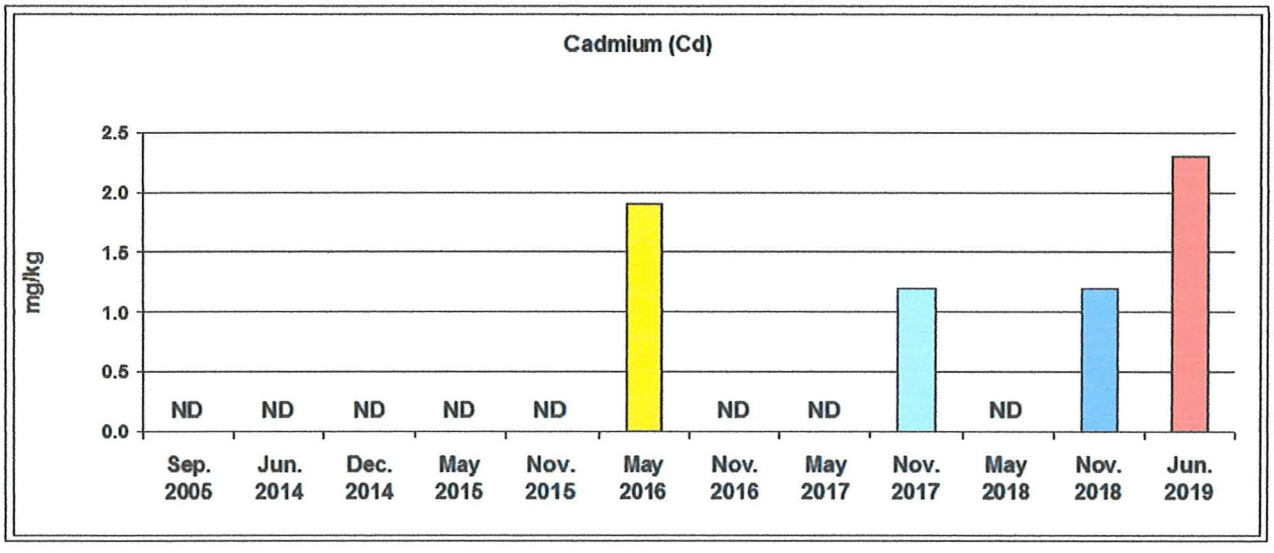


Figure 3. Cadmium, Cd (ND = Not Detected or Below Reporting Limit of 0.2 mg/Kg)

6. CONCLUDING REMARKS AND RECOMMENDATION

The objective of this study was to determine metal concentrations in the marine sediments from the Hanjin coast of Subic Bay. This study may serve as baseline information for future evaluation of metal pollution in this area.

To assess metal pollution in the area and to establish a more realistic baseline, it is suggested that a more detailed survey of metal concentrations in the sediments from the coastal areas of the project site may be conducted.

7. REFERENCES

Berman, E. 1980. Toxic metals and their analysis. Heyden & Sons Ltd., Spectrum House, Hillview Gradens, London NW42JQ. 239 pp.

GBRMPA. 1997. Heavy metals in commercial prawn and crayfish species in the Torres Strait. Great Barrier Reef Marine Park Authority, by Elizabeth Evans-Illidge, 1997.

Gutherie, R.K., E.M. Davis, D.S. Cherry and H.E. Murray. 1979. Bull. Environ. Contaro-Toxicol. 21, 53.

Hingco, T. 1990. Manila Bay researches. Tambuyog Development Center.

KAKCS (Kultura at Kalikasan Consultancy Services). Environmental impact assessment of the proposed Hanjin Subic Project – Shipbuilding Facility. Vol. 1. Prepared for Hanjin.

Lande, E. 1977. Environ. Pollut. 12, 187.

Leland, H.V. 1977. Distribution of solute and particulate trace elements in Southern Lake, Michigan. Proceed. Int. Conf. On Heavy Metals in the Environment, II/2, 17.

MacDonald Environmental Sciences Ltd. 1993. Development of an integrated approach to the assessment of sediment quality. Vol. 1. In Florida, Vol. 2 Supporting Documentation. Report Prepared for Florida State Department of Environmental Regulations. NTIS No. PB92-188465.

NOAA. 1991. " The potential for biological effects of sediment-sorbed contaminations tested in the national status and trends program" by Edward R. Long and Lee G. Morgan. Technical Memorandum NOS OMA 52, August 1991.

Oehme, F.W. 1978. Toxicity of heavy metals in the environment, Part I pp. 515 Marcel Dekker, Inc., New York.

Reimers, R.S., P.A. Krenkel, M. Eagle and G. Tragfit. 1975. In P.A. Krenkel ed. Heavy Metals in Environment, pp. 117-136, Oxford: Pergamon Press.

ANNEX G

Gap Assessment of IFC PS and EHS Guidelines

GAP ASSESSMENT WITH THE REFERENCE FRAMEWORK

IFC Performance Standards 2012

In this section, the IFC Performance Standards, together with all sub-requirements per Standard, are tabled next to a gap assessment and recommendations. In the third column of the table the gap assessment is summarized by a compliance indicator, differentiating between:

- **Aligned**: meaning that the requirement is sufficiently being fulfilled by the previous operator and that the Site operates according to the stipulations of the concerning requirement;
- **Partially aligned**: meaning that the requirement is partially fulfilled by the previous operator and that the Site needs to plan additional measures to achieve operations in accordance with the concerning requirement;
- **Not aligned**: meaning that the requirement is not fulfilled by the previous operator considering available information and that measures are required to ensure performances in line with the concerning requirement.
- **No information available**: If no information was received or insufficient information was received to make an assessment, this will be highlighted accordingly.

Compliance is considering the previous shipyard operator and the reviewed information that was made available or could be observed during the site visit.

In the situation that the shipyard will be acquired, the owner of the shipyard will most likely assign a new operator of the shipyard that will manage the operational aspects of the site. The new operator should ensure compliance to the IFC PS and other international standards, therefore recommendations have been included in the table for the new operator of the shipyard. These recommendations can be collated in an agreement between the owner and operator of the site to ensure that Environmental, Social, Health and Safety aspects of the site are contractually agreed.

All recommendations are specified and based on the IFC PS 2012 and the World Bank EHS Guidelines (General and Ports & Harbours). Thereby, plans that relate to Health and Safety and Labour and Working Conditions should align with the ILO Code of Practice for Safety and Health in Shipbuildign and ship repair (2009) for as far as practicable.

It is important to understand that the site was not operational at the time of this due diligence and gap assessment, therefore the review has been performed based on available information and the site visit observations.

Please also note that the EIA for the shipyard that was reviewed for this gap assessment, has been developed in 2005, a time where the IFC PS 2012 and IFC PS 2006 were not yet available as a reference framework.

Table 1 includes the gap assessment of IFC PS 2012 and Table 2 the gap assessment of the General and Ports & Harbours World Bank EHS Guidelines. After the tables, a short description of requirements set by the EHS guidelines is included as reference. These are considered applicable to the new operator of the shipyard.

Table 1: Gap Asseesment with respect to IFC Perfomance Standard

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
1	**ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS**			
1.1	Environmental and Social Impact Assessment	Partially aligned	The EIA has been performed in accordance with local Philippine requirements. Considering the timeframe of the EIA, which was developed in 2005, the IFC PS 2012 were not yet available, neither was a request made to comply to the safeguards applicable at that time of IFC. Thereby, the shipyard has been fully built and any impacts related to the construction on development of the shipyard are difficult to mitigate at this moment.	Ensure that operational policies and stakeholder engagement are included in such a way by the new operator that potential impacts coming from shipyard operations are minimzed as much as possible. This follows from the requirements as set out in this complete gap assessment.
1.2	Environmental and Social Management System (ESMS)	Partially aligned	The full ESMS of the previous operator was not made available although some procedurs related to environmental monitoring and emergency preparedness were reviewed. Thereby, certificates of ISO 14001 and OHSAS 18001 were present, referring to an ESMS that presumably should be there. Gaps are thus present, but emphasis should be put on the new operator and the future ESMS.	The future operator should develop and implement an ESMS that is compliant to the IFC PS, World Bank EHS Guidelines (general and for ports and harbours) and ILO 2019 Code of Practice on Safety and Health in shipbuilding and ship repair.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
1.3	Overarching Environmental and Social policy	Partially aligned	For the HCIC Shipyard in the Philippines certificates for ISO14001 and OHSAS18001 were reviewed. This would mean an environmental policy is in place a should be disclosed to the wider workforce. Nevertheless, the actual policy was not received for review and the implementation of the policy could not be reviewed, since the site is not operational.	As part of the overall ESMS, the new operator of the shipyard should develop an environmental, social and health and safety policy commensurate with the activities and work performed at the site. The policy should address applicable risks and the willingness to do what it takes to avoid these risks. The policy should be signed by senior management of the operator and disclosed to workers and personnel of the shipyard, whilst made available to any stakeholders.
1.4	Identification of Environmental and Social risks and impacts	Partially aligned	The EIA of the shipyard includes a detailed environmental and health risk assessment of work performed on the shipyard and the use of any chemicals/contaminants and the exposure of staff to them. No risk identification performed by Hanjin themselves was received nor reviewed.	The new operator of the shipyard should ensure that an extensive risk assessment is performed, including environmental and social risks of shipyard operations. The risk session should involve the mapping of different shipyard processes and the physical assets on the site. From the process and asset maps developed, relevant risk can be assigned, and mitigation measures can be formulated. The risk assessment should be developed in collaboration with personnel and team leads for different activities as performed on the shipyard.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
1.5	Compliance with all applicable laws and regulations.	Partially aligned	Currently the HCIC shipyard is not operational, besides some general activities for the maintenance of the shipyard and assets. Certificates of compliance were reviewed and most of them were available, except for the certificate of storage of flammables, the UST and the groundwate extraction permit.	The new operator of the shipyard should ensure compliance to local regulations is met and maintain a compliance register to understand which requirements are set by which regulation and how the shipyard is maintaining compliance to these requirements.
1.6	Environmental and Social Management Plan / Programs	No information available	No environmental and social management programs were reviewed for HCIC.	The new operator of the shipyard will have to develop a procedure for continual improvement, resulting from monitoring and evaluation of the ESMS and instigating management programs wherever improvements are necessary.
1.7	Organization (roles, responsibilities), capacity, commitment and competency	Partially aligned	The Arcadis team was welcomed by a team of HCIC staff responsible for the maintenance of the site. Personnel had specific roles assigned to the different processes on site. No formal EHS manager was assigned, hence it is unsure how the site used to operate on EHS management. Considering the certificates of ISO14001 and OHSAS18001 it is anticipated that a formal EHS team was available before.	Th new operator of the shipyard should assign one lead EHS manager that is appropriately trained to run a shipyard of this size. The EHS manager should have a team with supporting staff that can help maintain the ESMS and monitor/evaluate the implemetnatio of the ESMS accordingly.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
1.8	Environmental and Social Trainings	No information available	No training records were reviewed of HCIC staff and no HSE induction training was received when the Arcadis team arrived at site.	The new operator of the shipyard should ensure that all staff that is hired, received sufficient training for the activities that staff has to perform. The received training should at a minimum comply to the Philippine regulatory requirements and be recognized by the appropriate authority. A register of trained staff, re-training requirements and outstanding training session should be maintained to ensure that all staff receive the appropriate amount of training for the tasks at hand. An induction training should be prepared for all site staff and visitors to the site, to ensure that people understand the risks at the shipyard and how to avoid/minimize the chances of an incident, or how to act in case of an emergency amongst others.
1.9	Emergency Preparedness and Response System	Partially aligned	The Emergency Response Plan of HHIC was reviewed and included several items relating to human incidents, first aid, environmental incidents (spills), Storms/floods and general emergencies.	The new operator of the shipyard will have to ensure that an Emergency Preparedness and Response Plan is developed in accordance with the IFC PS and World Bank EHS Guidelines. This plan should amongst others include: - Spill prevention and response - Shipping accidents - Human incidents - Natural Disasters - Fire Emergency - Etc.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
1.10	Project Monitoring, Reporting, and Review	Partially aligned	Although monitoring records were reviewed for stormwater effluent, stp effluent, marine ecology, sediment quality and air emissions, no formal monitoring and evalution plan was received. No external audits were reviewed for previous shipyard operations.	The new operator of the shipyard should maintain, as part of the overall ESMS, a monitoring and evaluation plan that specifies which items of the ESMS should be monitored (including the implementation and adherence to these items) and also specify the frequency, responsibilities and approval process accordingly. The monitoring and evaluation plan should including auditing requirements on an annual basis, both performed internally as wel as provided by an external and legitimate auditing body.
1.11	Stakeholder Engagement and Grievance Management	Not information available	No stakehohlder engagement plan, nor grievance mechanism was received for review by HHIC	The new operator of the shipyard should develop a stakeholder engagement plan according to the IFC PS and including all relevant stakeholders and local communities as part of the process. A grievance mechanism should be setup in separate for both: - Workers of the shipyard - Communities around the shipyard. These grievance mechanisms should be readily available online or manually in appropriate locations. Grievances should be allowed to be made in private and significant efforts should be made to avoid retaliation on made grievances.
1.12	External communications incl. publicly available periodic reports on	Partially aligned	Besides the quarterly monitoring records, no publicly available periodic reports on environmental and social sustianablity were reviewed.	The new operator of the shipyard should maintain transparent communications towards stakeholders and communities around the site on environmental and social performance and efforts done in order to

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
	environmental and social sustainability			maintain this situation. The reporting should follow the IFC PS requirements and reports should be made available both online and on strategic locations for communities to review.
2	**LABOR AND WORKING CONDITIONS**			
2.1	Human Resource Policies and Documents	No information available	No human resource policy and documents were reviewed for Hanjin in this due diligence.	The new operator of the shipyard should ensure HR Policies will be aligned with IFC-PS and will be an integral part of ESMS. This includes issues such as equal conditions and opportunities for all workers (incl. contractors, migrant workers, women, etc.), zero tolerance towards forced labour and involvement of minors (covered by a dedicated prevention procedure), gender policy and recruitment and retrenchment. Further, a dedicated HR recruitment inclusiveness plan needs to be prepared to secure an increase of women workers at the site in due time. Secure clear disclosure of labor rights, HR Policy, worker grievance system and worker welfare provisions at several visible locations at site.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
2.2	Working conditions and terms of employment	No information available	No working ocnditions and terms of employment were reviewed for the previous shipyard operator.	Workers should be educated about their rights and compensation. The new shipyard operator should ensure that workers of different contractors are aware of national labour and employment law and any other applicable agreements.
2.3	Inclusion of migrant workers	Partially aligned	The EIA details potential risks of labour influx although no detailed labour influx plan was reviewed.	It is recommended that the new operator of the shipyard includes secure Environmental Social Health and Safety (ESHS) requirements (incl. Occupational Health and Safety (OHS), Community Health and Safety (CHS), Human Resources) in tender documents and contract documents in relation to migrant workers. To ensur that labour influx does not pose an issue for communities around the shipyard after reinstatement of shipyard activities, a labour influx plan should be detailed according to IFC PS and Guidelines.
2.4	Worker accommodations	No information available	No information on worker accommodations of the previous shipyard construction was received nor reviewed for this due diligence.	Worker accommodation facility should comply with the ILO guideline for worker accommodations (R115) and the Guidance note of Worker's Accommodation: Processes and Standards of the IFC and EBRD (2009).

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
2.5	Workers' organizations	Not aligned	No information on worker organizations and policies related was received nor reviewed for this due diligence of the previous shipyard operator. News websites have reported Hanjin on termination of contracts after employees were thought to be involved in union related activities, showing that worker organizations were not allowed.	It is recommended that the new operator of the shipyard provides an appropriate forum for the employees for collective bargaining and allow worker organizations.
2.6	Non-discrimination and equal opportunity	No information available	No information on non-discrimination and equal opportunity was received nor reviewed for this due diligence of the previous shipyard operator.	The operator of the new shipyard should maintain a non-discrimination and equal opportunity policy/standard that is actively implemented and monitored on applicability across their own organization, their shipyard personnel and the personnel of the contractors.
2.7	Retrenchment	Not aligned	No information on retrenchment was received nor reviewed for this due diligence of the previous shipyard operator. New articles show that retrenchment often happened after ship contracts were completed. Workers were only re-hired after a new ship building contract was received. An article in the Philippine Daily Inquirer (May 2019, Eduardo Tadem) reported that, after the bankruptcy of HHCIC many of the then contracted workers were layed-of and only 300 staff were	The new shipyard operator should ensure that the HR Policy on Retrenchment should be aligned with IFC "Good Practice Note: Managing Retrenchment".

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
			maintained as part of maintenance requirements. DOLE (Department of Labour and Employment) tried to organize events to get the workers new jobs, although these were reported not to be successful in May 2019. The same article reported that Samahan ng Manggagawa/Workers for People's Liberation (Samahan) has issued the following immediate demands: 1. Separation pay for the retrenched workers, 2. Return of the employment training bond of 3 percent deducted monthly from their pay, 3. Unemployment subsidies to those retrenched, 4. A moratorium on Pag-Ibig housing loan repayments, 5. Workers representation in all negotiations for Hanjin rehabilitation, 6. Allow the 100 wokrers who did not sign the Voluntary Retrenchment Program to return to work.	

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
2.8	Occupational Grievance Management	No information available	No information on grievance management was received nor reviewed for this due diligence of the previous shipyard operator.	Develop an IFC-PS 2 aligned Grievance Redressal Mechanism that is specific for workers on the shipyard and can be anonymous and free from retaliation and accessible to all.
2.9	Protecting the work force (child labor, forced labor)	No information available	No information on grievance management was received nor reviewed for this due diligence of the previous shipyard operator.	The new shipyard operator should have a policy on the protection of the work force in specific in relation to aspects like child labour, forced labour and activities in relatation to pregnant women. The new operator should ensure appropriate care is taken to ensure the applicability and implementation of these policies and delegate these policies to all their contractors.
2.10	Occupational Health and Safety	Not aligned	No specific information on Hanjin management of occupational health and safety was received, besides the emergency response plan. News websites and providers have reported several instances where Hanjin was reported to be at fault due to occupational safety risks which killed numerous (approximately 30) workers at the shipyard. In 2008 SBMA found several issues in relation to occupational health and safety at the shipyard and in 2018 the shipyard received a stop work order until occupational health and safety issues were resolved.	The new shipyard operator should ensure that job specific Standard Operating Procedures (SOPs) are developed for shipyard specific activities and these SOPs are disclosed to relevant workers and monitored on proper implementation. The SOPs are part of a site wide Occupational Health and Safety Plan according to ILO and IFC standards, which is the responsibility of the new shipyard operator.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
2.11	Hazardous Materials Management and Safety	Partially aligned	Hazardous materials management procedrues were reviewed and certificates of compliance, disposal, treatment and management of third parties were received and seemed compliant.	The new shipyard operator should maintain SOPs on hazardous materials management and safety and ensure these SOPs are disclosed to relevant workers and monitored on proper implementation.
2.12	Emergency Preparedness and Response	Partially aligned	Refer section 1.9 of this table	Refer section 1.9 of this table
2.13	Security Personnel Requirements	No information available	No information related to security personnel requirements was received nor reviewed for the previous shipyard operations.	The new shipyard operator shall draft contract documents for security personnel per the requirement of IFC PS (“GOOD PRACTICE HANDBOOK Use of Security Forces: Assessing and Managing Risks and Impacts Guidance for the Private Sector in Emerging Markets”).
3	**RESOURCE EFFICIENCY AND POLLUTION PREVENTION**			
3.1	World Bank Environmental Health and Safety (EHS) Guidelines	Partially aligned	Some procedures and management measures for the handling of waste and water extraction were available, although a compete resource efficiency plan according to EHS guidelines was not available.	The new shipyard operator should ensure EHS management of resources is modified to ensure scope of improvements are beyond regulatory compliance and minimally in line with WB EHS guidelines;

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
				EHS management should be updated with respect to followings: a. IFC general EHS guideline b. IFC EHS guideline for LNG Facilities c. IFC EHS guideline for Ports, Harbors and Terminals. (essentials of the guidelines included as Appendix 2). d. ILO Guidelines for Safety and Health in Shipbuilding and Ship Repair
3.2	Resource efficiency	Not aligned	No set resource efficiency plan was received nor reviewed for the previous shipyard operations. The shipyard does monitor water usage and waste production, although no proof of energy or other material consumption was reviewed.	The new operator of the shipyard should maintain a system to assess real time resource utilization efficiency viz-a-viz pollution discharge and performance of pollution management system. Items like energy consumption, waste production and discharges to water bodies should be monitored amongst others;
3.3	Pollution prevention	Partially aligned	The previous shipyard operations did not share a pollution prevention plan in whole. Efforst are done to manage waste in an appropriate way and several environmental parameters are monitored as part of meeting regulatory compliance. Records have been reviewed for 2019 and no reports of previous violations have been received, although actual monitoring records for years before 2018 were never reviewed.	The new shipyard operator should develop a pollution prevention plan that details the actions taken to avoid pollution of soil, groundwater, air and water bodies around the shipyard. This plan serves as the main framework and incorporates procedures and items as specified in the following cells.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
3.4	Air emissions	Partially aligned	Air emissions have been included in the EIA as estimates and are monitored for the generator sets at the site and the Miura boilers. Emissions from Wet scrubbers at the site have not been received nor reviewed, but quarterly monitoring results of the different stationary sources are delivered to DENR and checked on compliance. No issues have been reported.	The new shipyard operator should monitor NOx and CO emission from stationary sources like generator sets and ensure other air pollutants are monitored as deemed appropriate by the World Bank EHS Guidelines (general). Thereby, the new operator should implement energy efficient features to reduce energy use with an overall objective of reducing air emissions. Aggregate greenhouse gas emissions from all facilities should be quantified annually.
3.5	Wastewaters	Partially aligned	Water of the STP is monitored on a quarterly basis on local Philippine water quality limits. The results do not show exceedance of the national parameters nor from the permitted discharge limits as specified in the STP Discharge permit. Only records for 2019 were received and reviewed. Riverwater and sea water at the quay walls is monitored on quality parameters according to local Philippine standards and did not show any exceedance for the year 2019 where records were received and reviewed.	The new shipyard operator should estimate fresh domestic water requirement and industrial water requirement for shipyard activities on an annual basis. Water balance diagram to be established. Thereby, the following items should be maintained/checked. • Unit wise real time water and wastewater balance should be established. • It is recommended to install adequate metering facilities at appropriate location to measure the unit wise water consumption; • Sewage and industrial effluent to be treated separately. Treated wastewater should be recycled/reused for dust suppression, water sprinkling or other purposes if possible.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
				• It is recommended to install online analyzers for relevant parameters should be installed at outlet of wastewater treatment facilities.
3.6	Land	Partially aligned	Land is leased by Hanjin for the shipyard. At the tiem of the shipyard construction, policies of the IFC related to resource efficient land acquisition were not yet in place. The EIA reports that the process for land acquisition did follow regulatory requirements.	It is expected that no additional land will be acquired as part of the shipyard acquisition. If the new shipyard operator is acquiring new land in the future, this should follow the resource efficiency and pollution prevention standars as specified in IFC PS 3.
3.7	Wastes (solid, hazardous and non-hazardous)	Partially aligned	A hazardous waste management procedure is in place and proof of waste manifestos, transfer and disposal were reviewed for a particular case. A generic waste management plan was not available.	The new shipyard operator shall maintain a system shall be developed for storage, segregation and disposal of wastes as per IFC PS 3 and the World Bank EHS Guidelines.
3.8	Noise	Partially aligned	Ambient noise levels of the Hanjin site showed no exceedance of the 45 db(A) as specified in the Philipinne requirements. Nevertheless, the site was not operational, so no noise levels have been reviewed for the operational period. Site personnel informed that no issues have been reported before with noise levels from the shipyard.	The new shipyard operator will ensure that: • Noise sources in and around the project site are identified. • Vulnerable zones for noise are clearly identified and marked; • Noise prevention and mitigation measures are applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level. • Vulnerable noise generating sources should be identified and attempt should be made to control the same by providing enclosures, barriers etc.;

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
				• Accordingly, relevant PPE including soundproof cabins should be made in locations where noise levels are exceeding 85 dB(A) for extended periods as specified in the IFC PS;
3.9	Greenhouse Gases	Not aligned	No records of annual greenhouse gas emissions of the shipyard were received/reviewed as part of the due diligence.	The new shipyard operators should ensure that: • Aggregate greenhouse gas emissions from all facilities are quantified annually in accordance with internationally recognized methodologies.; • Management programs are carried out for further improvements in performance on regular basis; etc.
3.10	Water	Partially aligned	No secondary containment of chemicals/paints and other hazardous materials were present in the storage areas. Process areas like the blasting and painting shop were sealed off from the outside and cleaning was performed insite the confinement o the building and without the use of water, avoiding any surface run-off. Process water of pre-treatment and galvanizing is reportedly treated in the adjacent wastewater treatment plant. Drainage systems are not closed and lead out to sea. Monitoring is performed on quarterly basis and water quality records of 2019 do not show exceedance of Philippine standars on water quality.	The new shipyard operator should ensure that: • Water requirements for the shipyard operations are estimated. • Unit wise real time water and wastewater balance should be established by providing adequate metering facilities; • Necessary permits are obtained for the ground water extraction. • Water extraction is monitored. • Separate drainage systems/Wastewater treatment for drainage water from process areas that could be contaminated and drainage water from non-process areas (open drains) should be available. • All process areas should be bunded/contained or have adequate site drainage via a closed sewer system to

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
				ensure that uncontrolled contaminated surface run-off is avoided.
3.11	Safe Use and Management of Hazardous Substances and Materials	Partially aligned	Hazardous materials management and storage procedures were available and MSDS for hazardous substances was developed. Secondary containment in storage areas was not available and hence provided the risk of spills reaching the open drainage.	The new shipyard operator should ensure that secondary containment either via drip trays/pallets and spill kits is maintained, bunded buildings/storage areas are developed or a closed drainage system for areas with the potential for contamination/spills are developed. This in order to avoid that a spill might end up in a public water body, soil or groundwater.
4	**HEALTH AND SAFETY COMMUNITY HEALTH, SAFETY, AND SECURITY**			
4.1	Community Health and Safety	Partially aligned	• Impact on community health and safety due to shipyard operation was only part of the EIA in a limited way (air and noise pollution). • Community health concerns and prevalent diseases or health issues for surrounding settlements and workers is available in the EIA for certain cities near the shipyard. • A reviewed article specifies a Malaria outbreak in Cawag and contributes this impact to the influx of workers for the shipyard.	The new shipyard operator should: • Evaluate the risks and impacts to the health and safety of the nearby Communities during the shipyard operations and will establish preventive and control measures consistent with good international industry practice (GIIP). • Try to create an understanding of baseline health conditions in the locations of workers and personnel, so they can refer back to these conditions during shipyard operations and assess whether any changes are present that can be attributed to shipyard activities; • Develop a procedure and SOP for dismantling the old machinery and equipment must be prepared to include final

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
				disposal as per applicable local requirements and IFC PS.
4.2	Hazardous Materials Management and Safety	Partially aligned	• Reference is made to 3.7 and 3.11	• Reference is made to 3.7 and 3.11
4.3	Traffic and Road Safety	Not aligned	• No traffic study was performed as part of the EIA • No traffic and road safety plan were received nor reviewed for previous shipyard operations. • During the site visit rules in relation to traffic on site were followed, as the team was escorted by site personnel speed restrictions were present on the site	The new shipyard operator should develop a traffic and road safety plan for all traffic on site, ensuring safety of traffic and personnel on site is maintained. Thereby, the new shipyard operator should develop and maintain clear traffic safety rules for contractors that deliver and pick-up materials/people outside of the shipyard and ensure these traffic flows do not cause a potential community health and safety hazard.
4.4	Natural Hazards	Partially aligned	• Disaster management plan has been prepared to deal with storms/floods and is included in the emergency response plan. • Roles and responsibilities during natural hazard have been identified.	It is recommended that the new shipyard operator has a detailed disaster management plan prepared for the site with the facilities available and to be provided in future to handle any incident and specify actions to be taken by the responsible authorities. It should be revised for any modifications in the installation should those occur as part of the reopening of the shipyard or in future situations.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
4.5	Emergency Preparedness and Response	Partially aligned	• An emergency respons plan was available for previous site operations and specified different types of emergencies and how to handle these, considering human, natural and contaminiation risks.	The new shipyard operator should develop a detailed emergency preparedness and response plan in accordane with the General World Bank EHS Guidelines and the EHS Guidelines for Ports and Harbours.
4.6	Security Personnel	No information available	• Please refer to 2.13	• Please refer to 2.13
5	**LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT**			
5.1	Feasible alternative project designs	Not aligned	• The EIA does not show any proof of alternative designs for the development of the shipyard. Due to previous site occupations for the developmend of a concrete gravity structure, the site was deemed most suitable by the EIA.	It is currently understood that the new shipyard operator is not considering any new project designs for extension of the shipyard.
5.2	Compensation and Benefits for Displaced Persons	Partially aligned	• Compensation of displaced people of the shipyard has been mentioned in EIA as being the responsibility of Hanjin (from a cost perspective) and Subic Bay Marine Authority (SBMA). No compensation plan was received/reviewed as this is considered private information by Philippine regulations.	The new shipyard operator is taking over operations of the already existing shipyard. It is currently not anticipated that operations will displace further people. Would site operations in the future have an impact on communities around the site, causing physical or economic displacement, the new shipyard operator will have to ensure that compensation of these communities is performed in accordance with IFC PS 5.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
5.3	Community Engagement	Partially aligned	The EIA mentions the requirement to develop a community engagement office for the communities around the shipyard, although no proof of this type of office was received or reviewed.	The new shipyard operator should: • Develop a community engagement and management plan and engage with affected Communities if applicable, through the process of stakeholder engagement as per the applicable IFC PS. • Disclosure of relevant information and participation of Affected communities and persons will continue during the renewed shipyard operations
5.4	Grievance Management	No information available	No grievance mechanism was reviewed or received for the time that Hanjin was operating the shipyard.	The new shipyard operator should: • Develop and maintain a grievance mechanism for both workers as well as communities around the shipyard and in accordance with the IFC PS.
5.5	Resettlement and Livelihood Restoration Planning and Implementation	Partially aligned	No formal resettlement and livelihood restoration plan have been reviewed/received as part of previous resettlement activities. The EIA does mention the requirement to provide adequate compensation for affected people and the requirement to ensure income and livilhood facilities are equal to pre-shipyard conditions.	It is understood that no resettlement is required as part of the new shipyard operator taking over the shipyard operations. Would any of the renewed activities affect communities in such a way that either physical or economic displacement is apparent, the new shipyard operator will have to ensure that affected people are appropriately compensated for their lossess or shipyard activities resulting in these losses are changed/halted.
5.6	Physical Displacement	Partially aligned	Please refer to 5.5	Please refer to 5.5

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
5.7	Economic Displacement	Partially aligned	The EIA describes fisheries as already being damaged by the fishermen themselves. A quick search on publicly available information showed that fishermen were concerned about the degradation of their fishing grounds as part of the shipyard development and that this has impacted them. The EIA does not highlight compensation for any potential losses of the fishermen, so it is unsure whether this ever occurred. Economic compensation for losses of farmers and holder of fishponds are mentioned in the EIA.	Please refer to 5.5
5.8	Private Sector Responsibilities Under Government-Managed Resettlement	No information available	During the resettlement and compensation SBMA was made responsible for the implementation of the resetttlemetn and the compensation of affected people. It is unsure whether Hanjin has performed any of the responsibilities as highlighted in this articile fo the IFC PS, since no detailed information was received on compensation and resettlement besides what is available in the EIA.	This article of the IFC PS will apply to the new operator of the shipyard, should they be involved in any future resettlement or compensation activities which are management under a government authority.
6	**BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES**			
6.1	Assessment of Biodiversity and Living Natural Resources and	Partially aligned	• EIA report has identified marine and terrestrial biodiversity of project area, although the impact assessment on the marine environment is rather limited. The EIA	The new operator of the shipyard should continue marine ecological monitoring as part of their quarterly reports towards the authorities.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
	Protection and Conservation of Biodiversity		mentions marine biology will most likely improve during operations of the shipyard, which is hard to believe considering shipyard activities. • The EIA report does include a Monitoring Plan for the marine environment, requiring the monitoring of sediment quality, benthos and fish in the area.	In case any dredging activities as part of maintenance of the water depth is required, the new shipyard operator should ensure that sufficient measures are included to minimize the impact on marine ecology as much as possible.
6.2	Management of Ecosystem Services	Partially aligned	Impact on fishermen is assessed in limited way in the EIA and no mitimgation measures for fishermen are provided in case they would lose income due to the shipyard activities. Although the EIA highlights that the shipyard can provide alternative solutions for fishermen, this does not consider the willingness of fishermen to change occupation. Although marine ecology is monitored on benthos, fish and sediment quality, the EIA did not include any restoration activities as part of the neighbouring patches of reef or the sea grass being lost. Water quality impacts are assessed in the EIA and monitoring requirements are set to check discharges into the water bodies according to	The new operator of the shipyard should continue to monitor environmental parameters like marine ecology, water quality etc. to avoid that any of the shipyard activities is significantly impacting ecosystem services in the area. Would the shipyard activities impact any of the ecosystem services present in the communities surrounding the shipyard, the new shipyard operator will have to take appropriate action to solve the impact on these ecosystem services and would this involve loss of livelihood factors of the surrounding communities, compensate the communities for their losses.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
			regulatory requirements. Waste management and treatment options are provided. Groundwater extraction is mentioned as a necessity for the site functioning, although no clear requirements are set on the amount of water to be extracted. This is expected to be included in the permit for groundwater extraction, although this permit was not received/reviewed.	
6.3	Sustainable Management of Living Natural Resources	Partially aligned	The EIA included a monitoring and management plan for the monitoring of marine ecology and other items like water quality, groundwater extraction etc. The shipyard is currently continuing monitoring, which is performed by Berkman Systems Inc. although the only monitoring records that have been reviewed are from 2019, when shipyard operations halted. Any deviations in previous years have not been reviewed. No current initiatives are known by Hanjin to improve the sustainable resources in the area around the shipyard.	The new operator of the shipyard should continue the monitoring campaigns for environmental aspects on a quarterly basis. Thereby, it is recommended that if the new shipyard operator is finding any proof of environmental degradation, it will instigate a management program to solve the cause of environmental degradation and perform activities to restore the degraded areas. Lastly, the new shipyard operator can consider to develop programs for the improvement of marine and terrestrial environments around the shipyard.
6.4	Supply chain	Not aligned	Supply chain impacts have not been assessed as part of the EIA for the shipyard. As part of the regulatory requirement, Hanjin did audit part of their subcontractors on site on compliance to regulatory requirements.	The new shipyard operator should ensure that a policy and standard is in place on the sustainable procurement of resources from national or international suppliers. The suppliers should provide evidence of sustainable sourcing and have audits available serving as proof.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
7	**INDIGENOUS PEOPLES**			
7.1	Assessment of impacts on indigenous peoples	Not aligned	The EIA did not assess impacts on specific indigenous groups, but only assessed impacts on the population that was going to be resettled and the nearest two other communities. Public information shows that there are indigenous tribers in the Subic Bay area like the Ambala tribe of Pastolan; Cawag tribe of Subic, and the Magbukun tribe of Kanawan. It is unsure whether the shipyard has impacted them in the past years.	Currently it is understood that activities will not significantly differentiate from previous shipbuilding activities. Would the situation change, and grievances are received by populations that can be classified as indingeous people, the new shipyard owners should consider IFC PS 7 in their communication and treatment of complaint resolving.
	Further IFC PS 7 items are not assessed due to the inavailability of further information on potential impacts of the shipyard on these indigenous tribes.			
8.	**CULTURAL HERITAGE**			
	Protection of cultural heritage in project design and execution	Partially aligned	The EIA metions a shipwreck that lies 100 meter off the coast of the shipyard location. Dredging activities for the shipyard were not nearby the shipwreck, therefore it was suspected that no impact ot the shipwreck would be made. Next ot the shipwreck, the EIA identified the village of Sitio Agusuhin which reportedly had a shipyard and school and potentially other significant socio-cultural assets for the people living there. The	The new operator of the shipyard should consider socio-cultural activities and assets and the potential impact that the shipyard might have on those, considering grievances that are applied by communiteis surrounding the shipyard. Considering the shipyard is already build, any construction related impacts are not deemed present.

No.	Requirement	Compliance of previous operator	Gap/Description	Recommendation for new operator
			impact on resettlement of this village was only assessed from a socio-economic perspective (assets and livelihood).	
	Project's use of cultural heritage	No information available	The project was not reported to use any of the cultural heritage in the area for commercial purposes.	This standard is not deemed to be relevant considering the current information available of new operators of the shipyard.

Table 2: Gap Assessment with Respect to IFC General EHS Guidelines and Sector Specific Guidelines (Ports & Harbours)

No.	Requirement	Compliance	Gap	Recommendation
1	**GENERAL EHS MANAGEMENT**			
	Many of the EHS requirements of the guidelines are comparable to the requirements as set out in the IFC PS 1, therefore reference is made to Part 1 of previous table. Only contractor requirements were not handled in detail in the previous table, therefore is included in this table.			
1.3	Contractor requirements	Partially aligned	• No contractor requirements were reviewed by the previous shipyard operations • Contractors have been audited on environmental compliance and certificates of approval have been reviewed for some of the contractors.	• The new operator of the shipyard should develop contractor requirements in relation to EHS, which will be delegated to contractors working on- and off site for the shipyard. These requirements will be part of the contractual obligation to the new shipyard operator.

No.	Requirement	Compliance	Gap	Recommendation
				• The shipyard operator is required to monitor the adherence to these requirements at least once a year via verification by themselves or by review of audit reports related to the contractors.
2	**NOISE & VIBRATIONS**			
2.1	Identification and assessment	Partially aligned	• Noise impacts have been monitored and assessed in the EIA for all phases; • Ambient noise levels were monitored on a quarterly basis for shipyard activities • No information on occupational noise risks and industrial hygiene assessments were received nor reviewed • The EIA did not include an assessment on underwater noise on marine fauna.	The new operator of the shipyard should: • Identify sources of noise emission and continue quarterly measurement campaigns at the least; • Identify areas of signficnat occupational noise levels; It is recommended to install permanent noise monitors to have a real time noise levels that can be reviewed at any moment and be linked to exceedance warnings.
2.2	Prevention and Control measures	No information available	• Noise levels are specified in the EIA, but no noise levels are specified in HSE plans of the previous shipyard operations	The new operator of the shipyard should: • Develop a specific monitoring plan for noise emissions and monitor ambient noise levels not to exceed regulatory requirements; • Develop a noise management plan for locations on the site where personnel are exposed to 85 db(A) + noise levels and monitor noise levels and exposure on a recurrent basis (annually) or when situations change.
2.3	Monitoring	Partially aligned	• Monitoring records of 2019 for ambient noise levels were reviewed and compliant; • No other monitoring records of ambient and occupational noise levels were received or reviewed	The new shipyard operator should specify monitoring requirements for noise levels in their monitoring and evaluation plan, specifying: ○ Frequency; ○ Responsibility ○ Maximum noise levels; ○ Recommendations when exceeding the limits.

No.	Requirement	Compliance	Gap	Recommendation
3	**SOIL EROSION**			
3.1	Preventing or controlling soil erosion	Partially aligned	• The EIA prepared for the shipyard reported that the soil stability of the mountains around the shipyard are unstable and being eroded by the Agusuhin river. Recommendations were given to assess soil stability after heavy rainfall and earthquakes.	The new shipyard operator should ensure that they have: • Identification of locations of soil instability that could potenitallly impact shipyard activities and personnel; • A plan in place to assess and monitor soil stability on locations around the shipyard after heavy rainfall and earthquakes.
3.2	Sediment spill prevention and dredging plan	Partially aligned	• Sediment plumes as part of dredging have been assessed in the EIA, calculated using models of the Subic Bay authorities. Besides limiting the hours dredging per day, no significant mitigation measure was provided.	The new shipyard operator should ensru that: • A dreding plan is in place, if maintenance dredging is necessary in the future, detailing: ○ The amount of sediment to be dredged ○ Method of dredging (least impact) ○ Disposal of dredged materials and quality ○ Etc.
4	**AIR QUALITY**			
4.1	Identification and assessment	Partially aligned	• Air emission sources have been identified in the EIA and management and monitoring measures have been included in the EMMP; • Monitoring of air emissions of generator sets, and the Miura boiler is performed and reported to Philippine authorities on a quarterly basis; • No Green House Gas (GHG) emissions have been calculated for the shipyard nor received for shipyard operations over the year (on annual basis)	The new shipyard operator should: • Identify all point sources of air emissions • Develop a specific air emission monitoring plan detailing ○ Frequency; ○ Responsibility ○ Maximum noise levels; ○ Recommendations when exceeding the limits. • Include the specific plan into the overall monitoring and evaluation plan of the shipyard. • Consider installing point source air quality monitors that monitor air quality in real time. • Calculate the overall annual GHG emissions of the shipyard and set targets to lower these emissions.

No.	Requirement	Compliance	Gap	Recommendation
4.2	Prevention & Control of air emissions	No information available	• No air emission reduction targets or plans were received nor reviewed for the previous operator of the shipyard.	The new operator of the shipyard should: • Set goals for the reduction in air emission in their pollution prevention plan and report on activities done to reduce emissions on an annual basis; • Consider new technologies and reducing energy consumption to reduce air emissions accordingly through management programs
4.3	Energy conservation	No information available	• No energy consumption reduction targets or plans were received nor reviewed for the previous operator of the shipyard.	The new operator of the shipyard should: • Develop a plan to reduce energy consumption of the shipyard and set targets to monitor on a monthly basis.
5	**WASTE MANAGEMENT**			
5.1	(Non)-Hazardous Waste Management	Partially aligned	• A hazardous waste management procedure was reviewed as part of the previous shipyard operations, which included the storage, handling, disposal treatment and transportation of hazardous waste • The EIA for the shipyard detailed an environmental and health risk identification, which gave input on the risks of the different hazardous materials used on site and how to handle these. • No generic waste management plan was specified, and no forecasting and assessment of waste produced was received nor reviewed.	The new operator of the shipyard should: • Detail a Waste management plan according to IFC PS and Regulatory Requirement of the Philippines, including: ○ Identification of waste streams and types (including hazardous, non-hazardous and wastewater) ○ Set targets for reduction of waste; ○ Set procedures for storage, handling, transportation, disposal and treatment ○ Set standards for contractors who will handle the waste for the new operator; ○ Monitor waste management procedures ○ Track waste disposal with manifestos
6	**HAZARDOUS MATERIALS**			

No.	Requirement	Compliance	Gap	Recommendation
6.1	Identification and Assessment	Partially aligned	• The EIA for the shipyard identifies hazardous materials that will be used on site and assesses the risk associated with these hazardous materials • NO site-specific plan on all hazardous materials was received by the previous operator of the shipyard. • MSDS for some of the hazardous materials on site were reviewed and seemed in order.	The new shipyard operator should: • Identify and assess the hazardous materials that are used on the shipyard • Highlight any risks associated with the use of these hazardous materials for personnel and the environment amongst others.
6.2	Prevention and Control	Partially aligned	• The EIA includes recommendations on the handling of hazardous materials that are potentially used in the shipyard; • No site-specific plan that includes all the different hazardous materials, their risks and the procedures for handling these materials has been received. The pre-treatment and galvanizing procedure details some of the risks and how to handle these but are fairly non-descriptive.	The new shipyard operator should: • Detail a hazardous materials management plan, detailing, storage, handling and documenting procedures for these materials and an inventory of all the materials present.
6.3	Spill prevention plan	Partially aligned	• A generic spill prevention procedure was included in the emergency response plan of the previous shipyard operator • No spill prevention equipment was observed during the site visit	The new shipyard operator should: • Develop a site-specific spill prevention plan, that details different types of spills and spills of all hazardous materials that are present on site, whilst highlighting how to deal with the different kind of spills, what the risks are and which measures have to be followed to avoid that any of these risks manifest. • The spill prevention plan should also be a requirement of contractors that are performing tasks that could potentially cause a spill. Overall responsibility is maintained by the shipyard operator.
7	**CONTAMINATED LAND**			

No.	Requirement	Compliance	Gap	Recommendation
7.1	Assessment and mitigation	Aligned	• The EIA did not find any groundwater or soil contamination after sampling numerous locations at the shipyard site, before construction commenced.	Considering current information, it is not anticipated that soil and groundwater are significantly contaminated, however, considering processes on the shipyard use hyrdocarbons and other potentially contaminating substances, it is important to consider Phase II ESA's at strategic locations to assess potential soil and groundwater contamination, before repurposing or decmissioning the site. The responsibility for this lies between the site owner and operator and should be discussed accordingly.
	RESOURCE EFFICIENCY			
8	Prevent and Control	No information received	• No resource efficiency plan was received nor reviewed for the previous shipyard operator • No energy and water consumption records were received nor reviewed for the previous shipyard operator.	The new shipyard operator should: • Develop a resource efficiency plan that details the targets set for resource consumption reduction and management measures to track, reduce and report on these. • Monitor resource consumption (energy, water amongst others) and report on a monthly basis • Analyse resource consumption and initiate management programs to lower resource consumption if it is not reducing according to plan.
9	**OCCUPATIONAL AND COMMUNITY HEALTH & SAFETY**			
9.1	Permit to work system	No information received	• No permit to work system was reviewed as part of the previous shipyard operator's management system.	The new shipyard operator should: • Maintain a permit to work system for high-risk activities like working at height, hot works, confined spaces amongst others.

No.	Requirement	Compliance	Gap	Recommendation
				• Document the system and assign responsibilities for the execution of the system and the monitoring of implementation.
9.2	Occupational Health & Safety Plan	Partially aligned	• No occupational health and safety plan were reviewed as part of the previous shipyard operator's management system. • OHSAS 18001 certification was available, which should be based on a management system of some form.	The new shipyard operator should: • Develop a site-specific occupational health and safety plan that details procedures and requirements for maintaining occupational health and safety including job-safety analysis and job specific procedure, PPE requirements etc. • The OHS plan should align with ILO Standards for Safety and Health in Shipbuilding and Repair (2009) and the General and Port & Harbours EHS Guidelines of the World Bank
9.3	Community Health & Safety Plan	Partially aligned	• A short community health risk assessment was performed as part of the EIA for the shipyard; • No formal and site-specific community health and safety plan was received nor reviewed for the previous shipyard operator.	The new operator of the shipyard should: • Develop a project specific community health & safety plan, specifying how the community should respond in case of an emergency and highlighting potential risks and measures to the wider community around the port. • Communicate the health and safety risks and emergency procedures to the wider community; • Community health and safety risks of labour influx are part of the labour influx management plan • Develop a traffic management plan operation traffic.
9.4	Navigational safety	Not aligned	• No navigational safety assessment has been performed as part of the EIA nor has been received from the previous shipyard operator.	The new shipyard operator should: • Develop a navigational safety plan that aligns with MARPOL requirement for navigational safety • Develop requirements for vessels and how to ensure navigational safety in and near the shipyard; • Include requirements for shipping safety into the contractor's requirements

SUMMARY OF RELEVANT EHS REQUIREMENTS (GENERAL AND PORTS & HARBOURS)

IDENTIFICATION AND ASSESSMENT

General management

- Identify hazards
- Involve EHS professionals (competent and experienced)
- Likelihood and Magnitude of Risks
- Prioritisation of risk management strategies
- Follow mitigation hierarchy
- Occupational and Community Health & Safety Planning
- Monitoring and Evaluation

Identification and Assessment according to Ports & Harbours guidelines

- **Terrestrial and Aquatic Habitat Alteration and Biodiversity**
    - The port design should take into account the amount and type of dredging, blasting and reclamation required and their potential interference with natural or critical habitats. The scope of land reclamation activities, and the assessment and management of associated environmental impacts, should be incorporated into the project's design.

- **Coastal Processes and Seabed and Coastal Geomorphology**
    - To carry out surveys, assessment and modelling of metocean, hydrological, sedimentological and coastal geomorphological conditions.
    - Conduct risk assessment of littoral sediment transport, shoreline morphology and erosion patterns and trends; and coastal inundation profiles; define monitoring requirements and identify action triggers.

- **Climate Change Resilience**
    - Projected future climate change-related impacts and the development of adaptation measures to enhance resilience should be assessed in the design phase of new port projects and significant port expansions.
    - Design and operational issues for consideration as part of adaptation planning includes:
        - Design port-related infrastructure
        - Assess the contribution of port construction and operation to incremental climate change impacts on habitat of high biodiversity value.
        - Review tanker transport routes.

AIR EMISSIONS

- Minimize air emissions as much as possible by: Energy efficiency, process modification, selection of fuels, emission control systems.
- Baseline Air Quality assessments performed including at the minimum:
  - Sulfur dioxide
  - Nitrogen dioxide
  - PM10
  - PM2.5
  - Ozone
  - Carbon/CO2
- Reduce air emissions as much as possible next to national parks (Bhirtarkanika) - Nearby is 20 time the stack height
- Identify all point sources of air emissions
- Design stack heights according to GIIP
- Fugitive gases
  - Monitoring practices in the case of potential fugitive gases (such as VOCs and PM)
  - Leak Detection and Repair Systems (LDAR)
  - Use of dust control measures like covers, water suppression, increased moisture content etc.
- Avoid Ozone Depleting Substances
- Constructing traffic emissions (more than 120 heavy duty or 540 light duty vehicles)
  - Replace older vehicles
  - Convert high-use vehicles to cleaner fuels
  - Install emission control devices
  - Implement regular vehicle management
- GHG emission reduction recommendations
  - Carbon financing
  - Improve energy efficiency
  - Protect and enhance sinks
  - Promote renewable energy
- Monitoring plan
  - Baseline calculation
  - Parameters applicable to sources
  - Type and frequency
  - Locations (relevant)
  - Sampling and analysis

Requirements of Ports & Harbours guidelines

- Air Emissions from Combustion Sources
  - Application of air quality management procedures (including for GHG emissions) for ship operations while in port areas, such as:
    - Validate ship engine performance documentation and certification to ensure compliance with combustion emissions specifications (including NOx, SOx, and PM).
    - Require use of low-sulphur fuels in port, if feasible.
    - Use reduced ship propulsion power in port access areas when practical.
    - Use shore-based power in port where it is available.
  - Application of air quality management procedures to avoid, minimize, and control combustion emissions, including GHG emissions, related to land-based port activities, including:
    - Design port layouts and facilities to minimize travel distances and transfer points, when practicable.

        - Upgrade land vehicle and equipment fleets with low emission vehicles, including use of alternative energy sources, and fuels/fuel mixtures, when practicable.
        - Maintain cargo transfer equipment (e.g., cranes, forklifts, and trucks) in good working condition to reduce air emissions.
        - Encourage reduced engine idling during on- and off-loading activities.
- Volatile Organic Compounds
    - VOC emissions from fuel and cargo storage, and transfer activities should be minimized through vapor recovery systems for fuel storage, loading/offloading, and fueling activities, the use of floating top storage tanks, and the adoption of management practices
- Dust
    - Recommended equipment and techniques to manage fugitive dust associated with dry bulk materials storage and handling facilities in ports and terminals include:
        - Cover storage and handling areas, where practicable;
        - Install dust suppression mechanisms (e.g., water spray);
        - Use telescoping arms and chutes to minimize free fall of materials and eliminate the need for slingers;
        - Regularly sweep docks and handling areas, truck and rail storage areas, and paved roadway surfaces, and use vacuum collectors at dust-generating activities.
        - Use slurry transport, pneumatic or continuous screw conveyors, and covering other types of conveyors;
        - Minimize dry cargo pile heights and contain piles with perimeter walls and/or wind break fencing;
        - Remove materials from the bottom of piles to minimize dust re-suspension;
        - Ensure that hatches are covered when material handling is not being conducted; and
        - Cover transport vehicles.

RESOURCE EFFICIENCY

Energy conservation

- Develop an energy management program including all facilities
  - Identification and regular measurement of energy flows
  - Mass and energy balance
  - Review energy performance targets

Water conservation

- Include water conservation measures in the resource efficiency plan. Recommendations could be:
  - Storm/rainwater harvesting
  - Water saving taps, valves, fixtures etc.
  - Re-use treated waste water
  - Use dry (air) instead of wet technologies
  - Use of closed circuit cooling systems
- Measure water consumption and include aspects in the monitoring and evaluation plan like:
  - Identification of water using sources
  - Regular measurement
  - Comparison to previous dates
  - Set water reduction objectives

WASTEWATER AND WATER QUALITY

- General Wastewater and water quality management plan (as part of the wider waste management plan), including:
  - Quality, quantity, frequency and sources of liquid effluents of its installations
  - Segregation of liquid effluents that require specific treatment
  - Prevent or reduce wastewater pollution
  - Assess compliance to local regulations.
  - Water use efficiency measures
  - Process modification to optimize water use and pollution
  - Treatment techniques used, if applicable, and relevant to the discharge location (surface water or sewage)
  - Regulatory requirements for wastewater discharge and how compliance is met
- Industrial wastewater management
  - Treatment of process water and utilities operations wastewater
  - Storm water management and check for potential hydrocarbon contamination. If so, separation, treatment and proper disposal is necessary.
- Sanitary wastewater should be discharged in the sewer, with applicable pre-treatment for oil & grease (in case of kitchen wastewater for example)
- Include measures for wastewater discharge in the monitoring and evaluation plan including:
  - Parameters that should be monitored (applicable to the wastewater that is discharged)
  - Requirements (national and international)
  - Type and frequency
  - Locations
  - Sampling and Data collection methods

Ports & Harbours Wastewater and Water Quality Guidelines

Dredging

- *Dredged Materials Management*
  - Conduct a risk assessment for dredging activities as part of the development of Dredging Management Plan.
- *Dredge Planning Activities*
  - Dredging based on assessment of the need of new infrastructure components
  - To identify areas of high biodiversity value and/or areas used by aquatic life for feeding and breeding.
  - Consider seasonal factors (migration periods, breeding and growing seasons) for dredging activities.
  - To consider modelling of conditions expected during dredging operations to evaluate short- and long-term effects of dredging.
- *Dredging Techniques*
  - Excavation and dredging methods should be selected to minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy of the operation (to minimize impacts to areas adjacent to dredging zones), and maintain the density of the dredged material, especially if the dredge area includes contaminated materials.
  - Additional techniques and equipment to be used to minimize adverse impacts on aquatic life.
  - Inspection and monitoring (such as feedback or adaptive monitoring) of dredging activities should be conducted regularly.
- *Reuse and Disposal of Dredged Material*

- Port managers to engage with national and local authorities, as well as with facility owners and operators in the watershed, to reduce sources of key contaminants.
- Consideration should be given to hierarchy of management options:
  - Avoidance or minimization of dredging
  - Maximization of beneficial re-use options for uncontaminated dredged material
  - Use of a comparative risk assessment to determine which final disposal option is optimal.
- Treatment of contaminated dredged materials (e.g., using physical, chemical, and biological methods) should be evaluated
- Offshore disposal site evaluation should include the assessment and modelling of the impacts of the candidate disposal site
- Use of lateral containment in open water disposal should be considered.
- Use of submerged discharges should be considered for hydraulic disposal of dredged material.
- Confined disposal facilities should include liners or other hydraulic containment design options to prevent leaching of contaminants into adjacent surface or groundwater bodies.

- **Wastewater (Port Sewage, Storm water, and Ship Wastewater)**
  - Additional recommendations specific to storm water and wastewater from port facilities:
    - Avoid installing storm drainage catch basins that discharge directly into surface waters.
    - Install filter mechanisms.
    - Install oil/grit or oil/water separators in all runoff collection areas.
    - Manage recovered, contaminated solids or liquids.
  - Port operators should provide collection, storage, and transfer and/or treatment services, and facilities of sufficient capacity and type for all wastewater generated by vessels at the port in accordance with MARPOL and national regulations, including the following:
    - Oily waste and wastewater should be collected in barges, vehicles, or central collection systems and storage tanks.
    - Wastewater with noxious chemicals from bulk tank cleaning should be collected through appropriate on-site or off-site treatment prior to discharge.
    - Ports should provide ship operators with details on the pertaining ballast water management requirements, including the availability, location, and capacities of reception facilities, as well as with information on local areas and situations where ballast water uptake should be avoided.
    - Port facilities that conduct cleaning or repair of ballast tanks should be equipped with adequate reception facilities able to prevent the introduction of invasive species.
    - Sewage from ships should be collected and treated on-site or off-site according to the recommendations provided in the General EHS Guidelines.

HAZARDOUS MATERIALS MANAGEMENT

- Develop a **Hazardous Materials management plan** that includes general aspects like:
  - Hazard analysis/assessment
  - Avoidance and reduction measures as applicable for hazardous materials use
  - Prevention of uncontrolled releases
  - Use of engineering control to mitigate hazards
  - Management controls (procedures, inspections, training etc.)
  - Occupational Health & Safety measures
  - Process knowledge and documentation
  - Hazardous Materials Transfer practices
  - Overfill protection measures
  - Reaction, Fire and Explosion prevention measures
- The **release prevention and control plan** (spill prevention), as part of the hazardous materials management plan should include:
  - Training of operators
  - Implementation of inspection program
  - Standard Operating Procedures (SOPs) for containment and removal
  - Identification of locations
  - PPE requirements
  - Spill response equipment
  - Response activities (including responsibilities and informed parties)
- Occupational Health & Safety related to hazardous materials
  - Job safety analysis
  - Hazard communication (Material Safety Data Sheets) and training
  - Maintenance activities
  - PPE
  - Monitoring and record keeping of activities
- Process knowledge and documentation
  - Written process safety parameters
  - Written operating procedures
  - Compliance audit procedures
- Overfill protection
  - Procedures and checklist of measures
  - Installation of gauges on tanks
  - Dripless hoses for vehicle connection
  - Automatic fill shutoff valves
  - Catch basin to collect spills
  - Automatic overfill protection valves
  - Pump less volume than available capacity
  - Pressure vents in tanks
- Reaction, Fire and Explosion prevention
  - Proper storage of incompatible materials in separate areas
  - Use of flame arresting devices on vents
  - Grounding and lightning protection of tanks and transfer stations
  - Materials selection compatible for products stored and no reuse of tanks before checking compatibility
  - Storage location separate of main production works.
  - Ignition prevention measures
- Secondary containment of hazardous materials
  - Total volume greater than 1,000 liters need areas with impervious surfaces that are sloped and bermed to contain a minimum of 25 percent of the total storage volume

    - Periodic reconciliation of tanks contents
    - Double-walled, composite piping systems and storage tanks
- Leak detection
    - Pressure loss detectors
    - Integrity testing methods
    - Consider use of SCADA (Supervisory Control And Data Acquisition)
- Underground storage tanks
    - Assess local corrosion potential
    - Install impermeable liners or structures
    - Monitor surface above tank
    - Measure volume in tanks
    - Test integrity at regular intervals
    - Monitor groundwater and soil around the tank
- Management plan actions (continuously)
    - Management of change
    - Compliance audits
    - Incident investigation
    - Employee participation
    - Contractor management requirements
    - Training of personnel
- Emergency preparedness and response plan with the minimum:
    - Planning coordination (informing authorities, documentation, actions, reviewing and updating)
    - Emergency equipment
    - Training
- Community involvement and Awareness (part of the community health and safety plan)
    - Inform the communities of hazards and risks identification in an understandable and culturally sensitive manner
    - Give the public the opportunity to provide feedback
    - Information for communities on the prevention and control measures in place
    - Off-site effects of an accident in the facility
    - Timely information on appropriate behaviour
    - Access to information that is necessary to understand the potential risks.

Requirements of Ports & Harbours guidelines for Hazardous Materials Management

- Spill Prevention
    - Oil and chemical-handling facilities in ports should be located with consideration of natural drainage systems and the presence of environmentally sensitive areas/receptors.
    - Hazardous materials storage and handling facilities should be constructed away from traffic zones and should include protective mechanisms (e.g., reinforced posts, concrete barriers, etc.) to protect storage areas from vehicle accidents. Covered and ventilated temporary storage areas should be designed to facilitate collection of potentially hazardous leaks and spills, including the use of sloped surfaces to direct spill flows, and the use of catch basins with valve systems to allow spills and releases to enter a dead-end sump from which spilled materials can be pumped/recovered. Where hydraulic equipment is used over or adjacent to water or other sensitive receptors, biodegradable45 hydraulic oils should be used.
    - Ports should include secondary containment for above ground liquid storage tanks and tanker truck loading and unloading areas.
    - Fueling areas should be equipped with containment basins in areas with a high risk of accidental releases of oil or hazardous materials (e.g., fueling or fuel transfer locations). Fuel

dispensing equipment should be equipped with “breakaway” hose connections that provide emergency shutdown of flow should the fueling connection be broken by movement. Fueling equipment should be inspected prior to fueling activities to ensure all components are in satisfactory condition.

- Spill Control Plan
    - Port operators should prepare a spill prevention, control, and countermeasure plan consistent with the IMO Manual on Oil Pollution Section II—Contingency Planning, which:
        - Identifies areas within the port zone and nearby vicinity that are sensitive to spills and releases of hazardous materials and locations of any water intakes.
        - Outlines responsibilities for managing spills, releases, and other pollution incidents, including reporting and alerting mechanisms to ensure any spillage is reported promptly to the Port Authorities.
        - Includes provision of specialized oil spill response equipment.
        - Includes regular training schedules and simulated spill incident and response exercises.
- Dangerous Goods Handling
    - Ports should implement systems for the proper screening, acceptance, and transport of dangerous cargo based on local and international standards and regulations, including the following elements:
        - Requiring and validating Dangerous Goods Manifests for hazardous materials whether in transit, loading or unloading to and from ships.
        - Training of Port Authority staff in relevant aspects of dangerous goods management.
        - Establishment of segregated and access-controlled storage areas for dangerous goods with emergency response procedures and equipment.

Requirements for hazardous materials management from Shipping guidelines

Recommendations to prevent, minimize, and control spills of hazardous materials or oil from vessels include:

- Operational certification of the ship;
- For oil tankers, following applicable requirements, including those related to double-hull design and a phase-out timetable for existing single-hull tankers;
- Preparing and implementing spill prevention procedures for bunkering activities;
- Conducting ship to ship transfer of cargo oil (lightering) activities in accordance with specific safety regulations and guidance to minimize the risk of spills;
- Preparing and implementing spill prevention procedures for tanker loading and off-loading according to applicable standards and guidelines which specifically address advance communications and planning with the receiving terminal;
- Adequately securing hazardous materials and oil containers on deck;
- Maintaining the necessary emergency plans to address accidental releases of oil or noxious liquid substances;
- Maintaining the necessary specific oil and noxious liquid substances spill prevention plans and procedures for operations in Special Areas (as defined in Annex I and II of MARPOL 73/78)

WASTE MANAGEMENT

- Develop a waste management plan with the following minimum requirements (for construction and operation)
    - Differentiation between solid (non-hazardous) waste and hazardous waste;
    - Characterize waste according to composition, source, type, generation rates and include regulatory requirements.
    - Following the waste management hierarchy (prevention, reduction, reuse, recovery, recycling, removal and disposal) and identify opportunities to follow this hierarchy in the project
    - Identification of waste and waste streams
    - Storage of waste and how this is appropriate to the nature of the waste
    - Transportation requirements as necessary for the kind of waste
    - Use of legitimate contractors and setting contractor requirements for waste management (up to treatment and disposal)
    - Monitoring and evaluation measures necessary for waste management

Waste management requirements of Ports & Harbours guidelines

- General Waste Reception
    - Port facilities should provide adequate means of receiving and managing effluents and wastes to meet the needs of the port and those of visiting ships that the port is designed to service. The provision of waste reception facilities should be developed in coordination with the local governments according to their commitments to the MARPOL Convention as port states. Port waste reception facilities should provide adequate capacity to receive port- and ship-generated wastes, including appropriately sized and located receptacles, and the capacity to deal with seasonal fluctuations.
- Ship Wastes
    - Information should be available for ship captains to identify solid waste reception facilities and acceptable handling procedures at ports.
    - Discharge of solid waste from vessels should be prohibited while in port in accordance with MARPOL and national regulations
    - A collection and disposal system should be developed for ship-generated garbage for ships alongside and at anchor, consistent with the International Maritime Organization (IMO) Comprehensive Manual on Port Reception Facilities. Closable skips should be provided at the berths, and towed or self-propelled barges fitted with skips should be used to collect garbage from ships at anchor
    - Food waste from ships delivered to the port should be managed according to applicable local regulations intended to protect human and animal health.

NOISE

- Set a baseline for noise levels at the facility
- Identify sources of noise production
- Prevent or control noise production as much as possible and necessary in relation to regulatory requirements
- Monitor noise levels at the perimeter of the site on a regular basis to avoid crossing legal requirements.

Noise & Vibrations requirements from Ports & Harbours guidelines

- Terrestrial Noise
    - Management measures to prevent, minimize, and control terrestrial noise sources in port facilities include:
        - Establishing noise deflection walls
        - Paving and leveling the terminal area
        - Replacing forklifts and reach-stackers with gantry cranes with rubber tires
        - Substituting diesel engines with electric power
        - Reducing noise from warning bells
        - Insulating machinery
- Underwater Noise and Vibration
    - Measures to prevent, minimize, and control underwater noise from offshore pile driving and dredging during construction and operational phases of ports and terminals include:
        - Coordinating and scheduling offshore piling and dredging activities to avoid or minimize the presence of sensitive aquatic species.
        - Employing observers during offshore piling and dredging activities to detect the presence of sensitive aquatic species, and allow for these species to vacate the area.
        - Using soft-start/slow ramp-up during pile driving and dredging activities to allow time for sensitive aquatic species to vacate the area.
        - Implementing noise mitigation techniques for offshore pile driving, including bubble curtains, pile caps, and cofferdams (where practicable) to absorb/scatter pile driving energy.
        - Establishment of low power propulsion zones near ports will minimize underwater noise related to ship operation.

CONTAMINATED LAND

- Identify potential areas that could be contaminated due to previous use or current activities
- If contamination is suspected, do the necessary assessment to test whether contamination is in need of treatment
- Treat the contamination accordingly
- Identify receptors and pathways for contamination to spread.
- Ensure appropriate health and safety procedures are taken if contaminated land is handled

OCCUPATIONAL HEALTH AND SAFETY

General Guidelines

- Development of occupational health and safety plan with respective assessment of risks and procedures to mitigate these risks for the different activities on site;
- General facility design with necessary amenities like fire exits, first aid, water supply, lighting, safe access and egress, proper temperature and ventilation etc.
- Communication (signage) and training efforts relevant to the activities on site;
- Monitoring and evaluation of the H&S hazards and implementation of procedures
- Incident reporting and follow-up

Occupational Health & Safety requirements of Ports & Harbours guidelines

- **General Approach**
  - Port operation activities should be conducted in accordance with applicable international regulations and standards, including:
    - International Labour Organization (ILO) Code of Practice for Safety and Health in Ports (2005);
    - General Conference of the International ILO Convention concerning Occupational Safety and Health in Dock Work, C-152, (1979)
    - General Conference of the ILO Recommendation concerning Occupational Safety and Health in Dock Work, R-160;
    - IMO Code of Practice for Solid Bulk Cargo (BC Code);
    - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code);
    - International Code for the Safe Carriage of Grain in Bulk (International Grain Code);
    - Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code); and
    - International Maritime Dangerous Goods Code (IMDG Code).

- **Physical Hazards**
  - Prevention, minimization, and control techniques specific to ports and the implementation of applicable recommendations include the following:
    - Separate people from areas of vehicle traffic and make vehicle passageways one-way, to the extent practical;
    - Design materials handling operations to allow for a simple, linear layout and reduce the need for multiple transfer points, which can increase the potential for accidents/injuries;
    - To the extent practical, locate access and transit routes to avoid situations where suspended loads pass overhead;
    - Construct the surface of port areas to be of adequate strength to support the heaviest expected loads. The surface should be level or only slightly sloped; free from holes, cracks, depressions, unnecessary curbs, or other raised objects; continuous; and skid resistant;
    - Consider, when determining the method by which the goods are stacked, the maximum permissible loadings of quays or floors; the shape and mechanical strength of the goods and containers (including allowable stacking mass and stack height); the natural angle of repose of bulk material; and the possible effects of high winds;

- Provide safe access arrangements suitable for the size and type of vessels calling at port facilities,
- Install and use guarding arrangements (e.g., rails, etc.) for weather deck and 'tween-deck' hatchways when open;
- Avoid placing cargo on, or allowing passage of vehicles over, any hatch cover that is not of adequate strength for that purpose;
- As far as is reasonably practicable, prevent workers from working in the part of a hold where a trimming machine or grab is operational;
- Minimize the risk of free fall of materials by installing telescoping arm loaders and conveyors; inspect all slings before use;
- Equip lifting appliances with means of emergency escape from the driver's cabin and a safe means for the removal of an injured or ill driver; and
- Inspect disposable pallets and similar reusable devices before use and avoid re-use of such devices if the integrity of the device has been weakened or otherwise compromised.

- **Port Marine Safety**
  - Port operators should therefore implement a Safety Management System (SMS) able to effectively identify and correct unsafe conditions. The SMS should be informed by initial risk and hazard assessments and should include consideration of alterations to coastal processes and seabed and coastal geomorphology that may impact navigational and vessel berthing activities.
  - The Safety Management System should include procedures to regulate the safe movement of vessels within the harbour (including pilotage procedures, port control and vessel traffic services, navigational aids, and hydrography surveys), protect the general public and communities from dangers arising from offshore activities at the harbour, and prevent events that may result in injury to workers and the public. It should also include comprehensive emergency preparedness and response plans that provide a coordinated response based on government, port authority, port users, and community resources required to manage the nature and severity of the emergency event.
- **Port Security**
  - Port security arrangements (e.g., access control) may be established through the completion of a Port Facility Security Assessment of port operations followed by the appointment of a Port Facility Security Officer and the preparation of a Port Facility Security Plan, depending on the outcome of the risk assessment.
- **Visual Impacts**
  - Visual impacts, including excessive background illumination, should be prevented during the port planning process or managed during operations through the installation of natural visual barriers such as vegetation or light shades, as applicable. The location and colour of bulk storage facilities also should be selected with consideration of visual impacts.

ANNEX H

Documentation received (and outstanding)

Documents and Drawings Received by Arcadis per Item

1.1	Property description and particulars (number of storeys, Maximum Permissible and consumed GFAs,year of construction, year of last renovation works, number of car park spaces, details of any external	Received	Remarks
1	Building List, Shelter and Barracks	23-Oct-19	
	Tab 1 => Building List		List of all buildings including corresponding area, no. of stories,structure system, building height and use
	Tab 2 => Baracks		List of structures, building type, quantity, materials, dimensions and total area
	Tab 3 => Moving Shelter		List of structures, location, size, quantity and total
	Tab 4 => Building List & Summary		Same data with tab 1

1.5	Building Agreements / State Lease Agreements / Supplemental State Lease Agreements / Easement Agreements	Date Received	Document Title
1	Amendment to the lease agreement #820	21-Oct-19	Amendment to Lease Agreement Dated February 28, 2006 Between the Subic Bay Metropolitan Authority and HHIC-PHIL Inc #820
2	Amendment to the sublease agreement #829	21-Oct-19	Amendment to the Sublease Agreement #829
3	Amendment to the sublease agreement	21-Oct-19	Amendment to the Sublease Agreement with stamp
4	Industrial Lease Agreement	21-Oct-19	Industrial Lease agreement By and Between SBDMC INC and HHIC-Phil Inc
5	Lease Agreement #823	21-Oct-19	Lease Agreement #823
6	Lease Agreement #824	21-Oct-19	Lease Agreement #824
7	Lease of Agreement	21-Oct-19	Lease of Agreement "Controlled Copy Stamped"
8	Memorandum of Agreement	21-Oct-19	Memorandum of Agreement
9	Second Addendum to the lease agreement #821	21-Oct-19	Second Addendum to the lease agreement #821
10	Third Memorandum to the lease agreement #822	21-Oct-19	Third Memorandum to the lease agreement #822

1.6	Details of any warranties or guarantees for the property (e.g. waterproofing installations, cladding systems, items of plant and machinery etc.).	Date Received	Document Title
1	Laboratory Test Reoirts HCL	21-Oct-19	Certificate of Analysis of Hydro chloric Acid
2	Laboratory Test Reoirts KMNO4	21-Oct-19	Certificate of Analysis of Pottassium Permanganate
3	Laboratory Test Reoirts Paint Sludge	21-Oct-19	Certificate of Analysis of Paint Sludge
4	Third Party Report Ambient Air Monitoring	21-Oct-19	Intial Report on Ambient Air Quality and Noise Level Monitoring
5	Third Party Report Ambient Emmission Test	21-Oct-19	Certificate of Analysis of Nitrogen Dioxide
6	Third Party Environmental Report Marine Biology Monitoring	21-Oct-19	Marine Biologival Monitoring Report - June 2019
7	Third Party Environmental Report River Ecology Monitoring	21-Oct-19	River Ecology Monitoring Report - February 2019
8	Third Party Environmental Report Sediment Analysis	21-Oct-19	Heavy Metal Concetrations in Marine Sediment Monitoring Survey Report - June 2019
9	Third Party Environmental Report STP Effluent Monitoring	21-Oct-19	Result of Analysis Effluent STP 1-1
10	Third Party Environmental Report Water Quality Monitoring	21-Oct-19	Result of Analysis Water Quality Monitoring Quay Wall, Agusuhin (Downstream), North Channel, and South Channel

2.0	Statutory Approvals and Permits	Date Received	Document Title
1	Cetificate of Occupancy	21-10-2019	Cert *1-111 pages
2	Completion Report	21-10-2019	Cert *112-114 pages
3	Equipment Testing Summary Report	21-10-2019	Cert *115 - 122

2.3	**Copies of all latest Approved As Built drawings (including approval of external structures and signage).**	Date Received	Document Title
Architectural As-Builts			
	1. MAIN OFFICE		Architectural As-Builts
	2.PAINTING & BLASTING SHOP B		Architectural As-Builts
	3. GASOLINE STATION		Architectural As-Builts
	4. PRE-OUTFITTING SHOP A		Architectural As-Builts
	5. SUB-ASSEMBLY SHOP A		Architectural As-Builts

2.7	Any Environmental Audits that have been undertaken.	Date Received	Document Title
1	Environmental Performance Evaluation	21-10-2019	Environment Inspection Audit Result In-House Contractors
2	Environmental Audit-Inspection Report	21-10-2019	Environmental Audit-Inspection Report
3	Environmental Inspection Result	21-10-2019	Environmental Inspection Result
4	ISO 14001_2018 Issue	21-10-2019	ISO 14001_2018 Issue

2.8	Health & Safety audits, fire risk assessments etc to verify compliance with the latest Building Authority Regulations	Date Received	Document Title
1	OHSAS 18001_2018 Issue	21-10-2019	OHSAS 18001_2018 Issue

2.9	Copy of all outstanding orders, if any, issued by the statutory authorities	Date Received	Document Title
1	Indorsement for Postponement of Certification	21-10-2019	Indorsement for Postponement of Certification
2	Request for Postponement of Certification_RC	21-10-2019	Request for Postponement of Certification_RC

3.1	As-Built of Mechanical, Electrical, Plumbing and Fire Protection drawings and specifications / Equipment and Load Schedule. All PMS and Service Records that pertains to MEPF system. Single Line Diagrams for building M&E Services.	Document Title	Document Title
Part 1	**1. Welding Shop**		
	Power Riser Diagram for Electrical System	18-11-2019	Welding Shop Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Welding Shop Lighting Plan
	1213F132001 (Fire Alarm Plan).dwg	18-11-2019	1213F132001 (Fire Alarm Plan).dwg
	1213T104002 (Cctv Plan).dwg	18-11-2019	1213T104002 (Cctv Plan).dwg
	2. Pre-Outfitting Shop B		
	Power Riser Diagram for Electrical System	18-11-2019	Pre-Outfitting Shop B Power Riser Diagram
	1st Floor Electrical Power Feeder Plan	18-11-2019	Pre-Outfitting Shop B Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Pre-Outfitting Shop B Lighting Plan
	1205F132002 (Fire Alarm Plan).DWG	18-11-2019	1205F132002 (Fire Alarm Plan).DWG
	1205T104003 (Cctv plan).dwg	18-11-2019	1205T104003 (Cctv plan).dwg
	2.3 Field office #12		
	1263E101001 (Power Riser & Panel Board Diagram.dwg)	18-11-2019	1263E101001 (Power Riser & Panel Board Diagram).dwg
	1263E133001 (Power Feeder Plan).dwg	18-11-2019	1263E133001 (Power Feeder Plan).dwg
	1263E134001 (Lighting Plan).dwg	18-11-2019	1263E134001 (Lighting Plan).dwg
	1263F132001 (Fire Alarm Plan).dwg	18-11-2019	1263F132001 (Fire Alarm Plan).dwg
	3. Panel Shop		
	Power Riser Diagram for Electrical System	18-11-2019	Panel Shop Power Riser Diagram
	1st Floor Electrical Power Feeder Plan	18-11-2019	Panel Shop Power Feeder Plan
	1st Floor Electrical Power Feeder Plan -1	18-11-2019	Panel Shop Power Feeder Plan 1
	1st Floor Electrical Power Feeder Plan -2	18-11-2019	Panel Shop Power Feeder Plan 2
	1st Floor Electrical Power Feeder Plan -3	18-11-2019	Panel Shop Power Feeder Plan 3
	1st Floor Electrical Power Feeder Plan -4	18-11-2019	Panel Shop Power Feeder Plan 4
	1st Floor Electrical Power Feeder Plan -5	18-11-2019	Panel Shop Power Feeder Plan 5
	1st Floor Electrical Power Feeder Plan -6	18-11-2019	Panel Shop Power Feeder Plan 6
	1st Floor Electrical Power Feeder Plan -7	18-11-2019	Panel Shop Power Feeder Plan 7
	1st Floor Electrical Power Feeder Plan -8	18-11-2019	Panel Shop Power Feeder Plan 8
	1st Floor Electrical Power Feeder Plan -9	18-11-2019	Panel Shop Power Feeder Plan 9
	1st Floor Electrical Power Feeder Plan -10	18-11-2019	Panel Shop Power Feeder Plan 10
	1st Floor Lighting Plan	18-11-2019	Panel Shop Lighting Plan
	1st Floor Lighting Plan - 1	18-11-2019	Panel Shop Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Panel Shop Lighting Plan 2
	1st Floor Lighting Plan - 3	18-11-2019	Panel Shop Lighting Plan 3
	1st Floor Lighting Plan - 4	18-11-2019	Panel Shop Lighting Plan 4
	1st Floor Lighting Plan - 5	18-11-2019	Panel Shop Lighting Plan 5
	1st Floor Lighting Plan - 6	18-11-2019	Panel Shop Lighting Plan 6
	1st Floor Lighting Plan - 7	18-11-2019	Panel Shop Lighting Plan 7
	1st Floor Lighting Plan - 8	18-11-2019	Panel Shop Lighting Plan 8
	1st Floor Lighting Plan - 9	18-11-2019	Panel Shop Lighting Plan 9
	1st Floor Lighting Plan - 10	18-11-2019	Panel Shop Lighting Plan 10
	1210F132001 (Fire Alarm Plan).dwg	18-11-2019	1210F132001 (Fire Alarm Plan).dwg
	1210T104004 (Cctv plan).dwg	18-11-2019	1210T104004 (Cctv plan).dwg
	4. Assembly Shop C		
	Power Riser Diagram for Electrical System	18-11-2019	Assembly Shop C Power Riser Diagram
	1st Floor Lighting Plan - 2	18-11-2019	Assembly Shop C Lighting Plan 2
	1st Floor Electrical Power Plan	18-11-2019	Assembly Shop C Power Feeder Plan
	1st Floor Electrical Power Feeder Plan - 1	18-11-2019	Assembly Shop C Power Feeder Plan 1
	1st Floor Electrical Power Feeder Plan - 2	18-11-2019	Assembly Shop C Power Feeder Plan 2
	1st Floor Electrical Power Feeder Plan - 3	18-11-2019	Assembly Shop C Power Feeder Plan 3
	1st Floor Electrical Power Feeder Plan - 4	18-11-2019	Assembly Shop C Power Feeder Plan 4
	1st Floor Electrical Power Feeder Plan - 5	18-11-2019	Assembly Shop C Power Feeder Plan 5
	1st Floor Electrical Power Feeder Plan - 6	18-11-2019	Assembly Shop C Power Feeder Plan 6
	1st Floor Lighting Plan	18-11-2019	Assembly Shop C Lighting Plan

	1st Floor Lighting Plan - 1	18-11-2019	Assembly Shop C Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Assembly Shop C Lighting Plan 2
	1st Floor Lighting Plan - 3	18-11-2019	Assembly Shop C Lighting Plan 3
	1st Floor Lighting Plan - 4	18-11-2019	Assembly Shop C Lighting Plan 4
	1st Floor Lighting Plan - 5	18-11-2019	Assembly Shop C Lighting Plan 5
	1st Floor Lighting Plan - 6	18-11-2019	Assembly Shop C Lighting Plan 6
	1203F132001 (Fire Alarm Plan).dwg	18-11-2019	1203F132001 (Fire Alarm Plan).dwg
	5. Painting & Blasting Shop C		
	Power Riser Diagram for Electrical System	18-11-2019	Painting & Blasting Shop C Power Riser Plan
	1st Floor Electrical Power Feeder Plan	18-11-2019	Painting & Blasting Shop C Power Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Painting & Blasting Shop C Lighting Plan
	1st Floor Lighting Plan - 1	18-11-2019	Painting & Blasting Shop C Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Painting & Blasting Shop C Lighting Plan 2
	1216F132002 (Fire Alarm Plan).dwg	18-11-2019	1216F132002 (Fire Alarm Plan).dwg
	6. Hull Shop B		
	Power Riser Diagram for Electrical System	18-11-2019	Hull Shop B Power Riser Plan
	1st Floor Electrical Power Feeder Plan	18-11-2019	Hull Shop B Power Feeder Plan
	1st Floor Electrical Power Feeder Plan - 1	18-11-2019	Hull Shop B Power Feeder Plan 1
	1st Floor Electrical Power Feeder Plan - 2	18-11-2019	Hull Shop B Power Feeder Plan 2
	1st Floor Electrical Power Feeder Plan - 3	18-11-2019	Hull Shop B Power Feeder Plan 3
	1st Floor Electrical Power Feeder Plan - 4	18-11-2019	Hull Shop B Power Feeder Plan 4
	1st Floor Electrical Power Feeder Plan - 5	18-11-2019	Hull Shop B Power Feeder Plan 5
	1st Floor Electrical Power Feeder Plan - 6	18-11-2019	Hull Shop B Power Feeder Plan 6
	1st Floor Electrical Power Feeder Plan - 6	18-11-2019	Hull Shop B Power Feeder Plan 7
	1st Floor Electrical Power Feeder Plan - 8	18-11-2019	Hull Shop B Power Feeder Plan 8
	1st Floor Electrical Power Feeder Plan - 9	18-11-2019	Hull Shop B Power Feeder Plan 9
	1st Floor Lighting Plan	18-11-2019	Hull Shop B Lighting Plan
	1st Floor Lighting Plan - 1	18-11-2019	Hull Shop B Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Hull Shop B Lighting Plan 2
	1st Floor Lighting Plan - 3	18-11-2019	Hull Shop B Lighting Plan 3
	1st Floor Lighting Plan - 4	18-11-2019	Hull Shop B Lighting Plan 4
	1st Floor Lighting Plan - 5	18-11-2019	Hull Shop B Lighting Plan 5
	1st Floor Lighting Plan - 6	18-11-2019	Hull Shop B Lighting Plan 6
	1st Floor Lighting Plan - 7	18-11-2019	Hull Shop B Lighting Plan 7
	1st Floor Lighting Plan - 8	18-11-2019	Hull Shop B Lighting Plan 8
	1st Floor Lighting Plan - 9	18-11-2019	Hull Shop B Lighting Plan 9
	1202F132001 (Fire Alarm Plan).dwg	18-11-2019	1202F132001 (Fire Alarm Plan).dwg
	1202T104004 (Cctv plan).dwg	18-11-2019	1202T104004 (Cctv plan).dwg
	7. Sub-Assembly Shop		
	Power Riser Diagram for Electrical System	18-11-2019	Sub-Assembly Power Riser Diagram
	1st Floor Electrical Power Feeder Plan	18-11-2019	Sub-Assembly Power Feeder Plan
	1st Floor Electrical Power Feeder Plan - 1	18-11-2019	Sub-Assembly Power Feeder Plan 1
	1st Floor Electrical Power Feeder Plan - 2	18-11-2019	Sub-Assembly Power Feeder Plan 2
	1st Floor Electrical Power Feeder Plan - 3	18-11-2019	Sub-Assembly Power Feeder Plan 3
	1st Floor Electrical Power Feeder Plan - 4	18-11-2019	Sub-Assembly Power Feeder Plan 4
	1st Floor Lighting Plan	18-11-2019	Sub-Assembly Lighting Plan
	1st Floor Lighting Plan - 1	18-11-2019	Sub-Assembly Lighting Plan - 1
	1st Floor Lighting Plan - 2	18-11-2019	Sub-Assembly Lighting Plan - 2
	1st Floor Lighting Plan - 3	18-11-2019	Sub-Assembly Lighting Plan - 3
	1st Floor Lighting Plan - 4	18-11-2019	Sub-Assembly Lighting Plan - 4
	1204F132002 (Fire Alarm Plan.dwg)	18-11-2019	1204F132002 (Fire Alarm Plan.dwg)
Part 2	**8. Assembly Shop B**		
	Power Riser Diagram for Electrical System	18-11-2019	Assembly Shop B Drawing Plan
	9. Hull Shop A		
	Power Riser Diagram for Electrical System - 1	18-11-2019	Hull Shop A Power Riser Diagram 1
	Power Riser Diagram for Electrical System - 2	18-11-2019	Hull Shop A Power Riser Diagram 2
	1st Electrical Power Feeder Plan	18-11-2019	Hull Shop A Power Feeder Plan
	1st Electrical Power Feeder Plan - 1	18-11-2019	Hull Shop A Power Feeder Plan 1
	1st Electrical Power Feeder Plan - 2	18-11-2019	Hull Shop A Power Feeder Plan 2
	1st Electrical Power Feeder Plan - 3	18-11-2019	Hull Shop A Power Feeder Plan 3
	1st Electrical Power Feeder Plan - 4	18-11-2019	Hull Shop A Power Feeder Plan 4
	1st Electrical Power Feeder Plan - 5	18-11-2019	Hull Shop A Power Feeder Plan 5
	1st Electrical Power Feeder Plan - 6	18-11-2019	Hull Shop A Power Feeder Plan 6
	1st Electrical Power Feeder Plan - 7	18-11-2019	Hull Shop A Power Feeder Plan 7
	1st Electrical Power Feeder Plan - 8	18-11-2019	Hull Shop A Power Feeder Plan 8
	1st Electrical Power Feeder Plan - 9	18-11-2019	Hull Shop A Power Feeder Plan 9
	1st Electrical Power Feeder Plan - 10	18-11-2019	Hull Shop A Power Feeder Plan 10
	1st Floor Lighting Plan - 1	18-11-2019	Hull Shop A Ligthing Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Hull Shop A Ligthing Plan 2
	1st Floor Lighting Plan - 3	18-11-2019	Hull Shop A Ligthing Plan 3
	1st Floor Lighting Plan - 4	18-11-2019	Hull Shop A Ligthing Plan 4
	1st Floor Lighting Plan - 5	18-11-2019	Hull Shop A Ligthing Plan 5
	1st Floor Lighting Plan - 6	18-11-2019	Hull Shop A Ligthing Plan 6
	1st Floor Lighting Plan - 7	18-11-2019	Hull Shop A Ligthing Plan 7
	1st Floor Lighting Plan - 8	18-11-2019	Hull Shop A Ligthing Plan 8
	1st Floor Lighting Plan - 9	18-11-2019	Hull Shop A Ligthing Plan 9
	1st Floor Lighting Plan - 10	18-11-2019	Hull Shop A Ligthing Plan 10
	1102F130002 (Fire alarm plan).dwg	18-11-2019	1102F130002 (Fire alarm plan).dwg
	1102T104004 (Cctv plan).dwg	18-11-2019	1102T104004 (Cctv plan).dwg
	10. Assembly Shop A		
	Power Riser Diagram for Electrical System - 1	18-11-2019	Assembly Shop A Power Riser Diagram 1
	Power Riser Diagram for Electrical System - 2	18-11-2019	Assembly Shop A Power Riser Diagram 2
	1st Electrical Power Feeder Plan	18-11-2019	Assembly Shop A Power Feeder Plan
	1st Electrical Power Feeder Plan - 1	18-11-2019	Assembly Shop A Power Feeder Plan 1
	1st Electrical Power Feeder Plan - 2	18-11-2019	Assembly Shop A Power Feeder Plan 2
	1st Electrical Power Feeder Plan - 3	18-11-2019	Assembly Shop A Power Feeder Plan 3
	1st Electrical Power Feeder Plan - 4	18-11-2019	Assembly Shop A Power Feeder Plan 4
	1st Electrical Power Feeder Plan - 5	18-11-2019	Assembly Shop A Power Feeder Plan 5
	1st Electrical Power Feeder Plan - 6	18-11-2019	Assembly Shop A Power Feeder Plan 6
	1st Floor Lighting Plan - 1	18-11-2019	Assembly Shop A Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Assembly Shop A Lighting Plan 2
	1st Floor Lighting Plan - 3	18-11-2019	Assembly Shop A Lighting Plan 3
	1st Floor Lighting Plan - 4	18-11-2019	Assembly Shop A Lighting Plan 4
	1st Floor Lighting Plan - 5	18-11-2019	Assembly Shop A Lighting Plan 5
	1st Floor Lighting Plan - 6	18-11-2019	Assembly Shop A Lighting Plan 6
	1st Floor Lighting Plan - 7	18-11-2019	Assembly Shop A Lighting Plan 7
	1st Floor Lighting Plan - 8	18-11-2019	Assembly Shop A Lighting Plan 8
	1st Floor Lighting Plan - 9	18-11-2019	Assembly Shop A Lighting Plan 9
	1103F132001 (Frie alarm plan).dwg	18-11-2019	1103F132001 (Frie alarm plan).dwg
	11. Pre-Outfitting Shop A		
	Power Riser Diagram for Electrical System	18-11-2019	Pre-Outfitting Shop A Power Riser Diagram
	1st Electrical Power Feeder Plan	18-11-2019	Pre-Outfitting Shop A Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Pre-Outfitting Shop A Lighting Plan
	1105F132003 (Fire alarm plan).dwg	18-11-2019	1105F132003 (Fire alarm plan).dwg
	12. Painting & Blasting Shop B		
	Painting Shop A 1st Electrical Power Feeder Plan	18-11-2019	Painting & Blasting Shop B Drawing Plan
	1114F132003 (Fire alarm plan).dwg	18-11-2019	1114F132003 (Fire alarm plan).dwg
	13. Outfitting Shop		
	Power Riser Diagram for Electrical System	18-11-2019	Outfitting ShopPower Riser Diagram
	1st Electrical Power Feeder Plan - 1	18-11-2019	Outfitting ShopPower Feeder Plan 1
	1st Electrical Power Feeder Plan - 2	18-11-2019	Outfitting ShopPower Feeder Plan 2
	1st Floor Lighting Plan - 1	18-11-2019	Outfitting Shop Lighting Plan 1
	1st Floor Lighting Plan - 2	18-11-2019	Outfitting Shop Lighting Plan 2
	1111F132001 (Fire alarm plan).dwg	18-11-2019	1111F132001 (Fire alarm plan).dwg
	14. Piping Shop A		
	Power Riser Diagram for Electrical System	18-11-2019	Piping Shop A Power Riser Diagram
	1st Electrical Power Feeder Plan	18-11-2019	Piping Shop A Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Piping Shop A Lighting Plan
	15. Piping Shop B		
	Power Riser Diagram for Electrical System	18-11-2019	Piping Shop B Power Riser Diagram
	1st Electrical Power Feeder Plan	18-11-2019	Piping Shop B Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Piping Shop B Lighting Plan
	16. Assembly Shop D		
	Power Riser Diagram for Electrical System	18-11-2019	Assembly Shop D Power Riser Diagram
	1st Floor Electrical Power Plan	18-11-2019	Assembly Shop D Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Assembly Shop D Lighting Plan
	17. Painting & Blasting Shop E		

	Power Riser Diagram for Electrical System	18-11-2019	Painting & Blasting Shop E Power Riser Diagram
	1st Floor Electrical Power Plan	18-11-2019	Painting & Blasting Shop E Power Feeder Plan
	1st Floor Lighting Plan	18-11-2019	Painting & Blasting Shop E Lighting Plan
	18. Field office #1		
	1151E101001 (Power riser & panel board diagram).dwg	18-11-2019	1151E101001 (Power riser & panel board diagram).dwg
	1151E133001 (Power feeder plan).dwg	18-11-2019	1151E133001 (Power feeder plan).dwg
	1151E134001 (Lighting plan).dwg	18-11-2019	1151E134001 (Lighting plan).dwg
	1151F132001 (Fire alarm plan).dwg	18-11-2019	1151F132001 (Fire alarm plan).dwg
	19. Field office #2		
	1152E101001 (Power riser & panel board diagram).dwg	18-11-2019	1152E101001 (Power riser & panel board diagram).dwg
	1152E133001 (Piower feeder plan).dwg	18-11-2019	1152E133001 (Piower feeder plan).dwg
	1152E134001 (Lighting plan).dwg	18-11-2019	1152E134001 (Lighting plan).dwg
	1152F132001 (Fire alarm plan).dwg	18-11-2019	1152F132001 (Fire alarm plan).dwg
	20. Field office #3		
	1153E101001 (Power riser & panel board diagram.dwg)	18-11-2019	1153E101001 (Power riser & panel board diagram.dwg)
	1153E133001 (Power feeder plan).dwg	18-11-2019	1153E133001 (Power feeder plan).dwg
	1153E134001 (Lighting plan).dwg	18-11-2019	1153E134001 (Lighting plan).dwg
	1153F132001 (Fire alarm plan).dwg	18-11-2019	1153F132001 (Fire alarm plan).dwg
Part 3	**21. Field office #4**		
	1154E101001 (Power riser & panel board diagram.dwg)	18-11-2019	1154E101001 (Power riser & panel board diagram.dwg)
	1154E133001 (Power feeder plan).dwg	18-11-2019	1154E133001 (Power feeder plan).dwg
	1154E134001 (Lighting plan).dwg	18-11-2019	1154E134001 (Lighting plan).dwg
	1154F132001 (Fire alarm plan).dwg	18-11-2019	1154F132001 (Fire alarm plan).dwg
	22. Field office #5		
	1155E101001 (Power riser & panel board diagram).dwg	18-11-2019	1155E101001 (Power riser & panel board diagram).dwg
	1155E133001 (Power feeder plan).dwg	18-11-2019	1155E133001 (Power feeder plan).dwg
	1155E134001 (Lighting plan.dwg)	18-11-2019	1155E134001 (Lighting plan.dwg)
	1155F132001 (Fire alarm plan).dwg	18-11-2019	1155F132001 (Fire alarm plan).dwg
	23. Field office #5A		
	1265E101001(as).dwg	18-11-2019	1265E101001(as).dwg
	1265E133001(as).dwg	18-11-2019	1265E133001(as).dwg
	1265E134001(as).dwg	18-11-2019	1265E134001(as).dwg
	1265E138001(as).dwg	18-11-2019	1265E138001(as).dwg
	1265F132001(as).dwg	18-11-2019	1265F132001(as).dwg
	1265T104001(as).dwg	18-11-2019	1265T104001(as).dwg
	1265T104002(as).dwg	18-11-2019	1265T104002(as).dwg
	24. Field office #6		
	1156E101001 (Power riser & panel board diagram)	18-11-2019	1156E101001 (Power riser & panel board diagram).dwg
	1156E133001 (Power feeder plan)	18-11-2019	1156E133001 (Power feeder plan).dwg
	1156E134001 (Lighting plan)	18-11-2019	1156E134001 (Lighting plan).dwg
	1156F132001 (Fire alarm plan)	18-11-2019	1156F132001 (Fire alarm plan).dwg
	25. Field office #7		
	1257E101001 (Power Riser Diagram & Panel board Diagram).dwg	18-11-2019	1257E101001 (Power Riser Diagram & Panel board Diagram).dwg
	1257E133001 (Power Feeder Plan).dwg	18-11-2019	1257E133001 (Power Feeder Plan).dwg
	1257E134001 (Lighting Plan).dwg	18-11-2019	1257E134001 (Lighting Plan).dwg
	1257F132001 (Fire Alarm Plan).dwg	18-11-2019	1257F132001 (Fire Alarm Plan).dwg
	26. Field office #8		
	1258E101001 (Power Riser & Panel Board Diagram.dwg)	18-11-2019	1258E101001 (Power Riser & Panel Board Diagram.dwg)
	1258E133001 (Power Feeder Plan).dwg	18-11-2019	1258E133001 (Power Feeder Plan).dwg
	1258E134001 (Lighting Plan).dwg	18-11-2019	1258E134001 (Lighting Plan).dwg
	1258F132001 (Fire Alarm Plan).dwg	18-11-2019	1258F132001 (Fire Alarm Plan).dwg
	27. Field office #9		
	1259E101001 (Power Riser & Panel Board Diagram).dwg	18-11-2019	1259E101001 (Power Riser & Panel Board Diagram).dwg
	1259E133001 (Power Feeder Plan.dwg	18-11-2019	1259E133001 (Power Feeder Plan.dwg
	1259E134001 (Lighting Plan).dwg	18-11-2019	1259E134001 (Lighting Plan).dwg
	1259F132001 (Fire Alarm Plan).dwg	18-11-2019	1259F132001 (Fire Alarm Plan).dwg
	28. Field office #10		
	1260E101001 (Power Riser & Panel Board Diagram).dwg	18-11-2019	1260E101001 (Power Riser & Panel Board Diagram).dwg
	1260E133001 (Power Feeder Plan).dwg	18-11-2019	1260E133001 (Power Feeder Plan).dwg
	1260E134001 (Lighting Plan).dwg	18-11-2019	1260E134001 (Lighting Plan).dwg
	1260F132001 (Fire Alarm Plan.dwg	18-11-2019	1260F132001 (Fire Alarm Plan.dwg
	29. Field office #11A		
	1261E101001 (Power Riser & Panel Board Diagram).dwg	18-11-2019	1261E101001 (Power Riser & Panel Board Diagram).dwg
	1261E133001 (Power Feeder Plan).dwg	18-11-2019	1261E133001 (Power Feeder Plan).dwg
	1261E134001 (Lighting Plan).dwg	18-11-2019	1261E134001 (Lighting Plan).dwg
	1261F132001 (Fire Alarm Plan).dwg	18-11-2019	1261F132001 (Fire Alarm Plan).dwg
	30. Field office #11b		
	1262E101001 (Power Riser & Panel Board Diagram).dwg	18-11-2019	1262E101001 (Power Riser & Panel Board Diagram).dwg
	1262E133001 (Power Feeder Plan).dwg	18-11-2019	1262E133001 (Power Feeder Plan).dwg
	1262E134001 (Lighting Plan).dwg	18-11-2019	1262E134001 (Lighting Plan).dwg
	1262F132001 (Fire Alarm Plan).dwg	18-11-2019	1262F132001 (Fire Alarm Plan).dwg
	31. Main Office		
	1115E104001 (Power riser diagram-1) **dwg files	18-11-2019	1115E104001 (Power riser diagram-1) **dwg files
	1115E104002 (Power riser diagram-2)	18-11-2019	1115E104002 (Power riser diagram-2)
	1115E107001 (Panel board diagram-1)	18-11-2019	1115E107001 (Panel board diagram-1)
	1115E107002 (Panel board diagram-2)	18-11-2019	1115E107002 (Panel board diagram-2)
	1115E107003 (Panel board diagram-3)	18-11-2019	1115E107003 (Panel board diagram-3)
	1115E107004 (Panel board diagram-4)	18-11-2019	1115E107004 (Panel board diagram-4)
	1115E107005 (Panel board diagram-5)	18-11-2019	1115E107005 (Panel board diagram-5)
	1115E132001 (Single line diagram)	18-11-2019	1115E132001 (Single line diagram)
	1115E132002 (Substation power supply plan)	18-11-2019	1115E132002 (Substation power supply plan)
	1115E134001 (B1f lighting plan)	18-11-2019	1115E134001 (B1f lighting plan)
	1115E134002 (1f lighting plan)	18-11-2019	1115E134002 (1f lighting plan)
	1115E134003 (2f lighting plan)	18-11-2019	1115E134003 (2f lighting plan)
	1115E134004 (3f lighting plan)	18-11-2019	1115E134004 (3f lighting plan)
	1115E134005 (4f lighting plan)	18-11-2019	1115E134005 (4f lighting plan)
	1115E134006 (5f lighting plan)	18-11-2019	1115E134006 (5f lighting plan)
	1115E134007 (Ph lighting plan)	18-11-2019	1115E134007 (Ph lighting plan)
	1115F130001 (Fire alarm diagram)	18-11-2019	1115F130001 (Fire alarm diagram)
	1115F132002 (B1f fire alarm plan)	18-11-2019	1115F132002 (B1f fire alarm plan)
	1115F132003 (1f fire alarm plan)	18-11-2019	1115F132003 (1f fire alarm plan)
	1115F132004 (2f fire alarm plan)	18-11-2019	1115F132004 (2f fire alarm plan)
	1115F132005 (3f fire alarm plan)	18-11-2019	1115F132005 (3f fire alarm plan)
	1115F132006 (4f fire alarm plan)	18-11-2019	1115F132006 (4f fire alarm plan)
	1115F132007 (5f fire alarm plan)	18-11-2019	1115F132007 (5f fire alarm plan)
	1115F132008 (Ph fire alarm plan)	18-11-2019	1115F132008 (Ph fire alarm plan)
	1115T104013 (1f cctv plan)	18-11-2019	1115T104013 (1f cctv plan)
	1115T104014 (2f cctv plan)	18-11-2019	1115T104014 (2f cctv plan)
	1115T104015 (3f cctv plan)	18-11-2019	1115T104015 (3f cctv plan)
	1115T104016 (4f cctv plan)	18-11-2019	1115T104016 (4f cctv plan)
	1115T104017 (5f cctv plan)	18-11-2019	1115T104017 (5f cctv plan)
	SINGLE LINE DIAGRAMS		
	Substations		
	Single Line Diagram for Substations - 46 Sheets	23-10-2019	Substation #1-#38 Single Line Diagram
	CCTV DRAWING	23-10-2019	CCTV & Fence Light
	1 sheet		
	FIRE ALARM PLAN		
	Blasting Shop A	23-10-2019	1st Fire Alarm Plan - 1 sheet
	Painting Shop A		1st Fire Alarm Plan - 1 sheet
	Blasting & Painting Shop B		1st Fire Alarm Plan - 1 sheet
	Blasting & Painting Shop C		1st Floor Fire Fighting Piping Plan - 1 sheet
	Blasting & Painting Shop D		1st Floor Fire Fighting Piping Plan - 1 sheet

3.3	Drawings and maintenance records for LV System - Transformers, Generator, LV Switchboards, MCBs, lighting and small power, etc.	**Date Received**	**Document Title**
1	Main Operating Generator Report	11-Oct-19	
		4-Oct-19	
		27-Sep-19	
		20-Sep-19	
		13-Sep-19	
		6-Sep-19	
		30-Aug-19	
		23-Aug-19	
		16-Aug-19	

		9-Aug-19	
		2-Aug-19	
		26-Jul-19	
		18-Jul-19	
		11-Jul-19	
		5-Jul-19	
		28-Jun-19	
		21-Jun-19	
		14-Jun-19	
		7-Jun-19	
		31-May-19	
		24-May-19	
		17-May-19	
2	MTR Checklist	Sept 1, 2019 - Oct 15, 2019	
3	Main Power Station Incoming Power Data	Sept 1, 2019 - Oct 15, 2019	

3.6	Structural drawings and specifications	Date Received	Document Title
1	**Assembly Shop and Shelter**		
	Assembly Shelter - 1st floor framing plan	13-11-2019	1103S102001a-Model
	Assembly Shelter - 1st floor framing plan	13-11-2019	1103S102001-Model
	Main Column Arrangement	13-11-2019	1103S102002-Model
	Sub Column arrangement	13-11-2019	1103S102003-Model
	Gantry Crane framing plan	13-11-2019	1103S102004a-Model
	Crane girder framing plan -1	13-11-2019	1103S102004-Model
	Crane girder framing plan -2	13-11-2019	1103S102005-Model
	Roof framing plan	13-11-2019	1103S102006-Model
	Roof framing plan (bott.)	13-11-2019	1103S102007-Model
	1st floor and roof framing plan	13-11-2019	1103S102009 other-Model
	1st floor and roof framing plan	13-11-2019	1103S102009-Model
	Sub station # 11 : 1st floor framing plan and column arrangement	13-11-2019	1103S102010-Model
	Sub station # 11 : roof framing plan	13-11-2019	1103S102011-Model
	Foundation, Slab and Girder & beam list	13-11-2019	1103S104001-Model
	Gantry foundation list -1	13-11-2019	1103S104002-Model
	Gantry foundation list -2	13-11-2019	1103S104003-Model
	Substation #11: Foundation, Slab, Girder & Beam and Anchor Bolt list	13-11-2019	1103S104004-Model
	Typical detail of foundation @ Y1a & Y1b plans and sections	13-11-2019	1103S104006-Model
	Typical detail of foundation @ Y1a & Y1b plans and sections	13-11-2019	1103S104007-Model
	Typical detail of foundation @ Y1a & Y1b plans and sections	13-11-2019	1103S104007-Model
	Framing elevation - 1	13-11-2019	1103S111001-Model
	Framing elevation - 2	13-11-2019	1103S111002-Model
	Framing elevation - 3	13-11-2019	1103S111003-Model
	Framing elevation - 4	13-11-2019	1103S111004-Model
	Framing elevation - 5	13-11-2019	1103S111005-Model
	Framing elevation - 6 (INT)	13-11-2019	1103S111006-Model
	Framing elevation	13-11-2019	1103S111007-Model
	Framing elevation	13-11-2019	1103S111008-Model
	Sub station # 11 Framing elevation	13-11-2019	1103S111009-Model
	Main section with rebar arrangement	13-11-2019	1103S111010-Model
	Main section with rebar arrangement	13-11-2019	1103S111011-Model
	Main section with rebar arrangement	13-11-2019	1103S111012-Model
	Main section with rebar arrangement	13-11-2019	1103S111013-Model
	Main section with rebar arrangement	13-11-2019	1103S111014-Model
	Main section with rebar arrangement	13-11-2019	1103S111015-Model
	Main section with rebar arrangement	13-11-2019	1103S111016-Model
	Main section with rebar arrangement	13-11-2019	1103S111017-Model
	Main section with rebar arrangement	13-11-2019	1103S111018-Model
	Main section with rebar arrangement	13-11-2019	1103S111019-Model
	Main section with rebar arrangement	13-11-2019	1103S111020-Model
	Base plate detail	13-11-2019	1103S112001-Model
	Detail of storm anchor base Detail of down base	13-11-2019	1103S112002a-Model
	Detail of end stopper	13-11-2019	1103S112002-Model
	Connection detail	13-11-2019	1103S113001-Model
	Connection detail - 1	13-11-2019	1103S113002-Model
	Connection detail - 2	13-11-2019	1103S113003 other1-Model
	Sub station #11: Connection detail - 2	13-11-2019	1103S113003 other2-Model
	Connection detail - 2	13-11-2019	1103S113003-Model
	Sub station #11: Connection detail - 1	13-11-2019	1103S113004-Model
	Sub station #11: Connection detail - 2	13-11-2019	1103S113005-Model
	Sub station #12: Connection detail - 1	13-11-2019	1103S113006-Model
	Main truss List - 1	13-11-2019	1103S114001-Model
	Main truss List - 2	13-11-2019	1103S114002-Model
	Main truss typical joint detail	13-11-2019	1103S114003-Model
	Sub truss framing elevation detail	13-11-2019	1103S114004-Model
	Sub truss typical joint detail	13-11-2019	1103S114005-Model
	Main column detail - 1	13-11-2019	1103S116001-Model
	Main column detail - 2	13-11-2019	1103S116002-Model
	Main column detail - 3	13-11-2019	1103S116003-Model
	Main column detail - 4	13-11-2019	1103S116004-Model
	Main column detail - 5	13-11-2019	1103S116005-Model
	Crane girder list - 1a	13-11-2019	1103S117001a-Model
	Crane girder list - 1	13-11-2019	1103S117001-Model
	Crane girder list - 2	13-11-2019	1103S117002-Model
	Crane girder list - 3	13-11-2019	1103S117003-Model
	Crane girder typical joint detail	13-11-2019	1103S117004-Model
	Crane girder lattice typical joint detail - 1	13-11-2019	1103S117005-Model
	Crane girder lattice typical joint detail - 2	13-11-2019	1103S117006-Model
	Crane girder lattice typical joint detail - 3	13-11-2019	1103S117007-Model
	Sub column & wall bracing detail - 1	13-11-2019	1103S191001-Model
	Sub column & wall bracing detail - 2	13-11-2019	1103S191002-Model
	Sub column & wall bracing detail - 3	13-11-2019	1103S191003-Model
	Sub column & wall bracing detail - 4	13-11-2019	1103S191004-Model
	Wall bracing typical joint detail - 1	13-11-2019	1103S191005-Model
	Wall bracing typical joint detail - 2	13-11-2019	1103S191006-Model
	Sub column partial detail	13-11-2019	1103S191007A-Model
	Sub column partial detail	13-11-2019	1103S191007-Model
	Roof framing plan detail - 1	13-11-2019	1103S191008-Model
	Roof framing plan detail - 2	13-11-2019	1103S191009-Model
	Roof bracing typical joint detail	13-11-2019	1103S191010-Model
	Horiz. Lattice framing plan detail	13-11-2019	1103S191011-Model
	Horiz. Lattice typical joint detail	13-11-2019	1103S191012-Model
	Ventilator grill detail	13-11-2019	1103S191013-Model
2	**Gas(fuel) Station**		
	Partial site plan & building summary	13-11-2019	1134A101001-Model
	Pit & oil tank plan	13-11-2019	1134A103001-Model
	1st floor and roof plan	13-11-2019	1134A103002-Model
	Elevation - front, rear, left, right	13-11-2019	1134A104001-Model
	Plan, section & detail (large)	13-11-2019	1134A105001a-Model
	Plan, section & detail (small)	13-11-2019	1134A105001b-Model
	Lubricator plan Lubricator pit opening frame section	13-11-2019	1134A105001c-Model
	Section 6	13-11-2019	1134A105001d-Model
	Section	13-11-2019	1134A105001e-Model
	Section 1, 2 & 3	13-11-2019	1134A105001-Model
	Door and window sched	13-11-2019	1134A112001-Model
3	**Hull Shop A**		
	1st floor framing plan	13-11-2019	1102S102001-Model
	Main column arrangement	13-11-2019	1102S102002-Model
	Sub column arrangement	13-11-2019	1102S102003-Model
	Crane girder framing plan - 1a	13-11-2019	1102S102005a-Model
	Crane girder framing plan - 1a	13-11-2019	1102S102005b other-Model
	Crane girder framing plan - 1a	13-11-2019	1102S102005b-Model
	Crane girder framing plan - 1	13-11-2019	1102S102005-Model
	Crane girder framing plan - 2	13-11-2019	1102S102006-Model
	Lower roof framing plan (Top)	13-11-2019	1102S102007-Model

	Lower roof framing plan (Bottom)	13-11-2019	1102S102008-Model
	High roof framing plan (Top)	13-11-2019	1102S102009-Model
	High roof framing plan (Bottom)	13-11-2019	1102S102010-Model
	Wooden pattern & sub station #14: 1st floor framing plan	13-11-2019	1102S102011-Model
	Wooden pattern & sub station #14: Column arrangement	13-11-2019	1102S102012-Model
	Wooden pattern & sub station #14: Roof framing plan	13-11-2019	1102S102013-Model
	Sub station # 15: 1st floor framing plans & column arrangement	13-11-2019	1102S102014-Model
	Foundation & slab & pedestal & girder list	13-11-2019	1102S104001-Model
	gantry foundation list	13-11-2019	1102S104002-Model
	girder, beam & slab list	13-11-2019	1102S104003-Model
	Wooden pattern & sub station #14: found. & girder, slab & anchor list	13-11-2019	1102S104004-Model
	Sub station #15: found. & girder, slab & anchor list	13-11-2019	1102S104005-Model
	Press bender found. list - 1	13-11-2019	1102S104006-Model
	Press bender found. list - 2	13-11-2019	1102S104007-Model
	Enlarged plan - 1	13-11-2019	1102S104008-Model
	Enlarged plan - 2	13-11-2019	1102S104009-Model
	Enlarged plan - 3	13-11-2019	1102S104010-Model
	Enlarged plan - 4	13-11-2019	1102S104011-Model
	Detail - Partial Section	13-11-2019	1102S104012-Model
	Detail - Partial Plan & Section - 1	13-11-2019	1102S104013-Model
	Detail - Partial Plan & Section - 2	13-11-2019	1102S104014-Model
	Detail - Partial Plan & Section - 3	13-11-2019	1102S104015-Model
	Detail - Partial Section - 1	13-11-2019	1102S104016-Model
	Detail - Partial Section - 2	13-11-2019	1102S104017-Model
	Detail - Partial Section - 3	13-11-2019	1102S104018-Model
	Detail - Partial Section - 4	13-11-2019	1102S104019-Model
	Detail - Partial Section - 5	13-11-2019	1102S104020-Model
	Framing elevation - 1	13-11-2019	1102S111001-Model
	Framing elevation - 2	13-11-2019	1102S111002-Model
	Framing elevation - 3	13-11-2019	1102S111003-Model
	Framing elevation - 4	13-11-2019	1102S111004-Model
	Framing elevation - 5	13-11-2019	1102S111005-Model
	Framing elevation - 6	13-11-2019	1102S111006-Model
	Framing elevation - 7	13-11-2019	1102S111007-Model
	Framing elevation - 8	13-11-2019	1102S111008-Model
	Framing elevation - 9	13-11-2019	1102S111009-Model
	Framing elevation - 10 (INT)	13-11-2019	1102S111010-Model
	Framing elevation - 11 (INT)	13-11-2019	1102S111011-Model
	Wooden pattern & sub station #14: Framing elevation	13-11-2019	1102S111012-Model
	Sub station #15: Framing elevation	13-11-2019	1102S111013-Model
	Base plate detail - 1	13-11-2019	1102S112001-Model
	Base plate detail - 3	13-11-2019	1102S112002a-Model
	Base plate detail - 2	13-11-2019	1102S112002-Model
	Connection Detail	13-11-2019	1102S113001-Model
	Wooden pattern & sub station #14: Connection detail - 1	13-11-2019	1102S113002-Model
	Wooden pattern & sub station #14: Connection detail - 2	13-11-2019	1102S113003-Model
	Sub station #15: Connection detail - 1	13-11-2019	1102S113004-Model
	Sub station #15: Connection detail - 2	13-11-2019	1102S113005-Model
	Main truss list	13-11-2019	1102S114001a-Model
	Main truss list - 1	13-11-2019	1102S114001-Model
	Main truss list - 2	13-11-2019	1102S114002-Model
	Main truss list - 3	13-11-2019	1102S114003-Model
	Main truss list - 4	13-11-2019	1102S114004-Model
	Main truss list - 5	13-11-2019	1102S114005-Model
	Main truss list - 6	13-11-2019	1102S114006-Model
	Main truss list - 7	13-11-2019	1102S114007-Model
	Main truss list - 8	13-11-2019	1102S114008-Model
	Main truss list - 9	13-11-2019	1102S114009-Model
	Main truss list - 10	13-11-2019	1102S114010-Model
	Main truss list - 11	13-11-2019	1102S114011-Model
	Main truss typical joint detail - 1	13-11-2019	1102S114012-Model
	Main truss typical joint detail - 2	13-11-2019	1102S114013-Model
	Main truss typical joint detail - 3	13-11-2019	1102S114014-Model
	Cable tray connection reinforcement detail	13-11-2019	1102S114015a-Model
	Sub truss framing elevation detail	13-11-2019	1102S114015-Model
	Cable tray connection detail	13-11-2019	1102S114016a-Model
	Cable tray connection biometric detail	13-11-2019	1102S114016b-Model
	Sub truss typical joint detail	13-11-2019	1102S114016-Model
	Main column detail - 1	13-11-2019	1102S116001-Model
	Main column detail - 2	13-11-2019	1102S116002-Model
	Main column detail - 3	13-11-2019	1102S116003-Model
	Main column detail - 4	13-11-2019	1102S116004-Model
	Main column detail - 5	13-11-2019	1102S116005-Model
	Main column detail - 6	13-11-2019	1102S116006-Model
	Main column detail - 7	13-11-2019	1102S116007-Model
	Main column detail - 8	13-11-2019	1102S116008-Model
	Main column detail - 9	13-11-2019	1102S116009-Model
	Main column detail - 10	13-11-2019	1102S116010-Model
	Main column detail - 11	13-11-2019	1102S116011-Model
	Main column detail - 12	13-11-2019	1102S116012-Model
	Main column detail - 13	13-11-2019	1102S116013-Model
	Main column detail - 14	13-11-2019	1102S116014-Model
	Main column detail - 15	13-11-2019	1102S116015-Model
	Main column detail - 16	13-11-2019	1102S116016-Model
	Main column detail - 18	13-11-2019	1102S116017a-Model
	Main column detail - 19	13-11-2019	1102S116017b-Model
	Main column detail - 20	13-11-2019	1102S116017c-Model
	Main column detail - 21	13-11-2019	1102S116017d-Model
	Main column detail - 22	13-11-2019	1102S116017e-Model
	Main column detail - 23	13-11-2019	1102S116017f-Model
	Main column detail - 24	13-11-2019	1102S116017g-Model
	Main column detail - 17	13-11-2019	1102S116017-Model
	Crane girder list -1	13-11-2019	1102S117001-Model
	Crane girder list -2	13-11-2019	1102S117002-Model
	Crane girder list -3	13-11-2019	1102S117003-Model
	Crane girder list -4	13-11-2019	1102S117004-Model
	Crane girder list -5	13-11-2019	1102S117005-Model
	Crane girder list -6	13-11-2019	1102S117006-Model
	Crane girder list -7	13-11-2019	1102S117007-Model
	Crane girder list -8	13-11-2019	1102S117008-Model
	Crane girder list -9	13-11-2019	1102S117009-Model
	Crane girder list -11	13-11-2019	1102S117010a-Model
	Crane girder list -12	13-11-2019	1102S117010b-Model
	Crane girder list -13	13-11-2019	1102S117010c-Model
	Crane girder list -14	13-11-2019	1102S117010d-Model
	Crane girder list -15	13-11-2019	1102S117010e-Model
	Crane girder list -16	13-11-2019	1102S117010f-Model
	Crane girder list -17	13-11-2019	1102S117010g-Model
	Crane girder list -18	13-11-2019	1102S117010h-Model
	Crane girder list -19	13-11-2019	1102S117010i-Model
	Crane girder list -20	13-11-2019	1102S117010j-Model
	MGT1 Truss & WT1 List	13-11-2019	1102S117010k-Model
	Crane girder list -10	13-11-2019	1102S117010-Model
	Crane girder typical joint detail	13-11-2019	1102S117011-Model
	Crane girder lattice typical joint detail -1	13-11-2019	1102S117012-Model
	Crane girder lattice typical joint detail -2	13-11-2019	1102S117013-Model
	Crane girder lattice typical joint detail -3	13-11-2019	1102S117014-Model
	Crane girder lattice typical joint detail -5	13-11-2019	1102S117015a-Model
	Crane girder lattice typical joint detail -6	13-11-2019	1102S117015b-Model
	Crane girder lattice typical joint detail -4	13-11-2019	1102S117015-Model
	Sub col. & wall bracing detail -1	13-11-2019	1102S191001-Model
	Sub col. & wall bracing detail -2	13-11-2019	1102S191002-Model
	Sub col. & wall bracing detail -3	13-11-2019	1102S191003-Model
	Sub col. & wall bracing detail -4	13-11-2019	1102S191004-Model
	Sub col. & wall bracing detail -5	13-11-2019	1102S191005-Model
	Sub col. & wall bracing detail -6	13-11-2019	1102S191006-Model
	Sub col. & wall bracing detail -7	13-11-2019	1102S191007-Model

	Sub col. & wall bracing detail -8	13-11-2019	1102S191008-Model
	Sub col. & wall bracing detail -9	13-11-2019	1102S191009-Model
	Sub col. & wall bracing detail -10	13-11-2019	1102S191009-Model
	Sub col. & wall bracing detail -11	13-11-2019	1102S191011-Model
	Sub col. & wall bracing detail -12	13-11-2019	1102S191012-Model
	Sub col. & wall bracing detail -13a	13-11-2019	1102S191013a-Model
	Sub col. & wall bracing detail -13	13-11-2019	1102S191013-Model
	Sub col. & wall bracing detail -14	13-11-2019	1102S191014-Model
	Sub col. & wall bracing detail -15	13-11-2019	1102S191015-Model
	Sub col. & wall bracing detail -16	13-11-2019	1102S191016-Model
	Sub col. & wall bracing detail -17	13-11-2019	1102S191017-Model
	Sub col. & wall bracing detail -18	13-11-2019	1102S191018-Model
	Wall bracing typical joint detail -1	13-11-2019	1102S191019-Model
	Wall bracing typical joint detail -2	13-11-2019	1102S191020-Model
	Sub column partial detail	13-11-2019	1102S191021-Model
	Roof framing plan detail - 1	13-11-2019	1102S191022-Model
	Roof framing plan detail - 2	13-11-2019	1102S191023-Model
	Roof framing plan detail - 3	13-11-2019	1102S191024-Model
	Roof framing plan detail - 4	13-11-2019	1102S191025-Model
	Roof framing plan detail - 5	13-11-2019	1102S191026-Model
	Roof framing plan detail - 6	13-11-2019	1102S191027-Model
	Roof framing plan detail - 7	13-11-2019	1102S191028-Model
	Roof framing plan detail - 8	13-11-2019	1102S191029-Model
	Roof framing plan detail - 9	13-11-2019	1102S191030-Model
	Roof framing plan detail - 10	13-11-2019	1102S191031-Model
	Lower roof framing plan (top)	13-11-2019	1102S191032a-Model
	Lower roof framing plan (top)	13-11-2019	1102S191032b-Model
	Roof framing plan detail - 11	13-11-2019	1102S191032-Model
	Roof bracing typical joint detail	13-11-2019	1102S191033-Model
	Horiz. Lattice framing plan detail	13-11-2019	1102S191034-Model
	horiz lattice typical joint detail	13-11-2019	1102S191035-Model
	Ventilator grill detail	13-11-2019	1102S191036-Model
	WT1 & Hangar door canopy frame detail	13-11-2019	1102S191037-Model
	Exterior Stair detail (X8-X9)	13-11-2019	1102S191039a-Model
	Exterior Stair detail (X8-X9)	13-11-2019	1102S191039-Model
4	**Pre-Outfitting Shop A**		
	Drawing list - 2	13-11-2019	1100S100002-Model
	1st floor framing plan	13-11-2019	1105S102001-Model
	Column Arrangement	13-11-2019	1105S102002-Model
	Crane girder framing plan	13-11-2019	1105S102003-Model
	Roof framing plan	13-11-2019	1105S102004-Model
	Foundation & pedestal & girder & slab list	13-11-2019	1105S104001-Model
	Framing elevation - 1	13-11-2019	1105S111001-Model
	Framing elevation - 2	13-11-2019	1105S111002-Model
	Anchor bolt list	13-11-2019	1105S112001-Model
	Connection detail -1	13-11-2019	1105S113001-Model
	Connection detail -2	13-11-2019	1105S113002-Model
	Connection detail -3	13-11-2019	1105S113003-Model
	Crane girder list	13-11-2019	1105S117001-Model
	Crane girder joint detail	13-11-2019	1105S117002-Model
	Crane girder lattice typical joint detail	13-11-2019	1105S117003-Model
5	**Pre-Treatment Shop A**		
	1st floor framing plan & column arrangement	13-11-2019	1101S102001-Model
	Control room framing plan & Crane girder & Roof (Lower) Framing Plan	13-11-2019	1101S102002-Model
	Roof (High) Framing Plan & Ventilator grill framing plan	13-11-2019	1101S102003-Model
	Framing Plan & Elevation	13-11-2019	1101S102004-Model
	Foundation & Girder & Slab list	13-11-2019	1101S104001-Model
	Pedestal Column list	13-11-2019	1101S104002-Model
	Foundation & Slab & Column & Girder & Beam list	13-11-2019	1101S104003-Model
	Shot M/C Foundation Plan -1	13-11-2019	1101S104004-Model
	Shot M/C Foundation Plan -2	13-11-2019	1101S104005-Model
	Shot M/C Foundation Plan -3	13-11-2019	1101S104006-Model
	Framing Elevation -1	13-11-2019	1101S111001-Model
	Framing Elevation -2	13-11-2019	1101S111002-Model
	Anchor Bolt List	13-11-2019	1101S112001-Model
	Connection Detail - 1	13-11-2019	1101S113001-Model
	Connection Detail - 2	13-11-2019	1101S113002-Model
	ET1 Eave Truss & Lattice typical joint detail	13-11-2019	1101S113003a-Model
	Connection Detail - 3	13-11-2019	1101S113003-Model
	Crane girder list & lattice typical joint detail	13-11-2019	1101S117001-Model
	Crane girder joint detail	13-11-2019	1101S117002-Model
6	**Sub-Assembly Shop A**		
	Drawing list	13-11-2019	1204S100001-Model
	1st floor framing plan	13-11-2019	1204S102001-Model
	Main column arrangement	13-11-2019	1204S102002-Model
	Sub column arrangement	13-11-2019	1204S102003-Model
	Crane Girder Framing Plan - 1	13-11-2019	1204S102004-Model
	Crane Girder Framing Plan -2	13-11-2019	1204S102005-Model
	Roof framing plan	13-11-2019	1204S102006-Model
	Sub station #12 - 1, 1st floor framing plan & Column arrangement	13-11-2019	1204S102007-Model
	Sub station #12 - 1, Roof framing plan	13-11-2019	1204S102008-Model
	Foundation & Slab & Pedestal & Girder List	13-11-2019	1204S104001-Model
	Sub station #12 - 1, Foundation & Girder, Slab & Anchor Bolt list	13-11-2019	1204S104002-Model
	Framing Elevation - 1	13-11-2019	1204S111001-Model
	Framing Elevation - 2	13-11-2019	1204S111002-Model
	Framing Elevation - 3	13-11-2019	1204S111003-Model
	Framing Elevation - 4	13-11-2019	1204S111004-Model
	Roof framing plan	13-11-2019	1204S111005-Model
	Base Plate Detail	13-11-2019	1204S112001-Model
	Connection Detail -1	13-11-2019	1204S113001-Model
	Sub station #12 - 1, Connection Detail -1	13-11-2019	1204S113002-Model
	Sub station #12 - 1, Connection Detail -2	13-11-2019	1204S113003-Model
	Main column detail -1	13-11-2019	1204S116001-Model
	Main column detail -2	13-11-2019	1204S116002-Model
	Main column detail -3	13-11-2019	1204S116003-Model
	Main column detail -4	13-11-2019	1204S116004-Model
	Main column detail -5	13-11-2019	1204S116005-Model
	Crane girder list -1	13-11-2019	1204S117001-Model
	Crane girder list -2	13-11-2019	1204S117002-Model
	Crane girder list -3	13-11-2019	1204S117003-Model
	Crane girder list -4	13-11-2019	1204S117004-Model
	Crane girder list -5	13-11-2019	1204S117005-Model
	Crane grider typical joint detail	13-11-2019	1204S117006-Model
	Crane girder lattice typical joint detail	13-11-2019	1204S117007-Model
	Sub column & Wall bracing detail -1	13-11-2019	1204S191001-Model
	Sub column & Wall bracing detail -2	13-11-2019	1204S191002-Model
	Sub column & Wall bracing detail -3	13-11-2019	1204S191003-Model
	Sub column & Wall bracing detail -5	13-11-2019	1204S191004a-Model
	Sub column & Wall bracing detail -4	13-11-2019	1204S191004-Model
	Wall bracing typical joint detail	13-11-2019	1204S191005-Model
	Sub column partial detail	13-11-2019	1204S191006-Model
	Roof framing detail -1	13-11-2019	1204S191007-Model
	Roof framing detail -2	13-11-2019	1204S191008-Model
	Roof bracing typical joint detail	13-11-2019	1204S191009-Model
	Horiz. Lattice Framing Plan Detail	13-11-2019	1204S191010-Model
	Side Wall Frame Detail	13-11-2019	1204S191011a-Model
	Wind Truss Framing Plan Detail - 1	13-11-2019	1204S191011b-Model
	Wind Truss Framing Plan Detail - 2	13-11-2019	1204S191011c-Model
	Wind truss joint detail	13-11-2019	1204S191011d-Model
	Horiz. Lattice Tyical Joint Detail	13-11-2019	1204S191011-Model
6	**Assembly Shop E**	26-11-2019	Structural Drawings and calculations

3.6	Structural drawings and specifications	**Date Received**	**Document Title**
1	Pavement Detail Summary	23-Oct-19	Includes pavement designation no. and the corresponding phase, drawing no., location, area, thickness, concrete strength, supporting layer and reinforcement

3.8	Utilities (power, gas, water) distribution layout plan	Date Received	Document Title
1	**Plumbing**		
	A FINAL(20111125).dwg	18-11-2019	A FINAL(20111125).dwg
	B(20120229).dwg	18-11-2019	B(20120229).dwg
	Barracks PLUMBING.dwg	18-11-2019	Barracks PLUMBING.dwg
	C FINAL(20111126).dwg	18-11-2019	C FINAL(20111126).dwg
	D FINAL(20111128).dwg	18-11-2019	D FINAL(20111128).dwg
	E FINAL(20111128).dwg	18-11-2019	E FINAL(20111128).dwg
	F(20120202).dwg	18-11-2019	F(20120202).dwg
	G1.dwg	18-11-2019	G1.dwg
	K1&K2(20120125).dwg	18-11-2019	K1&K2(20120125).dwg
	K3(20120124).dwg	18-11-2019	K3(20120124).dwg
	k4 (20120124).dwg	18-11-2019	k4 (20120124).dwg
	Pump stations and manhole	18-11-2019	Pump stations and manhole
	Pump Stations	18-11-2019	Pump Stations
	ROMANIAN,WELFARE.dwg	18-11-2019	ROMANIAN,WELFARE.dwg
	VIP(20120304).bak	18-11-2019	VIP(20120304).bak
	VIP(20120304).dwg	18-11-2019	VIP(20120304).dwg
	YARD TOILETS MAP	18-11-2019	YARD TOILETS MAP
2	**Utility**		
	Air utility pipeline lay-out.dwg	18-11-2019	Air utility pipeline lay-out.dwg
	CO2 utility pipeline lay-out.dwg	18-11-2019	CO2 utility pipeline lay-out.dwg
	FEX water pipeline lay-out.dwg	18-11-2019	FEX water pipeline lay-out.dwg
	Industrial water lay-out.dwg	18-11-2019	Industrial water lay-out.dwg
	Living water lay-out.dwg	18-11-2019	Living water lay-out.dwg
	LPG utility lay-out.dwg	18-11-2019	LPG utility lay-out.dwg
	O2 utility pipeline lay-out.dwg	18-11-2019	O2 utility pipeline lay-out.dwg
	UNDERGROUND LAY OUT each gas.dwg	18-11-2019	UNDERGROUND LAY OUT each gas.dwg
	Utility lay-out(all gases).dwg	18-11-2019	Utility lay-out(all gases).dwg
	utility pipeline lay-out.dwg	18-11-2019	utility pipeline lay-out.dwg

4.1	Asset List (including date of installation & capacity)	Date Received	Document Title
	Substation Equipment and Facility Checklist 19Sept2018	18-11-2019	Substation Equipment and Facility Checklist 19Sept2018

4.2	Copy of Certificates for authority recognition of quality water, quality air, energy efficiency. (Air Emissions, Exhaust)	Date Received	Document Title
1	DISCHARGE PERMIT_R03-19-00994	21-10-2019	DISCHARGE PERMIT_R03-19-00994
2	ECC SHIPBUILDING (AM1)_R03-1302-0067	21-10-2019	ECC SHIPBUILDING (AM1)_R03-1302-0067
3	ECC SHIPBUILDING_R03-1302-0067	21-10-2019	ECC SHIPBUILDING_R03-1302-0067
4	ECC TERMINAL FACILITY_R03-1302-0065	21-10-2019	ECC TERMINAL FACILITY_R03-1302-0065
5	HAZ WASTE GENERATOR (AMENDED)_GR-R3-71-00078	21-10-2019	PERMIT TO OPERATE (AIR)_POA-19B-03ZA-885
6	STP Wastewater Discharge Permit	23-10-2019	Wastewater Discharge Permit - Permit No. DP-R03-19-00994

4.3	Technical Due Diligence Reports (Due to April 2019 Earthquake)	Date Received	Document Title
1	Pictures Rain Water Leak at Shelter, Shop or Bay Report	23-10-2019	Assessment Report for Shop/Bay Water Leak due to Rainy Days
2	Pictures Report of Property Damages Earthquake	23-10-2019	Property Damages from March 22nd, 2019 Earthquake
3	Summary of Damage Report (APRIL 2019)	23-10-2019	Summary of Damage Report Subic Shipyard (OCT. 7,2019)

4.4	Permit to Operate Records	Date Received	Document Title
	PRESSURE VESSELL CERTIFICATES		
	Air Receiver Tank - 16 Certificates	23-10-2019	Certifiate of Inspection
	LPG Storage Tank - 1 Certificate	23-10-2019	Certifiate of Inspection
	Liquid CO_2 Storage Tank - 9 Certificates	23-10-2019	Certifiate of Inspection
	Liquid O_2 Storage Tank - 3 Certificates	23-10-2019	Certifiate of Inspection
	Liquid C_2H_4 Storage Tank - 3 Certificates	23-10-2019	Certifiate of Inspection

5.3	Details of license/consent agreements: Effluent Discharges, Air Emissions	Date Received	Document Title
1	DISCHARGE PERMIT_R03-19-00994 (similar 4.2)	21-10-2019	DISCHARGE PERMIT_R03-19-00994 (similar 4.2)

5.8	Inventory of Waste Material, Chemicals, Solvents, oils	Date Received	Document Title
1	Hazardous Waste Inventory	21-10-2019	Hazardous Waste Inventory

5.9	Details of Waste Disposal License	Date Received	Document Title
1	Certificate of Disposal for Residual Waste Landfill	21-10-2019	Certificate of Disposal for Residual Waste Landfill
2	Certificate of Treatment for Diesel with Water	21-10-2019	Certificate of Treatment for Diesel with Water
3	Transporter Registration Certificate	21-10-2019	Third Party Hazardous Waste Compliance Certificate
4	Environmental Compliance Certificate	21-10-2019	Third Party Landfill Compliance Certificate
5	Permit to Transport	21-10-2019	Third Party Permit to Transport Compliance Certificate
6	Residual and Recycling Compliance Certificate	21-10-2019	Third Party Residual and Recycling Compliance Certificate
7	Scrap Materials Compliance Certificate	21-10-2019	Third Party Scrap Materials Compliance Certificate
8	Treatment Storage and Disposal Compliance Certificate	21-10-2019	Third Party Treatment Storage and Disposal Compliance Certificate

7.6	All UST and AST sizes and contents (the current sheet I have excludes some Diesel ASTs)	Date Received	Document Title
Storage tank drawings			
	CO2 storage tank 1n2	14-11-2019	CO2 storage tank 1n2
	CO2 storage tank 3n4	14-11-2019	CO2 storage tank 3n4
	CO2 storage tank 5 6 7	14-11-2019	CO2 storage tank 5 6 7
	Compressor Air receiver tank	14-11-2019	Compressor Air receiver tank
	Ethylene storage tank 1	14-11-2019	Ethylene storage tank 1
	Ethylene storage tank 2	14-11-2019	Ethylene storage tank 2
	Ethylene storage tank 3	14-11-2019	Ethylene storage tank 3
	LPG storage tank 1n2	14-11-2019	LPG storage tank 1n2
	Oxygen storage tank 1n2	14-11-2019	Oxygen storage tank 1n2
	Oxygen storage tank 3	14-11-2019	Oxygen storage tank 3

7.7	Flow of Galvanizing waste water and treatment (their process shows a wash water treatment facility, but it doesn't show where that water is ending)	Date Received	Document Title
1	Hazardous Working HAULING DOCS SAMPLE	13-11-2019	Hazardous Working HAULING DOCS SAMPLE
2	Hazardous WORKING PROCESS	13-11-2019	Hazardous WORKING PROCESS
3	SCRAP GARBAGE WORKING PROCESS	13-11-2019	SCRAP GARBAGE WORKING PROCESS

ANNEX I

Environmental Impact Assessment (performed in 2005)

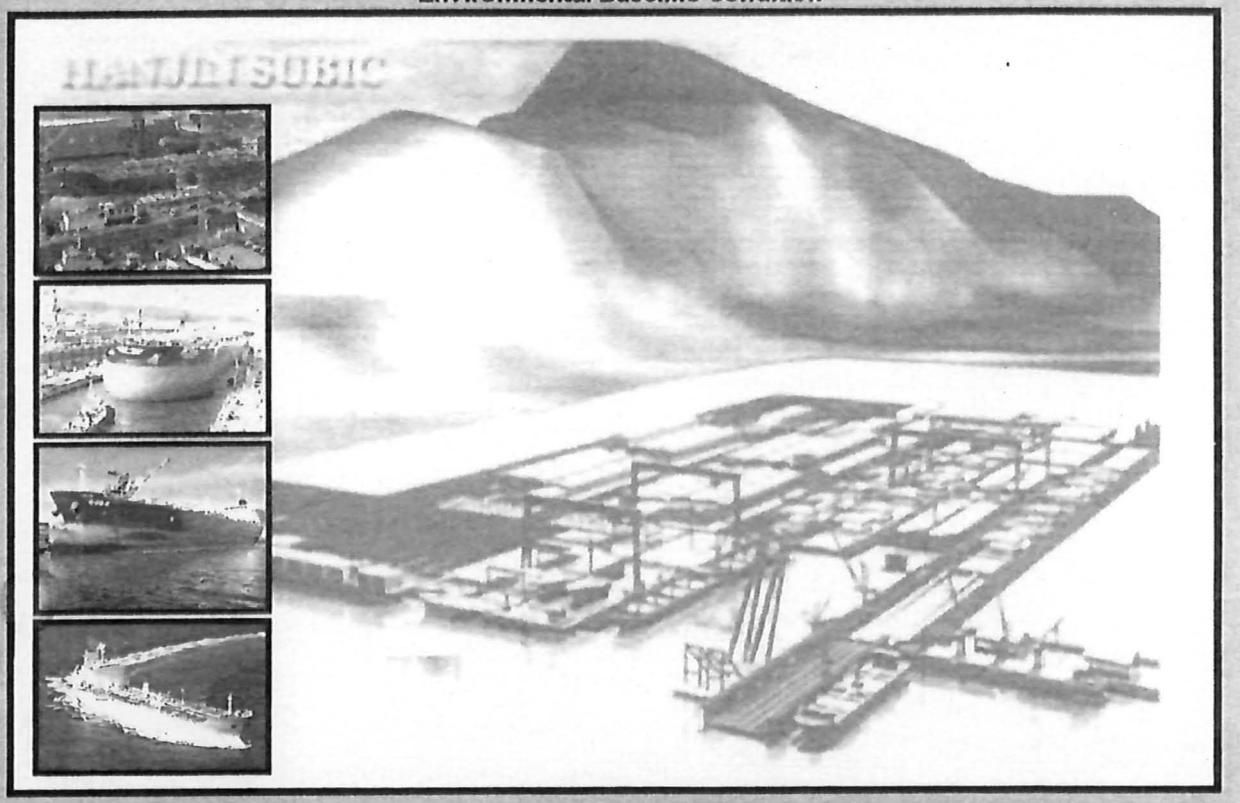
FINAL REPORT
(Revised)

ENVIRONMENTAL IMPACT STATEMENT OF THE PROPOSED HANJIN SUBIC PROJECT- SHIPBUILDING FACILITY

SITIO AGUSUHIN, REDONDO PENINSULA BRGY. CAWAG, SUBIC, ZAMBALES

VOLUME 1

Executive Summary, Introduction, Project Description, Environmental Baseline Condition



Prepared For:

HHIC-PHIL INC.
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SUBIC PROJECT
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Prepared By:

KULTURA AT KALIKASAN CONSULTANCY SERVICES
LG-32 City Square Condo., Estacion St., Makati City
NSD Compound Subic Bay Freeport Zone, Subic, Zambales

November 2005

CNG0432W5C/PPA1990309/[20191122-09:29:25]

EXECUTIVE SUMMARY

1. PROJECT BACKGROUND

1.1 PROPONENT DETAILS

Project Name	:	HHIC- Phil Inc. Subic Project - Shipbuilding Facility
Project Location	:	Green Beach, Subic Bay Freeport Zone (Sitio Agusuhin, Redondo Peninsula, Brgy. Cawag, Subic, Zambales)
Proponent	:	Hanjin Heavy Industries & Construction – Phil Inc. 2nd Floor, Eurovila Condo.I, Legaspi cor. V.A. Rufino Sts. Legaspi Village, Makati City
Contact Nos.	:	Telephone Nos.: 02-893-2063 to 64 (Manila Office); 047-252-5602 (Site Office) Fax Numbers: 02-8189366 (Manila Office); 047-252-3977 (Site Office)
Contact Persons	:	Byung Woo Ko Project Manager Kwang Ho Kang Chief Engineer, Construction Department Pyeong Yeol Lee Chief Engineer, Shipbuilding Department
Consultant	:	Kultura at Kalikasan Consultancy Services, Inc. LG-32 City Square Condominium, Estacion St., Makati City (Manila Office) (Site Office: NSD Compound, Subic Bay Freeport Zone) Telefax No.: 02-750-1990 Tel. No.:02-458-7192
Contact Person	:	Melchor L. Aguilera, Jr. Managing Director

1.2 THE PROJECT

The proposed shipbuilding facility project is considered as one of the biggest current foreign investment in the country with a total investment of US$ 800 million. The project aims to establish a state-of-the-art shipbuilding facility to further expand its operations outside of South Korea. It is estimated that a total of 18 large ocean-going ships with state-of-the-art automation system will be built annually. The project being the biggest shipbuilding facility will help boost the economy of the country with the employment and revenues that will be generated by the project.

Construction activities will involve earth-moving and leveling activities of the elevated areas of the northern side of the project site. An estimated volume of 1.16 million cubic meters of earth from this area will be used for the reclamation and filling of the existing ponds in the community. Other construction activities will also include dredging, excavation, reclamation and sheet piling.

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2. THE EIA APPROACH AND METHODOLOGY

2.1 THE EIA PROCESS

The scope of the study includes the assessment of the probable impacts of the proposed shipbuilding facility on the land, water, air and noise environments of the study area and perception and acceptability of the project by the stakeholders and recommendation for the mitigation of the perceived adverse impacts and enhancement of the positive effects. Primary and secondary data were gathered during surveys conducted from September 16 to October 09, 2005. In the process both positive and negative impacts were dealt with.

Baseline data on air, noise, soil, water and sediment quality, terrestrial ecology and freshwater and marine ecology within the project site and its vicinity were obtained through appropriate sampling techniques from September 21 to 25, 2005. Air quality samples were sent to Ostrea Mineral Laboratory in Biñan, Laguna, while the water and sediment samples were sent to CRL Environmental Corporation in Clarkfield, Angeles City, Pampanga. Water resources investigation consisted of well inventory and reconnaissance survey of surface and groundwater regimes.

Perception survey of the impact areas were conducted from 16-18 September 2005. The survey used a 38-item questionnaire. Secondary data were obtained from government and private agencies (*e.g.* PAGASA on climate, National Statistics Office and the Municipal Office for municipal profiles, etc.). For each project activity, the impacts were identified and/or predicted, and mitigating measures with the corresponding cost were identified. These are presented in the matrix form of the Environmental Management Plan (EMP). The Environmental Monitoring Program (EMP) has been prepared that details the parameters and frequency to be monitored to determine compliance to the environmental standards.

2.2 PARTICIPATION OF STAKEHOLDERS IN THE EIA STUDY

Active representation and participation from stakeholders in the municipality was gained during the scoping meeting held on 08 October 2005, which allowed stakeholders to raise issues of local importance to the EIA study. Focus Group Discussions (FGDs) with three Sitio Agusuhin peoples' organizations were held on 08 – 09 October 2005.

Assistance from the residents of Sitio Agusuhin was engaged during the data gathering process, particularly for the terrestrial, river and marine ecology and socio-economic sections of the EIA study.

2.3 THE EIA TEAM

The EIA Team is composed of multi-disciplinary experts whose tasks area follows:

Key Personnel	**Responsibilities/Fields of Expertise**
Melchor L. Aguilera, Jr.	Project Director and Overall Coordinator
Ruben A. Estudillo	Project Manager and Team Leader: Aquatic-Marine Ecology, Water and Sediment Quality
Anacleto Q. Suelto, Jr.	Deputy Project Manager and Team Leader: Geology, Hydrology and Hydrogeology

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Rolando T. Soncuya	Team Leader/Socio-Cultural and Economic and Political Aspects, Public Consultation and Social Acceptability
Benjamin U. Garcia	Team Leader: Terrestrial Ecology- Vegetation and Wildlife Flora and Fauna
Alexander T. Guintu	Environmental Risk Assessment
Dr. Daphne D. Bate	Health Risk Assessment
Jesus V. Lorenzo	Meteorology & Air Quality and Noise
Paul Rivera, Ph.D.	Oceanography
Angelito I. David	Waste Management

3. BASELINE ENVIRONMENTAL CONDITIONS

3.1 PHYSICO-CHEMICAL ENVIRONMENT

3.1.1 Geology

The project site is underlain by recent alluvial deposits overlying an igneous (gabbro) bedrock. The alluvial deposits consist primarily of alternating sand and gravel layers with intercalations of silt and clay typical of alluvial sediments. These materials were transported and laid by the Agusuhin River and gradually grades with littoral deposits towards the Subic Bay shoreline as shown by coralline sands and associated mud and shell fragments encountered in some boreholes near the bay. Thickness of the alluvial deposits, based on geotechnical boreholes is from 3.5 m to more than 44 m. The current shoreline has been drastically changed by pyroclastic material from Pinatubo Volcano by fluvial transport. Most of the surface cover of the area is of the same material forming a thin layer a few centimeters thick. Local structures in the vicinity of the project area from Mines and Geosciences quadrangle geologic map consist predominantly of N-S, steeply dipping layers of the cumulate sequence of gabbro and peridotites. The nearest major structure in the project area is the offshore continuation of Subic Bay Fault, based on the geology of the islands in Subic Bay, is west of Pequeña and Mayanga Islands and east of Grande and Maricha Islands. The Subic Bay Fault, at its nearest approach, is about 2 km east of the project area.

3.1.2 Natural Hazards

The proposed project site is susceptible to seismic, volcanic hazards, typhoons and storm surges, and flooding.

Of the known major tectonic structures in the region, the nearest earthquake generator to the project site is the offshore extension of the Subic Bay Fault which is approximately two kilometers east of the project site.

Despite the apparent liquefaction proneness of the project site, there are no historical accounts, which we are aware of its occurrence in the area. An assessment of liquefaction potential of the project area was performed by Geoscience Technologies Inc. Saturated sandy layers within 20 meters from ground surface and the groundwater table within 10 meters from the ground surface, and with D_{50} values on the grain size accumulation curve between 0.02 and 2.0 mm, should be considered vulnerable to liquefaction.

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The project "Mapping Philippine Vulnerability to Environmental Disasters" classified the area as no present risk to earthquake-induced shallow landslides.

The western coast of the Bataan Peninsula has been known as a tsunami prone area. The earliest recorded tsunamigenic earthquake in this area occurred in December 7, 1677 (NOAA / NESDIS / National Geophysical Data Center / World Data Center) and generated a magnitude and intensity 1 tsunami. Based on the work of Uy and Punzalan (1984), this tsunami, with a height of at most 5 m, impinged on the western coast of the Bataan Peninsula. However, it was not able to penetrate into Subic Bay.

Numerous earthquakes occur in the vicinity of Subic Bay. These are typically generated along the Manila Trench to the west, the Zambales Fault and its splay to the north and east, and the Verde Passage Zone to the south.

Of the volcanic hazards, airfall tephra is considered as more likely to affect the project area. The nearest active volcano is Pinatubo Volcano which is located some 40 km northeast of the project site. The volcano's eruption in 1991 blanketed the area with more than 15 cm of tephra deposits. Mount Natib, situated some 22 km east-southeast of the project area, is considered by PHIVOLCS as a potentially active volcano.

The Subic Bay area is not exempted from the devastating effects of tropical cyclones. However, the frequency of tropical cyclone occurrence in the vicinity of the project site is just about 5 cyclones every 3 years.

The hazards associated with storm surges include inundation and flooding of coastal areas due to an abnormal rise in sea level arising from wave pile-up during the passage of a typhoon. A modeled storm surge map of the Subic Bay Area is presented.

The most recent flooding event that occurred in Green Beach was in July 2005 where the overtopping of the Agusuhin River produced 3 feet floodwaters. The flood however subsided soon after the strong rain event and the high tides.

3.1.3 Hydrology

The project site which faces the western side of Subic Bay is within two catchments, namely: the Agusuhin Catchment that covers the southern portion of the project site; and an unnamed catchment which covers the northern part of the project site. The unnamed catchment will be referred to as the North Catchment.

The Agusuhin Catchment is approximately 13.934 square kilometers (km^2), about 94% of which exhibit moderate to rugged terrain and the remaining 6% is flat to gently sloping terrain. It is a fan-shaped basin about 6 kilometers (km) long and up to 4.7 km at its widest breadth. It consists of three (3) sub-catchments: the Main Agusuhin Sub-catchment (AG-1), the North Agusuhin Sub-catchment (AG-2) and the Agusuhin River Downstream Sub-catchment (AG-3) from the confluence of AG-1 and AG-2 to the coast. From sea level at the eastern side, the catchment attains maximum elevations of 760 meters (m) at Cinco Picos and 600 m at Mount Redondo.

The North Catchment, with an area of about 2.358 km^2, is an elongated basin 3.6 km. long and 0.8 km wide. With Mount Redondo as a common summit with the North Catchment has a general slope of 0.16.

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3.1.4 Water and Sediment Quality

River Water Quality

Water temperature ranged from 25.4 to 26.4°C. Dissolved oxygen (6.6 to 8.4 mg/L), pH (7.90 to 8.40), TSS (3 to 24 mg/L), total coliform (500 to 2,400 MPN/100 mL), fecal coliform (240 to 500 MPN/100 mL), and oil & grease (0.3 to 0.5 mg/L) were all within the prescribed standards for DENR Class C waters (*i.e.*, waters for fishery for propagation and growth of fish and other aquatic resources). Of the 7 metals analyzed, arsenic, cadmium, chromium (hexavalent) and lead were not detected *(i.e.*, below the reporting limits). In contrast, mercury (0.0001 to 0.001 mg/L) showed detectable levels in all stations, but were still within the standard. Copper and zinc were also not detected in all the sampling stations except at Station R1 (Downstream of Agusuhin River), which showed detectable levels of 0.04 and 0.03 mg/L, respectively.

River Sediment Quality

Oil & grease, cadmium, chromium (hexavalent) and lead were not detected in all the sediment samples. Arsenic ranged from not detectable levels to 0.05 mg/kg. Detectable concentrations of copper (2.9 to 12 mg/kg) and zinc (4.2 to 6.2 mg/kg) were obtained in all stations. Similarly, mercury (0.31 to 0.36 mg/kg) was detected in all stations.

Groundwater Quality

The water temperature measured was 26°C. Salinity (6.4 ppt) obtained indicates saltwater intrusion. The pH (7.2) obtained was within the range specified in the PNSDW (Philippine National Standards for Drinking Water). The water sample analyzed had low concentration of total suspended solids (TSS, 4.0 mg/L). The total dissolved solids (TDS, 294 mg/L) and chloride (13 mg/L) concentrations were way below the standards. An elevated concentration of total hardness (201 mg/L) was found in the sample. Elevated levels of total coliform and fecal coliform (2,400 MPN/100 mL each) were also found in the sample. Of the 7 heavy metals analyzed, only mercury (0.003 mg/L) was detected in the water sample, which exceeded the PNSDW limit for mercury.

Marine Water Quality

Levels obtained for the various parameters showed little variation among the three marine sampling stations. Water temperature (27.0 to 27.5°C), salinity (21.0 to 24.9 ppt), pH (8.17 to 8.31), and dissolved oxygen (8.20 to 9.34 mg/L) have similar pattern of normal values for tropical estuarine and marine waters. Total suspended solids (TSS) ranged from 9 to 13 mg/L. The levels of biological oxygen demand (BOD_5), oil & grease and total coliform, were consistently way below the limits set for Class SC waters. Nitrate was not detected. Similarly, the concentrations of heavy metals arsenic, chromium (hexavalent) and lead were not detected. Elevated content of cadmium (0.02 to 0.07 mg/L) was noted in all stations, which exceed the prescribed 0.01 mg/L standard. Mercury (0.001 to 0.0013mg/L) was also detected in all stations. Copper ranged not detectable to 0.05 mg/L. Zinc also ranged from not detectable to 0.08 mg/L.

Marine Sediment Quality

Oil & grease, cadmium, chromium (hexavalent) and lead were not detected. In contrast, copper (4 to 13 mg/kg), zinc (2.7 to 8.2 mg/kg) and mercury (0.31 to 0.35 mg/kg) were detected in all stations. Arsenic, on the other hand, ranged from not detectable to 0.25 mg/kg. The sediment metal data from this survey were compared to the NOAA apparent effects threshold (AET) and the effect range-low (ER-L) criteria proposed by Long and Morgan (1991), and to the no

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observed effects level (NOEL) proposed by MacDonald (1993). The detected levels of arsenic, copper and zinc are way below their respective AET, ER-L and NOEL. Mercury concentrations are also way below the AET level but exceed the ER-L and NOEL levels.

3.1.5 Physical Oceanography

Tides

The observed tide in Subic Bay is normally mixed with a predominantly diurnal character. In general, the semi-diurnal constituents, which are responsible in the observed two high and two low water levels in the area, occur almost every after two weeks.

Waves

During the passage of typhoons in the area, extreme waves such as that due to storm surge may occur. In general, a southerly wind direction was considered as posing a surge threat in the area due to the orientation of the bay with one opening towards the south. When typhoons crosses the Philippine Islands and passes south of Subic Bay, storm winds with a southerly orientation may result.

Currents

Previous observation in Subic Bay showed that during the dry season (NE Monsoon) with winds ranging from 3-6 meters per second (m/s), currents may range from 3-21 centimeters per second (cm/s) at the surface. In addition, observed current directions do not necessarily go with the direction of the wind due to the influence of the complex coastal geometry and bottom topography of the bay. The simulated results of the present study show that at flood tide, a maximum mid-depth current velocity of about 5.0 cm/s directed towards the head of the bay may occur. A very weak current is noted during this season at flood tide at the proposed project site. The seemingly weak currents during the northeast monsoon season are generally attributed to the opposing tides and winds (*e.g.*, winds coming from the opposite direction at flood tide). This translates to a surface current of about 7-8 cm/s. At ebb tide, the currents in the bay appear to be reversed in direction. At the same time, the current magnitudes in some parts of the bay increase. Stronger currents occur near Grande Island as the ebb tide exits the bay. At the project site, currents tend to be slightly stronger with magnitudes of 2-4 cm/s and directed southwards towards the mouth of the bay.

Depending on the wind speed, the current magnitude during the wet season may range from 3 to about 20 cm/s, which is also the order of current magnitude observed during the dry season (SBPAMPP 2002). The wind speed in the area during the wet season without storm may range from 2-5 m/s. The wind effect is normally noticeable in the shallow areas located extreme north of the bay. In addition, a reversal of currents may occur with the change of wind conditions during the southwest monsoon season (*i.e.* wet season). It was predicted by the model that the depth-averaged currents may range from 2 -7 cm/s during the wet season. Near the project site, the coastal waters appear to be generally weak with depth-averaged magnitudes of less than 4 cm/s. The general tendency of currents during this season at tidal flooding is to rush northwards. At ebb tide, the currents reversed almost in the opposite direction. Remarkably, the current magnitudes appeared to be slightly stronger during ebbing. However, the project site appears to have calm waters during this tidal phase.

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3.1.6 Meteorology

Climate

The climate at the project site belongs to Type 1 according to Corona's Climate Classification. In this classification, the project site (and the whole Subic Bay) has two pronounced seasons, the wet and dry seasons. These correspond to the southwest monsoon season that prevails in the area from June to September and the northeast monsoon season that prevails during the months of November to April. May and October are transition months between the seasons. Reversal of wind direction from northeast to southwest seasons and vice-versa occur during these months.

Rainfall

In general, the project site experiences about 4 months of rainy period. The average rainfall during the rainy months of June-September ranges from 591.8 to 1089.7 mm. Peak rainfall occurs in August. The mean monthly temperature ranges from 26.7 to 30.0 °C. The warmest period occurs during the months of April and May. The minimum temperature occurs on January each year.

Relative Humidity

Relative humidity is generally high in the Philippines which range from 65 to 84 % with an annual mean of about 74.2 %. The most humid month is generally experienced in September. The sky over the project site is generally cloudy. Cloudiness has an annual average of about 5 oktas where 1 okta refers to 1/8 of the sky covered with clouds. Cloudy skies prevail in September whereas clear skies are generally experienced during the months of February to April.

Prevailing Winds

The surface wind in the project site is known to be affected by synoptic systems such as the northeast and southwest monsoon. However, as the coastal area and the adjacent seawater develop a thermal and pressure difference especially in the afternoon, the sea-breeze wind occurs almost everyday. Surface winds prevail from the east-northeast direction with an annual frequency of 25% and with magnitudes ranging from 1 to 21 knots. Winds prevail from this direction in Subic Bay most of the time with about 25 % frequency. This is followed by easterly wind direction with over 15% frequency. During the year, the winds in the area predominantly range from 1 to 16 knots. However, the annual average wind speed is only 6.4 knots (equivalent to about 3 m/s).

Tropical cyclones

The frequency of tropical cyclone occurrence in the vicinity of the project site is just about one per year. This frequency depends on whether an El Niño (corresponding to dry months) or La Niña (rainy months) occurs during the year (Anglo, 1999 as cited in de las Alas, 2001). During an El Niño, the frequency of tropical cyclone occurrence in the Subic Bay Freeport Zone is about 1.1 cyclones per year. On the other hand, this frequency increases during the occurrence of La Niña with about 1.5 cyclones per year.

3.1.7 Air and Noise Quality

Ambient Air Quality

The observed Ground Level Concentrations (GLC's) ranged from 24.0 to 76.9 µg/Ncm for TSP, from <3.0 to 23.4 µg/Ncm for sulfur dioxide (SO_2), from 25.4 to 37.6 µg/Ncm for nitrogen dioxide (NO_2), and from 7.3 to 20.8 µg/Ncm for particulate matter (PM10). The high concentrations of TSP at Stations S2 and S3 was due to the fugitive dust emitted by the nearby quarry located 500 to 700 meters SE of the sampling stations. The DENR Standard for ambient air quality in µg/Ncm is 300 for TSP, 340 for SO_2, 260 for NO_2 and 200 for PM_{10}

Observed Meteorological Data

The average ambient air temperature was between 27.0°C and 30.0°C. The prevailing wind direction was southwesterly with light to moderate wind conditions.

Noise Level

The ambient noise levels recorded were consistently low (> 55 dBA) around the vicinity of proposed project site. During daytime periods, observed noise level ranged from 49.0 to 54.0 dBA. A slight increase in the noise level measurement was observed in Station 2 due to the ongoing quarry operation located SE of the sampling station.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Terrestrial Ecology

Site Flora

Vegetation Types

The project area is predominantly a herbaceous plant community with woodland vegetation confined in the riverine areas and the coastal zone of the project site where majority of human settlement converges. In preponderance are the grasses in association with forage species. Sparse tree species are present in the middle upper portion of the project site which is the middle riparian part of the Agusuhin River Basin. The surrounding ridges are almost devoid of trees. In terms of number, agoho is the dominant tree in these areas. The ground vegetation is dominated by hardy grasses like samsamon (*Themeda triandra*) and cauacauayan (*Apluda mutica*). Channels of upper catchment areas of the tributaries of Agusuhin River are predominantly covered by bocawe (*Dinochloa scandens*) and very few trees. The Agusuhin River Basin was formerly agoho-dominated woodland with the riparian areas having mixed species agoho, bamboos and other riparian trees. A very small patch of mangrove (about 200 m^2) can be seen in Sitio Agusuhin Proper. It is dominated by bungalon (*Avicennia marina*). The current fire-climax vegetation is a result of logging and eventual agricultural land conversion with fire as the main tool for vegetation management.

Rice Paddies

At the central portion of the project area, approximately 5 hectares of rice paddies are being maintained by some of the residents. Three farmers were interviewed during the visit. Accordingly, they have been tilling the land for more than 10 years. The paddies are irrigated by

water from the Agusuhin North Creek diverted through man-made channels. Cropping was being maintained twice a year. Harvest is around 100 sacks palay per hectare per cropping. The farmers employs the usual practice of applying 14-14-14 and urea fertilizers and do not introduce organic fertilizer and other environment-friendly practices.

Reforestation Project

A 100-ha reforestation project is situated just at the north-eastern section of the proposed project. This project coined as ACRA (Agusuhin Community Reforestation Assistance) was funded by Pilipinas Shell Foundation Inc. (PSFI). Planting in August 2000 and was turned over to SBMA in February 2001. Ten thousand (10,000) mangos and 45,000 eucalyptus were established during the said period. Site observations revealed that the plantation survival is barely 10%. A few spots of eucalyptus were found in the area. The area was regularly burned by wildfires from the grasslands which were ignited by hunters to enhance growth of grass species to wild deers. With this periodic burning, the reforestation area is practically reverting back to grassland ecosystem with patches of fire-resistant species such as Agoho and Binayuyu.

Ecological Status of Plant Species

The plant species identified in the area are considered common which means they can be found in similar habitats in other parts of the country. No endangered species can be sacrificed in the process of developing the area.

Economically Important Species

Mango and rice are agricultural crops, which contribute in part on the sustenance of the community of Agusuhin. However, they are raised in small scale and therefore not deterrent to the survival of the local people. Ipil-ipil is also important as a multi-purpose tree species; however this tree is very common and widely distributed in the country. Eucalyptus trees were planted as reforestation species and can be sourced of electricity posts if they had been protected well.

Site Fauna

Birds

Thirty-seven species of birds belonging to 25 families were recorded during the survey. Six, which comprise 3% of the total number of species found in the area, were endemic. These include: *Anas luzonica, Phapitreron leucotis, Turnix ocellata, Centropus viridis, Hypsipetes philippinus* and *Zosterops meyeni.* One of these species (*Anas luzo*nica) was classified as threatened species under the Red data Book published by Haribon Foundation and Birdlife International. Grasslands with patches of Agoho and Binayuyu were the dominant vegetation found in the area. Homogeneity of habitat reflected the types of bird species observed. Majority of the species found belongs to the group of munias, grassbirds, swallows, bulbuls and doves. These species are either insectivorous or granivorous.

Mammals and Reptiles

Only two individuals belonging to the same species (*Cynopterus brachyotis*) were captured during the whole sampling (trapping) period. In contrast, 2 species of rats (*Rattus argentiventer* and *Rattus exulans*) were fairly common. During transecting/traversing there was a very low or in fact none of these terrestrial mammals. Lizards and snakes were sighted in the field. The low turn out for bats was probably because the area is severely disturbed. In addition of the absence of fruiting and flowering trees makes the area unfavorable for this species to thrive.

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3.2.2 Aquatic Ecology

River/Freshwater Ecology

River Plankton

Phytoplankton population appeared to be the main constituent, comprising 84% (averaging 10,250 cells/L of the total plankton population). The phytoplankton population consists of 3 major groups: diatoms, blue-green algae and green algae. Only 1 animal group, the phytoflagellates represented solely by the genus *Phacus*, represented the zooplankton community, averaging only 16% of the total plankton population. The blue-green algae were the most abundant phytoplankton organisms (averaging 37 %) consisting of 3 genera. *Oscillatoria* (20 %) and *Chroococcus* (12 %) were the leading blue-green algae in the aquatic habitats. The next most abundant were the green algae (24%), represented with 5 genera dominated by *Cladophora* and *Oodegonium* (6 % each). The phytoplankton diatoms ranked third in abundance, averaging 22 %, consisting of 6 genera dominated by *Navicula* (8%), followed by *Gyrosigma* and *Coscinodiscus* (4% each).

River Soft Bottom Benthos

A total number of 10 benthic organisms were obtained from 4 samples taken in 4 sampling stations. These organisms were represented by 4 animal taxa. The crustacea represented by the gammarids were the most abundant organisms collected comprising 40% of the total collection, followed by the Insecta represented by the chironomids comprising 30%, nematodes composing 20% and polychaetes represented by a nereid worm constituting 10%.

Marine Ecology

Marine Plankton

Phytoplankton population was composed of three major groups: diatoms, blue-green algae, and dinoflagellates. Diatoms dominated all samples and were by far the most abundant phytoplankton organisms (averaging 54 %) of the total phytoplankton collection. Diatoms were represented with 8 genera dominated by *Chaetoceros* (19 %), followed by *Skeletonema* (11 %), *Coscinodiscus* (9 %) and *Thalassionema* (8 %). Dinoflagellates were next in abundance (41%), represented by only 3 genera dominated by *Noctiluca* (38%), followed by *Ceratium* (2%) and *Peridinium* (1%). Blue-green algae solely represented by *Trichodesmium* (5%) were never abundant.

Six major taxonomic groups represented the zooplankton population. The most abundant were the copepod nauplius larvae (23 %), followed by calanoid adult copepods (18%), ciliate *Tintinnopsis* (16%), foraminiferans (15 %) and appendicularians (11 %).

Soft Bottom Benthos

A total number of 359 benthic organisms were obtained from 6 replicate samples taken in 3 sampling stations. These organisms were represented by 35 animal taxa. The polychaetes were the most abundant organisms collected comprising 33 % of the total collection followed by the nematodes (22 %), rhynchocoelans (15%), crustaceans (11%), foraminiferans (9%) and echinoderms (6 %). The other groups constituted an aggregate of 4 %. There were 21 families that represented the polychaetes in the collection. The spionids, which are always present in any kind of benthic marine soft bottom, are most commonly encountered polychaetes constituting 8% followed by the goniadids.

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Coral Reef

Within the project site, a patch or platform reef (about 300 meters long and 185 meters wide), located about 400 m northeast of Sitio Agusuhin Proper (or in front of the former CGS casting basin), occurs. The percentage live coral cover was estimated at 20%, which fall under the poor category. Macroalgal cover was measured at 0.4%. The entire transect location was typically dominated by abiotic component (sandy substrate and coral rubble) at 49%, followed by old dead coral substrate at 25%. The poor coral condition observed at the patch reef indicates that there were rampant blast/dynamite and cyanide fishing activities in the area in previous years. In addition, the reef was not spared from the effects of the ash fall deposits during the 1991 Mt. Pinatubo eruption. The sudden deposition of up to 15 cm of Mt. Pinatubo ash changed all areas of the Subic Bay and water shed (Woodward-Clyde, Ecology Center-SBMA, 2001). The corals would have been engulfed by this air fall.

Reef Fish

There were 31 reef fish species noted at the patch reef, belonging to 15 families. Majority of the species belongs to the labrids family or wrasses. These were followed by the acanthurids or (surgeonfishes). There was an unnatural limitation of pomacentrids (chromis) in the area. A total of 192 individuals were counted along the transect line. Considering that the scanned area was 1000 m^2, the extrapolated fish density was low at 0.19/ m^2. Therefore, it takes a total area of 5 m^2 to shelter a single fish. The total estimated biomass was determined at 13,125.10 gms, thus, resulting into an average biomass estimate of 13.13 gm/m^2.

Artificial Reefs

Artificial reef (AR) structures can be found within the vicinity of the project site, about 1km on the northeastern side of Agusuhin Point (or approximately 650 m away from the shore or mouth of Agusuhin Creek at Lat. 14°49'32. 9 N, Long. 120°12'59. 5 E). A survey of the these AR structures commissioned by the Shell Philippines Exploration (SPEX) was carried out in April 2005 to assess the current status and condition of the ARs after about 5 years of its relocation in a designated disposal site (about 30-33 meters depth) off the coast of Agusuhin from the casting basin of the so called "Malampaya Concrete Gravity Structure (CGS) Project". The ARs were made of aggregated concrete slabs with rock boulders and rocks, which varied widely with regard to shape and size. There were 26 species of associated macroinvertebrates present at the AR sites, belonging to 13 animal groups namely, hydroids, octocorals, sponges, bryozoans, starfishes, featherstars, sea cucumbers, chitons, oysters, nudibranchs, cephalopods, crustaceans and sea squirts. The AR sites surveyed shelters 12 species of coral reef fishes under 9 families. The ARs were still in the process of recruitment and some of its units were not efficient as expected.

Seagrass Bed

Seagrass habitat, consisting primarily of the seagrass species *Enhalus acoroides*, occurs north of CGS (towards Petambu Point). The seagrass was found growing nearshore at a depth of 1.5 meters. The substratum is sand-silt and the visibility underwater is very low at 0.5 m. The length and width of the meadow is narrow at 250 m by 12 m, thus it runs parallel with the shoreline within a strip of 3000 m^2.

Marine Turtles

Three species of marine turtles are reported in Subic Bay: (1) the olive ridley (*Lepidochelys olivacea*), (2) the hawksbill turtle (*Eretmochelys imbricata*) and (3) the green turtle (*Chelonia mydas*). In all life stages, the olive ridley turtle is the most frequently observed and reported

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among the three species present in Subic Bay. Beaches along the 65-kilometer coastline of Subic Bay are used for nesting by the olive ridley (*L. olivacea*). Olive ridley is confirmed to nest in six beaches of Subic Bay. Among these, All Hands Beach had the most number (31%) of reported nests. However, marine turtles have not been sighted breeding on the sandy beaches of Sitio Agusuhin.

Fisheries

Around 20-25 motorized boats/bancas fitted with a 16 HP engine are based in Sitio Agusuhin, while around 10 are utilized by spear fishers doing compressor diving. The most commonly used gears in Sitio Agusuhin are: the simple hook and line, the multiple hook and line, bottom set gill net, improvised spear gun and other small fishing implements like jigs and lures. Another fishery related activity is the gathering of milkfish ("bangos") fry. Fry gatherers commonly operate during the summer months' of May until July. There is also an ongoing aquaculture activity in Sitio Agusushin. Milkfish (*Chanos chanos*) is being cultured extensively in an approximately 3-hectare pond. Illegal fishing activities within the immediate vicinity have been lessened, although blast or dynamite fishing have never been heard of for over a year now, cyanide fishing is still being practiced by some fishers, especially those targeting aquarium species. Several fishers practice compressor diving but their activity is coupled with the retrieval of steel ("kabilya") in the AR site. Gathering of invertebrates, specifically sea cucumber is another fishery related activity.

Mariculture (Fish Cages)

Fish cage operations inside Subic Bay can be found along the coast of Barangay Cawag. The nearest fish cage operation to the project site is located 2 km north of Sitio Agusuhin Proper, near Mahumaling Point at Lat. 14°50' 31. 3" N and Long. 120°12' 48.9" E. Milkfish or "bangos" (*Chanos chanos*) is the main fish species being cultured. Commercially available artificial (pelletized) feeds whose main ingredients are rice bran, fishmeal and soybeans are used. Local residents alleged that fish cages cause pollution. At present, there is no management plan in place so as to protect the water quality of the bay from the fish cage operation.

3.3 SOCIAL ACCEPTABILITY

3.3.1 Public Participation

The communities in the three impact areas and various stakeholders were provided different venues for participation in the conduct of this study. These include the conduct of unobtrusive informal interviews with key informants, community meetings, focus group discussions and public consultation (2nd level scoping). Key Informants Interview of the community leaders, the mayor, and SBMA was conducted to gather general issues and concerns towards the project as well as to map out socio-political influences that might affect the Project.

Residents discussed among themselves the possible environmental and social impacts as a result of the implementation of the proposed project. They also took a very active part in the identification of positive and negatives effects of the project and in the formulation of mitigating measures that would minimize if not totally eradicate the adverse socio-economic and environmental impacts.

Secondary information was collected from SBMA Ecology Center, where they recently conducted a complete survey (June 29 – July 15, 2005) for 477 households along Redondo Peninsula which covered Sitios Agusuhin (272 households) and Nagyantok (205). Some of data generated by this survey were adopted to present a fuller picture of the concerned communities.

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3.3.2 Socio-Economic / Perception Survey

The survey was conducted in the three sitios (village), namely: Agusuhin, Nagyantok, and Nagtulong – coastal communities along Redondo Peninsula in Barangay Cawag Subic, Zambales. The survey instrument patterned after the recommended form of Environmental Management Bureau (EMB) was used. Enumerators were enlisted from the cluster leaders of Agusuhin Neignborhood Association (ANA). The study area was classified into two types. The direct impact area (DIA) is the whole of Sitio Agusuhin where the proposed project site will be located. The survey undertook 100% interview coverage with the three-hundred fifty-five (355) households living within Sitio Agusuhin.

The secondary impact area (SIA) is defined as within a three-kilometer radius from the proposed project site. There are two sitios in the secondary impact area, namely: Sitio Nagyantok and Sitio Nagtulong. Fifty respondents (24%) in Sitio Nagyantok were selected out of the total of 205 households. Twelve respondents (20%) in Sitio Nagtulong were selected out of the total of 60 households. Overall, the total number of respondents for the DIA and SIA is 417 respondents. The respondents interviewed in the study were heads of the family, ages 18 and above and residents of Sitio Agusuhin, Nagyantok, and Nagtulong.

3.3.3 Results of the Awareness and Perception Survey

Respondents

Three hundred fifty-five (355) respondents or 100% of the total number of households were interviewed in Sitio Agusuhin. Respondents from Sitio Nagyantok and Sitio Nagtulong, on the other hand, represented the 20% - 24% of its total number of households (205 and 60 households). Sitios Agusuhin, Nagyantok, and Nagtulong have a combined household population of 620 where Sitio Agusuhin was the largest (53 % of the total households) while Sitio Nagtulong was the smallest with 10 % coverage.

Sitio Agusuhin, the center of the proposed shipbuilding facility, has significantly increased its household population by 46 % from 147 HH, in 1999 Pre-CGS construction survey (PSFI Accomplishment Report, 2001), to 272 HH latest survey conducted by SBMA in June 2005. This increase may be attributed to the development projects in the area where residents took the opportunity for employment and other compensations. There was an increase of 83 households from July 15 to third week of September 2005. It is surmised that the sudden increase of migrants is in anticipation of the compensation that the old residents may receive from the proponent and/or SBMA.

Stakeholders' Perception Towards the Project

Perception on Development Projects

In the survey conducted by SBMA last June 2005, 108 respondents viewed development projects as a very good source of employment.

The residents also expect that the development of projects in their areas will result in their displacement (90 respondents). They are fully aware that the lands they are presently occupying belong to SBMA. Concomitantly, they are also fully expectant that if they are displaced, they will receive compensation (35 respondents) for the structures and development that they have invested in the area.

There is also a realization that new projects (70 respondents) in their communities and

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employment (42 respondents) will solve their community problems and needs.

Community Awareness on the Project

Two hundred twenty (220) respondents are aware of the proposed project while 197 respondents are not aware of the project.

Acceptability of the Project

More than two-thirds of respondents (67.15%) are in favor of the project while only 11 respondents (2.6%) are against the project. A significant number of respondents (19.67%) are not sure if they will accept or reject the project. In addition, 44 respondents had no comments about the project.

Willingness of the Community to Relocate

Out of the 417 respondents of the survey, 173 respondents are willing to relocate their houses. In Sitio Agusuhin, 149 households (42 %) out of the total of 355 households are willing to be relocated.

Overall, thirty-four households are not willing to be relocated. In Sitio Agusuhin, 30 respondents (8.5 %) are not willing to be relocated.

There are 113 respondents who are not sure if they want to be relocated or not. Out of this total 101 respondents (28.5 %) are from Sitio Agusuhin.

Ninety-seven (97) respondents did not give any opinion about their willingness to relocation. Out of this total, 75 respondents (21 %) are from Sitio Agusuhin.

Proposed Relocation Site

Two hundred ten respondents (50.35 %) are in favor that the relocation site is within SBMA property. Thirty-two respondents are willing to be relocated in other areas within Barangay Cawag. Ninety-nine respondents are willing to be relocated in other barangays within Subic while thirty-five respondents are willing to be relocated in other municipalities within Zambales. Twenty respondents did not provide any answers.

Conditions for Relocation

Two hundred forty three (243) respondents wanted that they should be compensated for their houses and/or lots.

Highlights of the Focus Group Discussions

Focus Group Discussions (FGDs) were undertaken in the three community organizations of the directly affected community of Sitio Agusuhin, namely:

- Agusuhin Neighborhood Association (ANA);
- Samahang Magsasaka at Mangingisda ng Agusuhin (SMMA); and
- Agusuhin Community Reforestation Association (ACRA).

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The following issues were raised and discussed.

Agusuhin Neighborhood Association (ANA)

- The participants wanted that their houses and other structures that they built would be compensated;
- The participants said that they should also be compensated for the trees and crops that they have planted;
- They also want compensation from the improvements that they made on the land such as fishponds, irrigation and gardens;
- Compensation based on the length of stay in the community; and
- Compensation for the loss of income because of the disturbance brought about by the resettlement of the affected households;

Other issues and concerns raised in the discussion:

- Employment;
- Skills Training; and
- Livelihood

Samahang Magsasaka at Mangingisda ng Agusuhin (SMMA)

- Compensation for the farms and on fruit bearing trees;
- Compensation on the fishponds.;
- Compensation should be based on the area and improvements of the rice land and also based on the expected yield per year; and
- Compensation should also consider the length of time a household stayed in Agusuhin.

Agusuhin Community Reforestation Association (ACRA)

- Payment for trees and crops;
- Compensation for years of stay in the area;
- Compensation for nipa huts that they built to monitor the area against illegal activities and irrigation system that they channeled and developed for the project;
- Relocation site would be the parts of the reforestation area that is outside of the 300-hectare project site. They are suggesting re-subdividing the unaffected area to the members of ACRA as their relocation site and reforestation areas; and
- Members look forward to being employed in the project because of their unique positions of holders of a legal document signed by SBMA. Most of its members were trained during the CGS construction such as steel man, fabricators (rebar technician), and divers.

3.4 ARCHAEOLOGY

A shipwreck is located about 100 meters off the mouth of the former CGS casting basin at a depth of 20 to 21 meters. It has been identified as Land Sea Transport (LST) 1625, a steel vessel which sunk in August of 1946. On 4 November 2005, a KKCS survey team conducted

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an underwater inspection of the said shipwreck to determine its present status and condition. Similar to the previous findings of the Underwater Archaeological Team of the Philippine National Museum on 19 July 2000, the shipwreck still remains to be in a stable condition.

4. MATRIX OF ISSUES AND IMPACTS RAISED DURING THE SECOND LEVEL SCOPING MEETING AND CONSULTATIONS

Issues/ Concerns	Responses
Where will be the relocation site and how much will they be compensated for their houses and improvements? There were questions on the location of the relocation area, sizes of the lots, payment and other conditions.	The relocation and compensation issues will be handled by SBMA as the owner of the land. There is a long-term lease agreement between SBMA and Hanjin. Based on the lease agreement SBMA will be responsible for these issues. It was explained that SBMA has formed a group that will study and recommend how to handle the relocation and compensation issues
What will happen to the farm lots that are not included in the 300-hectare area to be occupied by the proponent?	It was explained that the scope of the study is only for the 300-hectare area, hence, in so far as the study is concerned, the area will be limited to the area to be occupied by Hanjin.
Is it true that SBMA would not permit the transfer or relocation of affected families into other SBMA areas? Some participants suggested that they be permitted to relocate to other SBMA areas. In this way, they will not be charged anymore for the amortization of their relocation lots because SBMA will not buy anymore from owners of nearby lands.	It was explained that SBMA would formulate and implement a policy about relocation. The details of the policy are not yet available. KKCS will study the viability of such proposal and come up with the findings and recommendations to SBMA.
There are residents who have a 2.5 hectares land stewardship under the CBFMA. Are they permitted to transfer to these areas for their relocation? It was suggested that the members of the reforestation association be permitted to be relocated in their respective areas under CBFMA.	It was reiterated that the final relocation site would be decided by SBMA as the responsible entity for relocation after considering a variety of factors including financial, social and legal aspects. KKCS will study this option and will provide recommendations as to the financial, legal and social viability.
A participant asked if the relocation site will have similar community facilities to that existing in their community such as chapels and schools.	A relocation site should have basic services such as provisions for education, health, power, water and roads. The details are now being studied by SBMA.
Accessibility of fishermen to their animals and boats from the relocation site.	KKCS to study and will endorse to SBMA concerns about the animals and bancas.
Will the length of stay in the area be a factor in determining compensation?	KKCS will study if the length of stay may be included as one of the factors in determining compensation considering the nature of the stay of the residents within SBMA land.

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Issues/ Concerns	Responses
	It should be emphasized that there are other factors to be considered.
What will happen to the trees they planted and the crops they grow? Agriculture.	The trees and crops will be properly compensated. The valuation of the trees and crops will be based on the rates of the Municipal Assessor's Office or Department of Agriculture
Will scholarship for students be offered?	The access to education will be provided for but scholarship will be at the discretion of SBMA or the project proponent. The study may recommend educational support for deserving but financially challenged households.
Employment for affected communities	Priority will be given to qualified residents of the affected communities. Applicants who are not qualified for employment may undergo skills training to acquire the needed qualifications to be employed in the project.
Can they still be hired even if they are relocated?	Priority employment will be given to qualified residents of Sitio Agusuhin and the neighboring sitios of Nagyantok and Nagtulong.
Issue on newly transferred migrants and their houses?	KKCS will study the matter and recommend measures to SBMA how to handle and address this issue.

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5. MATRIX OF POTENTIAL IMPACTS AND MITIGATING/ENHANCEMENT MEASURES

Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
Pre-Construction/Construction Phase							
Physical Environment							
Topography (alteration)	LO	(-)	F	IR	LT	SI	Unavoidable; excavated materials to be used as fill materials
Geology (excavation)	LO	(-)	S	IR	LT	MO	Unavoidable; excavated materials to be used as fill materials
Soil (erosion/siltation)	LO	(-)	S	IR	ST	MO	Retaining walls; sabo dam; siltation pond; silt curtains; armour rocks; use of geomembrane around reclamation boundary; proper stock piling of removed soils; benching; site grading in a progressive manner; revegetation
Hydrology (stream alteration)	LO	(-)	S	IR	LT	SI	Adequate drainage; bank protection
Hydrogeology (groundwater over abstraction – sea water intrusion)	LO	(-)	F	IR	LT	SI	Consider surface water; watershed management program
Water Quality (land clearing and excavation)	LO	(-)	S	R	ST	MO	Drainage canals with silt traps; settlement of suspended solids in natural depressions
Water Quality (oil and grease)	LO	(-)	S	R	ST	MO	Containment canal around motor pool Oil – water separator
Water Quality (reclamation and dredging)	W	(-)	S	IR	ST	MO	Silt curtains; scheduling of reclamation and dredging activities
Solid and Domestic Wastes	LO	(-)	F	R	ST	MO	Solid Waste Management Program following the Ecological Solid Waste Management Act of 2003 (RA 9003)
Air Pollution (emissions from equipment)	LO	(-)	S	R	ST	IN	Air quality monitoring Regular maintenance of equipment
Dust generation	LO	(-)	F	R	ST	MO	Wet suppression of dry surfaces
Noise generation	LO	(-)	S	R	ST	MO	Buffers; excessive noise construction activities confined during daytime when practicable

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Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
Biological Environment							
Flora (removal of vegetation)	LO	(-)	S	IR	ST	MO	Landscaping of grounds; watershed management
Fauna (displacement)	LO	(-)	S	IR	ST	MO	Replanting of indigenous plants in vacant spaces and along waterways
Aquatic Ecology (smothering of fish eggs, diminishing of food sources, reduction of availability of light, destruction of habitat)	LO	(-)	S	IR	ST	MO	Installation of sheet piles, silt curtains; selection of reclamation site
Socioeconomic Environment							
Change in actual land use	LO	(+)	F	IR	LT	MO	Prompt payment of lease and other permits and licenses to assist SBMA
Affects portion of reforestation area	LO	(-)	F	IR	LT	MO	Compensation for improvements
Within marine sanctuary	LO	(-)	F	IR	LT	MO	Consultations and secure proper documents
Displacement of households	LO	(-)	F	IR	LT	SE	Prepare and implement a resettlement action plan
Generation of employment and livelihood opportunities	W	(+)	F	IR	ST	SE	Priority of qualified local residents Establish a community relations office
Increase in commercial activities in the area	LO	(+)	F	R	ST	MO	Prioritize local suppliers in buying company requirements
Additional income and Benefits to LGUs	LO	(+)	F	IR	ST	MO	Prioritize local suppliers in buying company requirements
Air and noise pollution to workers	LO	(-)	S	R	ST	MO	Installation of a water sprinkling system Face masks for construction workers Proper maintenance of equipment
Operation Phase							
Physical Environment							
Water Resources (depletion/salt water intrusion)	LO	(-)	F	IR	LT	SI	Water management and conservation; watershed management; reforestation; mini dam; not over mining groundwater resources; more detailed groundwater assessment (through construction of test

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Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
							wells and aquifer test) to establish groundwater safe yields
Water Quality	LO	(-)	S	R	ST	MO	Water quality monitoring; wastewater treatment plant; use of organic chemicals
Air Pollution	LO	(-)	S	R	ST	IN	Air quality monitoring; regular maintenance of equipment
Noise generation	LO	(-)	S	R	ST	MO	Buffers, fences
Solid and domestic wastes	LO	(-)	F	R	LT	MO	Solid Waste Management Program following the Ecological Solid Waste Management Act of the DENR.
Biological Environment							
Flora (erosion due to deforested areas)	LO	(-)	S	IR	ST	MO	Re-landscaping of grounds; watershed management
Fauna (return of wildlife)	LO	(+)	F	IR	LT	MO	No enhancement measures
Aquatic Ecology (increase diversity of aquatic organism)	LO	(+)	F	IR	LT	MO	No enhancement measures
Socioeconomic Environment							
Influx of informal dwellers	W	(-)	S	R	LT	MO	SBMA will implement land use plan SBMA/Subic prevent influx of informal dwellers
Generation of employment and livelihood opportunities	W	(+)	F	IR	ST	SE	Priority of qualified local residents Farm out supply requirements as livelihood projects Buy local supplies Livelihood program
Additional revenues for the LGU	LO	(+)	F	IR	LT	SE	Prompt payment of taxes
Air and noise pollution to workers and nearby communities	LO	(-)	S	R	ST	MO	Installation of anti-pollution devises Monitor health conditions of communities Plant trees and shrubs around perimeter Personal Protective Equipment (PPE) to workers exposed to air and noise pollution

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6. SUMMARY MATRIX OF ENVIRONMENTAL MANAGEMENT PLAN (CONSTRUCTION PHASE)

Environment	Impact	Mitigation Measure	Institutional Responsibility
Physical	• Increase in solid waste generation	• Concrete Solid Waste Management Program following the guidelines set by the Ecological Solid Waste Management Act of the DENR	Proponent / Contractor / SBMA EC
	• Erosion due to cut and fill activities	• Installation of retaining walls and revegetation of cut areas	Proponent / Contractor
	• Alteration of Agusuhin River and North Agusuhin Creek courses	• Adequate channel design • Riverbank protection	Proponent / Contractor
	• Potential sea water intrusion due to over abstraction of groundwater	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent / SBMA / LGUs
	• Depletion of groundwater resource	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent
	• Water quality degradation due to land clearing and excavation	• Installation of drainage canals with silt traps. • Settlement of suspended solids in natural depressions • Water Quality Monitoring	Proponent / Contractor
	• Water quality degradation due to oil and grease	• Containment canal around motor pool • Oil and Grease separators • Water Quality Monitoring	Proponent / Contractor
	• Water quality degradation due to reclamation and dredging	• Installation of silt curtains • Scheduling of reclamation and dredging activities	Proponent / Contractor
	• Air pollution from equipment, machinery and generator set	• Regular maintenance of equipment, machinery and generator set • Air quality monitoring	Proponent / Contractor
	• Dust generation	• Periodic watering of bare soil in construction area	Proponent / Contractor
	• Noise generation	• Installation of buffer areas/ PPEs to workers exposed to excessive noise	Proponent / Contractor
Biological	• Removal of vegetation	• Watershed management • Re-landscaping of bare grounds	Proponent
	• Displacement of resident fauna	• Replanting of indigenous plants in vacant spaces and along waterways.	Proponent
	• Degradation of Aquatic Ecology	• Installation of sheet piles • Installation of silt curtains • Selection of reclamation site	Proponent

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Environment	Impact	Mitigation Measure	Institutional Responsibility
Socioeconomic	• Change in Land Use	• Prompt payment of lease and other permits	Proponent
	• Affect reforestation area	• Compensation for improvements to the reforestation area	Proponent
	• Affect Marine sanctuary	• Consultations with LGUs and community and securing proper documentation	Proponent
	• Displacement of households	• Resettlement Action Plan	SBMA
	• Generation of employment and livelihood opportunities	• Prioritizing qualified residents near the project site • Establishment of a Community Relations Office	Proponent
	• Increase in commercial activities	• Prioritizing local suppliers in buying company requirements	Proponent
	• Additional income and benefits to LGUs	• Prioritizing local suppliers in buying company requirements	Proponent
	• Health concerns (Air and Noise pollution)	• Installation of a water sprinkling system • Face masks for construction workers • Proper maintenance of equipment • Hiring of qualified drivers	Proponent

7. SUMMARY MATRIX OF ENVIRONMENTAL MANAGEMENT PLAN (OPERATION PHASE)

Environment	Impact	Mitigation Measure	Institutional Responsibility
Physical	• Solid waste generation	• Concrete Solid Waste Management Program following the guidelines set by the Ecological Solid Waste Management Act of the DENR	Proponent / SBMA EC
	• Potential sea water intrusion due to over abstraction of groundwater	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent / SBMA / LGUs
	• Depletion of groundwater resource	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent
	• Water quality (Surface Water)	• Water Quality Monitoring • Wastewater Treatment Plant • Use of organic chemicals in landscaping activities	Proponent / SBMA EC
	• Air quality	• Air Quality Monitoring • Regular maintenance of machinery and equipment	Proponent / SBMA EC

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Environment	Impact	Mitigation Measure	Institutional Responsibility
	• Noise generation	• Installation of fences and buffer area	Proponent
Biological	• Flora	• Re-landscaping of bare grounds • Watershed management	Proponent / SBMA EC
	• Return of Wildlife	• Preservation	Proponent
	• Return of Aquatic Organism	• Preservation	Proponent
Socioeconomic	• Influx of informal dwellers	• Implementation of land use plan • Prevention of influx of informal dwellers	Proponent / SBMA / Subic LGU
	• Generation of employment and livelihood opportunities	• Prioritizing of qualified local residents • Prioritizing of local suppliers for company needs (livelihood generation)	Proponent
	• Additional revenue for LGU	• Prompt and correct payment of taxes	Proponent
	• Health (Air and Noise Quality)	• Installation of air pollution devices • Health monitoring • Revegetation	Proponent / SBMA EC

8. MATRIX OF ENVIRONMENTAL MONITORING PLAN

Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
Construction Phase						
Dust	4 stations 50 m from site	Monthly during dry season and quarterly during rainy season	Gravimetric	DAO 14	Proponent	P 12,000
TSS	3 stations at northern tributary, 1 station at confluence	Quarterly	Gravimetric	DAO 34	Proponent	P 12,000
Color	3 stations at northern tributary, 1 station at confluence	Quarterly	Visual comparison	DAO 34	Proponent	P 4,000
Oil & Grease	3 stations at northern tributary, 1 station at confluence	Quarterly	Gravimetric (petroleum ether extraction)	DAO 34	Proponent	P 16,000
BOD_5	3 stations at northern tributary, 1 station at confluence	Quarterly	Azide modification (dilution technique)	DAO 34	Proponent	P 24,000

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Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
pH	3 stations at northern tributary, 1 station at confluence	Quarterly	pH meter	DAO 34	Proponent	P 6,000
DO	3 stations at northern tributary, 1 station at confluence	Quarterly	DO meter	DAO 34	Proponent	P 6,000
Siltation	3 stations at northern tributary, 1 station at confluence	Quarterly	Visual inspection	Presence of silted areas	Proponent	P 4,000
Solid and liquid wastes	Construction site	Quarterly	Visual inspection	Presence of accumulated wastes	Proponent	P 1,000
Aquatic Ecology	Coastline	Quarterly	Visual inspection	Presence of different living organisms	Proponent	P 120,000
Operation Phase						
SO_2	4 stations within 1000m from site	Quarterly	Pararosaniline Method	DAO 2000-81	Proponent	P 50,000
NO_2	4 stations within 1000m from site	Quarterly	Greiss-Saltzmann	DAO 2000-81	Proponent	P 50,000
TSP	4 stations within 1000m from site	Quarterly	Gravimetric	DAO-2000-81	Proponent	P 50,000
Noise	Outside plant, closest homes	Weekly for the first quarter after start of operations, quarterly thereafter	Noise meter	sleep disturbance annoyance	Proponent	P 10,000
Temperature	Settling pond Upstream, downstream and at proposed outfall	Quarterly	Hg thermometer	DAO 34	Proponent	P 6,000
pH	Upstream, downstream and at proposed outfall	Quarterly	pH meter	DAO 34	Proponent	P 6,000
COD	Upstream, downstream and at proposed outfall	Quarterly	Azide modification	DAO 34	Proponent	P24,000

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Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
BOD_5	Upstream, downstream and at proposed outfall	Quarterly	Azide modification (dilution technique)	DAO 34	Proponent	P24,000
Oil & Grease	Upstream, downstream and at proposed outfall	Quarterly	Gravimetric Method	DAO 34	Proponent	P 16,000
DO	Upstream, downstream and at proposed outfall	Quarterly	Gravimetric Method	DAO 34	Proponent	P 24,000
Aquatic Ecology	Coastline	Annually	Visual inspection	Presence of different living organisms	Proponent	P 30,000
Employee health status		Annually		DOLE OSHS	Proponent	P 200,000
ESTIMATED GRAND TOTAL PER YEAR						**P 695,000**

9. PROPOSAL OF ENVIRONMENTAL MONITORING AND GUARANTEE FUND

9.1 ENVIRONMENTAL MONITORING FUND (EMF)

The proponent shall open an account in Trust to finance the Environmental Monitoring Fund (EMF) at any mutually acceptable commercial bank in Subic (to be determined). The purpose of the EMF is to finance the monitoring activities to be conducted at the project site and affected areas.

9.2 ENVIRONMENTAL GUARANTEE FUND

The Environmental Guarantee Fund (EGF) shall be established and used exclusively for the following purposes:

- Immediate rehabilitation of areas affected by damages in the environment and the resulting deterioration of environmental quality as a direct consequence of project construction, operation and abandonment;
- Just compensation of parties and communities affected by the negative impacts of the project;
- Conduct of scientific or research studies related to the project that will aid in the prevention or rehabilitation of accidents and/or environmental damages; and
- Contingency clean-up activities, environmental enhancement measures, damage prevention programs and social equity measures (e.g. livelihood, social development programs) including the necessary IEC and capability building activities related to the project.

The EGF shall have two (2) components as follows:

1. Trust Fund – The proponent shall secure an Insurance Policy in the amount to be determined which will guaranty payment in fifteen (15) days from date of receipt of formal demand from the EGF COMMITTEE to pay a certain party by reason of the damage caused by the project as ascertained by the Committee; and
2. Environmental Guarantee Cash Fund – The proponent shall open an account for the Environmental Guarantee Cash Fund at a mutually acceptable commercial bank in the area in the initial amount to be determined which shall be earmarked for immediate rehabilitation and compensation of affected communities in case of damage or accidents. It shall also be used to cover the operational costs of the EGF Committee.

10. SUMMARY OF PROCESS DOCUMENTATION REPORT

The EIA process includes scoping and public consultations with various stakeholders and individuals that are directly affected by the proposed shipbuilding facility project. Related activities included the conduct of perception surveys in Sitios Agusuhin, Nagyantok and Nagtulong. Likewise, Focus Group Discussions (FGDs) were also conducted with the people's organizations of Sitio Agusuhin. The following is the chronology of events for the preparation of the EIS for the HHIC- Phil Inc. Proposed Construction of Shipbuilding Facility:

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August 5, 2005	First Level Scoping Meeting with Ecology Center, SBMA
October 8, 2005	Second Level Scoping Meeting with the Community in Sitio Agusuhin, Brgy. Cawag, Subic, Zambales
Sept. 16 - Oct. 9, 2005	Primary/Secondary Data Survey
Sept. 16 – 18, 2005	Perception Surveys (Sitios Agusuhin, Nagyantok and Nagtulong)
Oct. 21 – 25, 2005	Primary Baseline Survey (Air, Noise, Water, Site Geology,Terrestrial, River/Creek and Marine)
Oct. 8 – 9, 2005	Focus Group Discussions (Sitio Agusuhin)
Nov. 4, 2005	Shipwreck Survey and Verification (Sitio Agusuhin)

11. PROOF OF SOCIAL ACCEPTABILITY

Scoping meeting and public consultation were conducted to gain estimate of the public acceptance of the project. This was supported by a perception survey done in the impact area to gauge public acceptance levels.

More than two-thirds of respondents (67.15%) are in favor of the project while only 11 respondents (2.6%) are against the project. A significant number of respondents (19.67%) are not sure if they will accept or reject the project. In addition, 44 respondents had no comments about the project. The primary reason for acceptance is economic. The residents see the project as the salvation to their miserable economic conditions. The primary reasons for rejection are lack of information about the project and there is no agreement yet on what will SBMA offer for resettlement and/or compensation.

Compensation is being handled by HHIC- Phil Inc. while relocation is being handled jointly by the provincial goverrment of Zambales and municipal government of Subic.

With the new directives from the DENR, endorsements of stakeholders in favor of the project are not pre-conditions for the approval of an ECC. These endorsements merely reinforce the viability of a proposed project. The project should be assessed and evaluated based on its merits and should not depend on the endorsements of the stakeholders. In the past, some of these endorsements have been used to extract favors from the proponent of the project.

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1.1 PROJECT BACKGROUND

The proposed project site is located in the former US military training ground in Sitio Agusuhin also known as "Green Beach" of the Subic Bay Freeport Zone. In 1998, the project site was also developed into a casting basin for the construction of the Malampaya Concrete Gravity Structure (CGS), a component of Shell's Deep Water to Gas Project. The presence of the casting basin and the favorable physical, social and political settings of Sitio Agusuhin were among the basis for the selection of Green Beach for this project site.

The total area that will be developed for the shipbuilding facility is approximately 300 hectares. Details and description of the project components will be discussed in details in this section according to the level of project's operations, i.e. a) hatch cover assembly, b) construction of full container ships, and c) construction of bulk carriers, tankers, very large crude carriers, and LNG containers.

With the area coverage of 300 hectares, the existing community of Sitio Agusuhin will be relocated to give way for the construction of the shipbuilding facility. Construction activities will involve earth-moving and leveling activities of the elevated areas of the northern side of the project site. An estimated volume of 1.16 million cubic meters of earth from this area will be used for the reclamation and filling of the existing ponds in the community. Other construction activities will also include dredging, backfilling, excavation, reclamation, embankment, sheet piling and compaction of all materials within the limit of work required to construct drainage, building construction, dry docks, roads or other purposes in accordance with the design specification and conformity to the implementing rules set by SBMA.

Excavation is the extraction of materials by digging from which any useful material extracted will be used for building and engineering purposes. During excavation all suitable materials for backfilling and embankment will be stored at sufficient distance from bank or trenches to avoid overloading or slides that will endanger both life and property. Steep slopes will be provided with horizontal benches and sodding to control soil erosion. Another method to control migration of silt through waterways is to construct temporary siltation ponds along the discharge points of the channel.

Selective grading of designated areas will insure better distribution of run off, thus minimizing the danger of erosion. Grading will be by scarifying, balding, rolling and other methods to provide thoroughly compacted grades. Grading and excavation works will be done in phases.

Improvement of north Agusuhin Creek and south channel (Agusuhin River) is essential to improve the discharge capacity of natural channels and to protect adjacent facilities. Ditches and channels will convey runoff from building and other surrounding areas to the improved channels. Construction of embankment by layer placement begins in the deepest portion of the fill. As placement progresses, layers shall be constructed approximately parallel to finish pavement level. Slopes are protected by layers of filter mat, riprap, mortar concrete, 200 x 200 x 200 mm pre-cast concrete block/armour stone and sodding.

Reclamation work will commence with the installation of spiral steel pipe piling along the coastal area to provide protective barrier between reclamation and dredging works and the open sea. Pilings will prevent sea water from entering the work area of reclamation or preventing fine silt from escaping to coastal areas by providing layers of rubble stone, filter stone and filter mat as practical measures to assure economical, effective and continuous erosion control throughout the construction period.

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Dredging machine consists of hoisting or suction equipment, usually powered by a diesel engine mounted on a barge like float. Dredges are constructed to deepen or widen waterways, to provide fill material, to build dikes, and to prepare underwater foundations.

The proposed dredging work will utilize 11 m^3 capacity grabs bucket dredger or clamshell bucket dredger with hooper barge for the hauling and transfer of dredge materials. These materials are pump-out to the designated disposal area through floating pipelines. The proponent will adopt the same dredging procedure applied by the on-going Port Development Project of SBMA.

1.2 PROJECT STATEMENT

The proposed shipbuilding facility project of Hanjin Heavy Industries and Construction- Phil Inc. (HHIC- Phil Inc.) located in Green Beach, Subic Bay Freeport Zone (Sitio Agusuhin) is considered as one of the biggest current foreign investment in the country with a total investment of up to US$ 800 million. The project aims to establish a state-of-the-art shipbuilding facility to further expand its operations outside of South Korea. It is estimated that a total of 8 large ocean-going ships with state-of-the-art automation system will be built annually. The project being the biggest shipbuilding facility will help boost the economy of the country with the employment and revenues that will be generated by the project.

1.3 ENVIRONMENTAL IMPACT ASSESSMENT

1.3.1 THE EIA PROCESS

1.3.1.1 Scoping Process

First Level Scoping Meeting

The First Level Scoping of the Project was held on August 5, 2005 at the SBMA Ecology Center and was attended by the representatives of the proponent, the Ecology Center, and the KKCS as the EIA preparer. The main agendum of the meeting was to identify and discuss the items to be included in the EIS report as contained in the First Level Scoping Checklist (EIA Form RRA 1-A). A copy of the completed checklist, signed and agreed upon by parties, is attached as **Appendix 1**.

Second Level Scoping Meeting

As a requirement of DENR Administrative Order (DAO) 96-37, a Second Level Scoping Meeting was held on 08 October 2005 at the Sitio Agusuhin open basketball court. Various stakeholders attended the meeting which was headed by the Agusuhin Neighborhood Association (ANA), Barangay Cawag representatives, SBMA Ecology Center representative, Peoples Organizations, and KKCS (Hanjin's environmental consultants). The purpose of the meeting was to solicit issues and concerns of the various stakeholders regarding the proposed project.

Table 1-1 summarizes the issues and concerns raised by the various stakeholders during the open forum. Some of the issues were addressed by the proponent, whereas, other issues were noted and will be included in the scope of the EIA.

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Table 1 - 1. Stakeholder's Issues and Concerns

Issues/ Concerns	Responses
Where will be the relocation site and how much will they be compensated for their houses and improvements? There were questions on the location of the relocation area, sizes of the lots, payment and other conditions.	The relocation and compensation issues will be handled by SBMA as the owner of the land. There is a long-term lease agreement between SBMA and Hanjin. Based on the lease agreement SBMA will be responsible for these issues. It was explained that SBMA has formed a group that will study and recommend how to handle the relocation and compensation issues
What will happen to the farm lots that are not included in the 300-hectare area to be occupied by the proponent?	It was explained that the scope of the study is only for the 300-hectare area, hence, in so far as the study is concerned, the area will be limited to the area to be occupied by HHIC- Phil Inc.
Is it true that SBMA would not permit the transfer or relocation of affected families into other SBMA areas? Some participants suggested that they be permitted to relocate to other SBMA areas. In this way, they will not be charged anymore for the amortization of their relocation lots because SBMA will not buy anymore from owners of nearby lands.	It was explained that SBMA would formulate and implement a policy about relocation. The details of the policy are not yet available. KKCS will study the viability of such proposal and come up with the findings and recommendations to SBMA.
There are residents who have a 2.5 hectares land stewardship under the CBFMA. Are they permitted to transfer to these areas for their relocation? It was suggested that the members of the reforestation association be permitted to be relocated in their respective areas under CBFMA.	It was reiterated that the final relocation site would be decided by SBMA as the responsible entity for relocation after considering a variety of factors including financial, social and legal aspects. KKCS will study this option and will provide recommendations as to the financial, legal and social viability.
A participant asked if the relocation site will have similar community facilities to that existing in their community such as chapels and schools.	A relocation site should have basic services such as provisions for education, health, power, water and roads. The details are now being studied by SBMA.
Accessibility of fishermen to their animals and boats from the relocation site.	KKCS to study and will endorse to SBMA concerns about the animals and bancas.
Will the length of stay in the area be a factor in determining compensation?	KKCS will study if the length of stay may be included as one of the factors in determining compensation considering the nature of the stay of the residents within SBMA land. It should be emphasized that there are other factors to be considered.
What will happen to the trees they planted and the crops they grow? Agriculture.	The trees and crops will be properly compensated. The valuation of the trees and crops will be based on the rates of the Municipal Assessor's Office or Department of Agriculture.

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Issues/ Concerns	Responses
Will scholarship for students be offered?	The access to education will be provided for but scholarship will be at the discretion of SBMA or the project proponent. The study may recommend educational support for deserving but financially challenged households.
Employment for affected communities	Priority will be given to qualified residents of the affected communities. Applicants who are not qualified for employment may undergo skills training to acquire the needed qualifications to be employed in the project.
Can they still be hired even if they are relocated?	Priority employment will be given to qualified residents of Sitio Agusuhin and the neighboring sitios of Nagyantok and Nagtulong.
Issue on newly transferred migrants and their houses?	KKCS will study the matter and recommend measures to SBMA how to handle and address this issue.

Post Scoping

Proceedings and results of the first and second level scoping meetings were documented and contained in a Scoping Report which is attached as **Appendix 2**.

1.3.1.2 Environmental Baseline Studies

The scope of the study includes the assessment of the probable impacts of the proposed shipbuilding facility on the land, water, air and noise environments of the study area and perception and acceptability of the project by the stakeholders and recommendation for the mitigation of the perceived adverse impacts and enhancement of the positive effects. Primary and secondary data were gathered during surveys conducted from September 16 to October 09, 2005. In the process both positive and negative impacts were dealt with.

Baseline data on air, noise, soil, water quality, terrestrial ecology and water resources within the project site and its vicinity were obtained through appropriate sampling techniques from September 21 to 25, 2005. Air quality samples were sent to Ostrea Mineral Laboratory in Biñan, Laguna, while the water samples were sent to CRL Environmental Corporation in Manila. Primary data for terrestrial and aquatic ecology were gathered through field sampling, ocular inspection, and interviews. Water resources investigation consisted of well inventory and reconnaissance survey of surface and groundwater regimes.

Perception survey of the impact areas were conducted from 16-18 September 2005. The survey used a 38-item questionnaire. The questionnaire covers 11 areas: respondent's profile, migration and settlement history, perception of the project, housing and utilities, household income and employment, community problems, farming operation, perception on environmental situation, health, decision-making patterns and information sources.

Secondary data were obtained from government and private agencies (e.g. PAGASA on climate, National Statistics Office and the Municipal Office for municipal profiles, etc.) listed under the reference section of this report

In the impact assessment, predictions were quantified where applicable and where methods are available. For each activity, the impacts were identified and/or predicted, and mitigating measures with the corresponding cost were identified. These are presented in the matrix form of

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the Environmental Management Plan (EMP). The Environmental Monitoring Program (EMP) has been prepared that details the parameters and frequency to be monitored to determine compliance to the environmental standards. A Social Development Plan (SDP) has been prepared for the affected communities.

1.3.2 PARTICIPATION OF STAKEHOLDERS IN THE STUDY

Active representation and participation from stakeholders in the municipality was gained during the scoping meeting held on 08 October 2005, which allowed stakeholders to raise issues of local importance to the EIA study. Focus Group Discussions (FGDs) with three Sitio Agusuhin peoples organizations were held on 08 – 09 October 2005.

Whenever possible, assistance from the residents of Sitio Agusuhin was engaged during the data-gathering process, particularly for the marine ecology, fisheries and socio-economic sections of the EIA.

1.3.3 THE EIA TEAM

The EIA Team is composed of multi-disciplinary experts whose tasks areas follows:

Key Personnel	Responsibilities/Fields of Expertise
Melchor L. Aguilera, Jr.	Project Director/Overall Coordinator
Ruben A. Estudillo	Project Manager/Team Leader/Aquatic-Marine Ecology, Water Quality
Anacleto Q. Suelto, Jr.	Deputy Project Manager/Geology, Hydrology and Hydrogeology
Rolando T. Soncuya	Team Leader/Socio-Cultural and Economic and Political Aspects
Benjamin U. Garcia	Team Leader/Terrestrial Ecology- Vegetation and Wildlife
Alexander T. Guintu	Environmental Risk Assessment
Dr. Daphne D. Bate	Health Risk Assessment
Jesus V. Lorenzo	Meteorology & Air Quality and Noise
Paul Rivera, Ph.D.	Oceanography
Angelito I. David	Waste Management

1.3.4 SUMMARY OF PROCESS DOCUMENTATION REPORT

The EIA process includes scoping and public consultations with various stakeholders and individuals that are directly affected by the proposed shipbuilding facility project. Related activities included the conduct of perception surveys in Sitios Agusuhin, Nagyantok and Nagtulong. Likewise, Focus Group Discussions (FGDs) were also conducted with the people's organizations of Sitio Agusuhin. The following is the chronology of events for the preparation of the EIS for the Hanjin Proposed Construction of Shipbuilding Facility:

August 5, 2005	First Level Scoping Meeting with Ecology Center, SBMA
October 8, 2005	Second Level Scoping Meeting with the Community in Sitio Agusuhin, Brgy. Cawag, Subic, Zambales

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Sept. 16 - Oct. 9, 2005	Primary/Secondary Data Survey
Sept. 16 – 18, 2005	Perception Surveys (Sitios Agusuhin, Nagyantok and Nagtulong)
Oct. 21 – 25, 2005	Primary Baseline Survey (Air, Noise, Water, Site Geology,Terrestrial, River/Creek and Marine)
Oct. 8 – 9, 2005	Focus Group Discussions (Sitio Agusuhin)
Nov. 4, 2005	Shipwreck Survey and Verification (Sitio Agusuhin)

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2.1 BASIC INFORMATION

Project Name	:	**HHIC-Phil Inc. Subic Project – Shipbuilding Facility**
Proponent	:	**Hanjin Heavy Industries & Construction–Phil Inc.** 2nd Floor, Eurovila Condo.I, Legaspi cor. V.A. Rufino Sts. Legaspi Village, Makati City (Sitio Agusuhin, Brgy. Cawag, Subic, Zambales) Telephone Nos.: 02-893-2063 to 64 (Manila Office); 047-252-5602 (Site Office) Facsimile Numbers: 02-8189366 (Manila Office); 047-252-3977 (Site Office)
Contact Persons	:	**Byung Woo Ko** Project Manager **Kwang Ho Kang** Chief Engineer, Construction Department **Pyeong Yeol Lee** Chief Engineer, Shipbuilding Dept
Environmental Consultant	:	**Kultura at Kalikasan Consultancy Services, Inc.** LG-32 City Square Condominium, Estacion St., Makati City (Manila Office) (Site Office: NSD Compound, Subic Bay Freeport Zone) Tel. nos.: 02-458-7192 Telefax no.: 02-750-1990
Contact Person	:	**Melchor L. Aguilera, Jr.** Managing Director

2.2 SITE LOCATION

The project site is located in Central Luzon or Region 3, in the Province of Zambales, specifically within the political boundaries of the Municipality of Subic. It is more or less 90 km (straight distance) from Manila. Administratively, the site is within the jurisdiction of the Subic Bay Freeport Zone (SBFZ) as managed by the Subic Bay Management Authority (SBMA).

The facility is set to be constructed and operated in Sitio Agusuhin (Redondo Peninsula), Barangay Cawag, Subic, Zambales, Subic Bay Freeport Zone with a total area of 300 hectares and centered at geographic coordinates of 14° 49' 10.33" North latitude and 120° 12' 30.03" East longitude. It is located on the eastern side of the Silanguin Peninsula and is about 8 km west of the central business district across Subic Bay. The proposed 300-hectare project area includes the former site used for the construction of the concrete gravity structure (CGS) which was an integral component of the Malampaya Natural Gas Project providing the necessary foundation for the SWP, an off-shore gas processing facility that was designed to remove the unwanted moisture from the natural gas before this is piped onland to other receiving facilities. Proposed developments will extend from the CGS southwest and landward, and to the adjacent coastal areas north of it and south of it just across Agusuhin River. The project site lie spread over the valley of Agusuhin River and is bordered to the north and west by Mount Redondo, to the south by Mount Silanguin, and east by Subic Bay. Currently, there are no roads (all weather) that lead to the site and access to the area is via water transport. **Figure 2-1** shows the location of the project site.

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Figure 2-1. Location Map

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2.3 PROJECT RATIONALE

HHIC is expanding its shipbuilding business to the Philippines to cater to the needs of the international shipping market. The shipbuilding facility will generate about 10,000 jobs which will directly benefit around 3,000 managerial/supervisorial level and technical personnel and another 7,000 skilled shipyard workers, who will be employed and undergo company-sponsored state-of-the-art training to fully equip them for the operations of the facility. Indirectly, the project is estimated to benefit an additional 20,000 to 30,000 professionals/workers who will be engaged in the ancillary/related industries and by locator-clients. The project is considered high-priority by the Philippine Government, and the facility is envisioned to generate around US$ 800 million worth of exports (consisting of 18 ships built annually) and is expected to put the Philippines in the world map of shipbuilding.

The facility will also serve as some sort of a catalyst for introducing or expanding development into the area – thus spurring/increasing the economic productivity of the area. Once fully operational, the project site and the area immediately around it are expected to become a highly urban community, much like a small city.

2.4 PROJECT ALTERNATIVES

The site is ideal for this type of development which requires large areas both for operations and future expansion, wide and open berthing areas, and deep water levels, aside from being the former site of the CGS. In fact, it was anticipated that the former CGS site will be converted for possible use similar to that of the proposed facility. Much like the basis for the selection of the site for the CGS, the site fits the needs of the proposed facility due to the absence of critical ecosystems within the impact area and the high likelihood of social acceptability. In addition, the following are listed as advantageous in the selection of the site: given the topography of the area – it is a natural haven from typhoons, large undeveloped areas which facilitates expansion, presence of a pier, slightly rolling terrain, located far from the industrial areas of SBFZ – and will therefore pose no additional environmental burden to the said area, and of course being a Freeport zone, the proponent stands to benefit from tax exemption, among others. Thus, the proposed project essentially builds upon that of the previous one (CGS). Based from the abovementioned, there is no other alternative site considered for locating the proposed project. Technology and equipment-wise, there are no alternatives as the proponent will be bringing in its own as developed from their country. Processes to be employed and the materials to be used, especially during shipbuilding, will be those which are state-of-the-art and thus mostly likely proven to be already environment-friendly or which may require minimal management in terms of disposal.

State-of-the Art Processes:

Automated and mechanized blasting and painting systems: Pressure-controlled blasting and painting (drying) in an enclosed/contained environment thus preventing discharge of materials (blasting) and escape of volatile organic solvents (painting). Placement and movement of pressurized hoses containing blasting media are mechanically controlled from afar in a protected and well-ventilated part of the blasting shop, similarly, painting is done in similar fashion in the painting shop.

Plasma cutting (computer-aided): Plasma cutting is a process that severs metal by using a constricted electric arc to melt a localized area of a work piece, removing the molten material with a high-velocity jet of ionized gas issuing from the constricting orifice. This process produces fine and near-to-smooth cut materials and with the aid of computers (computer-aided

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manufacturing) generates accurate shapes and sizes of metals making the process efficient (less wastage).

Automated and mechanized transfer systems: Magnetized high-capacity cranes and controlled hoist systems, conveyors, and high-capacity prime movers (4-axle trucks).

Materials:

Use of TBT-free anti-fouling paint: a co-polymer compound which functions as effectively as TBT-containing fouling paints but with no proven adverse environmental effects.

Use of recyclable abrasive materials (for blasting): blasting will be done solely for surface preparation and not necessarily for stripping paints and thus the non-use of solvents and which can be reused several times. These materials include sand and beads, as well as, some metal grits. Another material used for this purpose is carbon dioxide (CO_2) pellet. CO_2 cleaning is a form of abrasive blasting, in which hard pieces of frozen CO_2 are shot at a surface with air or other gases. It is replacing some sandblasting and beadblasting operations. The pellets can be generated in different sizes and propelled at various speeds to increase cleaning rates or reduce surface damage. The advantage of the CO_2 pellets is that they sublimate on contact with the material to be cleaned. The sublimation of CO_2 pellets does not release new CO_2, a greenhouse warming gas. Instead, it uses CO_2 that is derived from other chemical processes.

2.5 PROJECT COMPONENTS, PHASES AND TIME FRAME

The project will involve the preparation/modification of the site, construction of the necessary facilities and utilities/support systems, and the actual operation - shipbuilding activities (**Figures 2-2 and 2-2a**).

a. Development Phase
   - Site preparation which shall involve property clearing, ground level preparation and activities necessary to stabilize the land and coastal area
   - Construction of temporary facilities, structures and channels
   - Construction and installation of perimeter roads, fence, gates , lighting and watch towers
   - Stream improvements
   - Construction of Access Road (by DPWH)
   - Installation of batching plants/crushers /power generators
   - Steel pipe piles, sheet pile and pile driving
   - Excavation and quarrying
   - Reclamation
   - Dredging and backfilling
   - Construction of underground Utilities (storm, sanitary, electrical/communication system and other mechanical provisions)
   - Construction of dry dock no.1, no.2, quays, wharves, seawalls, floating breakwaters, embankments/stockyards, P.E yards, roads, development of channels, and other offshore structures
   - Construction of assembly field and unloading area pavement roads
   - Construction and installation of deep wells and Water Treatment System for potable and industrial water supply
   - Construction and erection of steel structures and other shipbuilding facilities (shops, yard, storage building, sewerage and storm drain and wastewater collection facilities)

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- Installation of mechanical, electrical and communication distribution system
- Construction of ancillary facilities (office buildings, training centers, welfare center, catering building, employees quarters and recreational facilities)
- Installation of shipbuilding equipments and facilities (cranes, pumping stations, power station, auxiliary generators and distribution system, and fuel and gas stations)

b. Operational Phase
   - Expansion and development of shipbuilding facilities, equipments, and technology
   - Fabrication and construction of ship parts and assemblies
   - Shipbuilding works

The main project components are directly associated with the work processes involved in shipbuilding (actual operation) – and thus the construction of the corresponding and necessary facilities that support these processes. Shipbuilding process is described as follows: a) delivery and storage of materials to be processed or for outfitting, i.e., plate stowage, section stowage, outfit materials and brought in items; b) processing of materials, more particularly for plates which are shotblasted/sandblasted/primed and thereafter, flamed planed, flame profiles, marked and shaped (cut/bended – as desired/per design) and sections which are also shotblasted/sandblasted/ primed but which may undergo some bending and cutting only, while outfit materials and brought in items, such as pipes are bended mainly; c) assembly - where cut/bended plates are put together to come up with sub-assemblies, panel assemblies, and matrix assemblies, curved unit assemblies – and similarly for sections, as well as, outfit fabrication and assembly until palletisation and modules have been formed – thereby all forming a block (block assembly); d) pre-erection – blocks and modules are further fitted with related equipment or attachments and laid out to form the ship; and e) erection and testing where the blocks and modules are joined to form the ship and tested for its performance on water.

Cranes of varying types and capacities are placed strategically in areas where lifting of heavy equipment and materials from one point to another or transfer to trucks for delivery to appropriate shops for processing.

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Figure 2-2. Site Development Plan

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Figure 2 - 2-a. Project Site Development Plan

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In addition, necessary support utilities will also be constructed including a power station and distribution system, a gas station and distribution system, air compression and distribution systems, water supply, including pump station, and distribution system, wastewater treatment and collection system. Offices (field, main, and administration), production center/central tool station/utility station (restaurant and change lockers) and a maintenance shop, training center and a gymnasium, and apartment (personnel lodging/quarters) will also be constructed onsite as amenities and in support of the personnel engaged by the proponent. The area will be fenced and gates placed in strategic areas and maintained to facilitate entry and exit to the whole facility while at the same time securing it – the equipment and materials therein and its personnel. **Table 2-1** below shows project phases summary and time frame.

Table 2-1. Project Phase Summary and Time Frame (Source: HHIC-Phil Inc.)

	Phase 1	Phase 2	Phase 3
Time Frame	2 Yrs After Commencement of Investment	4 Yrs After Commencement of Investment	10 Yrs After Commencement of Investment
Site Area	200 Ha.	250 Ha.	250 Ha.
Products	Hatch Cover for Container Vessels	Bulk Carrier Over 52,000 DWT Grade (Medium-Sized Shipyard)	5,000 – 10,000 TEU Container Vessel/Oil & Gas Carrier/SPS
Capacity	30,000 Tons/Year	12 Vessels/Year	18 Vessels/Year
Remarks	Training of Filipino Workers	-	-

2.5.1 SITE PREPARATION

This shall involve property clearing and ground level preparation, dredging, and the attendant activities necessary to stabilize the land and coastal area in preparation for the construction of the crusher and concrete plant, dry docks, quay/quay wall, assembly field pavement / unloading area (foundation), road pavements, ducts, stream improvement, water supply and drain structure, and electrical installations, concrete plan and crusher, and a temporary office (**Figure 2-2b**).

Most of the works involved, especially for the dry dock and quay wall will involve dredging, pile sheet and pile driving, excavation and backfill, slope protection (rip-rapping), and massive reinforced concreting.

2.5.1.1 Dry Dock

The landward portion of the CGS basin will be further excavated to make way for Dry Dock No. 1. For newbuildings, the drydock is the area where erection is done and later on for testing the ship in water, as water is allowed to enter inside.

Two 600-ton Goliath Gantry Cranes are situated near both ends of the length of the dry dock for stabilizing the ships being constructed – as well as for the lifting of materials necessary for the construction (placement of engine and superstructure). In addition, two 60-ton Tower Cranes are

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situated on both sides of the dry dock and which also facilitate lifting/transfer of materials and equipment during building.

In the latter phase, the mouth of Agusuhin River, located south of the site of the former CGS basin, will be excavated landwards for the construction of Dry Dock No. 2. This dry dock will also used for the erection/servicing of ships. Two 450-ton Goliath Gantry Cranes are found near both ends of the dry dock. A 60-ton crane is also found beside one of the Goliath Gantry Cranes found on the seaward side of the dry dock.

Figure 2.2c is channel diversion layout plan for the Agusuhin River (South Channel) in relation to the proposed drydock and the North Agusuhin Creek (North Channel). As in any major development involving diversion of natural drainages, an extensive hydrological study will be conducted by the proponent to determine both normal and peak flows as part of the detailed engineering design. Generated streamflows and peak flows presented in this EIS are preliminary and will be subjected to a more extensive analysis during the detailed engineering design phase. All necessary permits will be secured from concerned agencies (Subicwater or the National Water Resources Board) prior to any planned development.

2.5.1.2 Quay Wall

This involves the construction of the wharves and seawalls wherein dredging and excavation will be done to establish the outline of the facility facing the bay (**Figure 2-2d**). The quay is essentially a platform, built upon dredged shoreline and stabilized by sheet pilings, which serves as a loading and unloading area for the delivery of materials, mainly metals/steel sheets used and other components necessary for the fabrication of hatch covers/other parts, to the facility. A crane, that facilitates loading and unloading of materials, is situated adjacent to the quay.

The quay will be built along the dredged shoreline adjacent to the former site of the Malampaya CGS casting basin as can be seen in **Figure 2-2e.**

2.5.1.3 Assembly Field and (Quay) Unloading Area Pavement

The quay is essentially a platform, built upon a dredged shoreline and stabilized by sheet pilings, which serves as a loading and unloading area for the delivery of materials, mainly metal/steel sheets used and other components necessary for the fabrication of hatch covers/other parts, to the facility. As opposed to a pier, which is constructed perpendicular to the shore, a quay is roughly parallel to and alongside navigable water. The quay will be built along the dredged shoreline adjacent to the former site of the CGS basin. A crane, that facilitates loading and unloading of materials, is situated adjacent to the quay. Situated nearby is the assembly field the construction of which essentially involves concreting of this portion.

2.5.1.4 Road Pavements

All roads as planned will be paved to grades that will support loads of heavy machineries, such as those used in transferring steel/metal sheets and/or assemblies.

2.5.1.5 Duct Construction

A gas pipeline network and a gas tank farm will be constructed to supply Nitrogen, Oxygen and Acetylene gas for the cutting and welding activities. The pipeline and Gas tanks shall be designed in accordance with standard engineering design, ASTM and DOLE standards for gas pipeline and gas storage tanks. Corresponding ERA for these structures will be included in the ERA.

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2.5.1.6 Stream Improvement

Banks along the portion of Agusuhin River traversing the project site will be also be rip-rapped for slope protection and minimize/prevent erosion while at the same time ensuring steady and natural flow of the river (**Figure 2-2f**).

2.5.1.7 Water Supply and Drain Structure

Sewerage pipes and storm drains will be constructed accordingly and, where appropriate, linked to the wastewater collection system for processing at the wastewater treatment plant. Sewage generated is estimated to 1,580 m^3/day and this will undergo treatment at the wastewater treatment plant.

Table 2-2 is an updated water demand for the proposed shipbuilding project. For the construction and operation of the facility, a total of 10,300 workers will be engaged starting from 2005 to 2015. These include 5,000 workers engaged in shipbuilding for Phases 1 to 2 (2005–2010) to 10,000 for Phase 3 (2011-2015), while 500 construction workers will be hired for Phases 1 and 2 and 300 for Phase 3, respectively.

Table 2-2. Updated Project Water Demand (m^3/day)

Water Usage	Phase 1	Phase 2	Phase 3	Total (Phases 1 to 3)
	2005 to 2007	2008 to 2010	2011 to 2015	
Domestic	615	987	372	1,974
Industrial	1,065	1,713	648	3,426
Total	**1,680**	**2,700**	**1,020**	**5,400**

Source: HHIC- Phil Inc.

Domestic water is not limited to drinking water but also include water for cooking, cleaning and flushing. Domestic water will be sourced from deep wells onsite. If onsite deep wells are insufficient, offsite sources will have to be considered. Drinking water may have to be contracted to an outside supplier. Industrial water will be supplied by surface water (Agusuhin River). All necessary permits for water utilization will be secured from Subicwater or from NWRB.

Sewerage pipes and storm drains will be constructed accordingly and, where appropriate, linked to the wastewater collection system for processing at the wastewater treatment plant. Sewage generated is estimated to 1,580 m^3/day and this will undergo treatment at the wastewater treatment plant.

The 1,580 m^3/day sewage is based on 80% of domestic water consumption. Industrial wastewater at full operation is estimated at 200 m^3/day. The WTF will only treat wastewater from domestic and industrial activities. Storm drains will be separated from sewerage pipes and will not undergo treatment.

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Figure 2 - 2-b. Project's Construction Layout

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Figure 2 - 2-c. Channel Diversion Layout Plan

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Figure 2 - 2-d. South Outfitting Typical Section

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Figure 2 - 2-e. Outfitting Quay Plan

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Figure 2 - 2-f. Typical Section (Embankment)

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2.5.1.8 Electrical Installations

The site is largely undeveloped and thus there are no power transmission lines leading to the site which can be tapped to supply the power needs of the facility during construction and operation. HHIC- Phil Inc. will source out its power requirements either from the NPC grid or EnerZone. Negotiation is on-going and it is anticipated that the connection and commissioning will materialize three to six months from the start of the Phase I activities.

As such, during the first six months of the Phase I, HHIC- Phil Inc. will use temporary source of power from approximately six (6) Diesel Engine Generators equivalent to 2,000 kw. With this capacity the environmental impacts are minimal to negligible.
Initially, the following are proposed to temporarily address the power needs of the project (**Table 2-3**) until such time that the facility has been connected to the electrical grid.

Table 2-3. Proposed Power Supply (Temporary)

Project Phase	Generator		Usage
	Capacity	No. of Units	
Phases 1 and 2	300 kW	8	Batching/Crushing Plant
	125 kW	4	Temporary Facilities
	100 kW	4	Construction Equipment
	50kW	8	Construction Equipment

It is foreseen that by the time operation shall have commenced, power will be supplied by power utilities like ZAMECO or MERALCO. Negotiations with the concerned authorities are underway for the provision of power supply. It will be likely that power and transmission lines shall be installed along the proposed paved all-weather road leading to the site, for which negotiations are also underway.

2.5.1.9 Concrete Plant and Crusher

A concrete plant (batching) and crusher will be installed at the site to process the necessary concrete needs of the project. Aggregates sourced onsite will be undergo processing at the crusher, as required.

HHIC- Phil Inc. will not perform actual quarrying in the area. There is an existing quarry in the area operated by Monark Constructors Corporation (MCC), which is covered by a separate ECC. There is however a possibility that in the future, Hanjin will make the necessary agreement with MCC to operate the quarry. In this case the ECC will be transferred to Hanjin subject to applicable rules and regulation that SBMA will require.

2.5.1.10 Temporary Office

A temporary office which shall serve as field office, temporary laboratory, warehouse, and quarters – until such time that appropriate facilities have been established onsite.

2.5.2 DELIVERY/STORAGE

Associated with the delivery and storage are unloading areas and the transfer of materials delivered to the steel stockyard where the materials will be systematically stored for ease and facility of retrieval and pre-treatment shops where materials are conditioned prior to undergoing

processing.

2.5.2.1 Steel Stock Yard

This consist of specially designed areas for the storage of metal/steel sheets delivered to the shipyard while awaiting processing (cutting, bending, etc.). The area is paved accordingly to grade that will be able to accommodate loading of heavy steel/metal sheets.

2.5.2.2 Pre-Treatment Shops

Materials to be used for shipbuilding undergo conditioning in the pre-treatment shops.

2.5.3 PROCESSING/TREATMENT OF MATERIALS

Processing of materials will be done in shotblasting/sandblasting/priming (painting) shops, galvanizing shops, hull shops (cutting and bending), and pre-outfitting shops.

HHIC- Phil Inc. will comply with applicable standards to the operation. In case of the non existent laws and regulations in the Philippines related to shipbuilding, HHIC- Phil Inc. shall adapt internationally accepted regulations. As such, it will comply with all the pertinent regulations of the International Maritime Organization particularly on the use of environment-friendly, long lasting and low toxicity anti-bio-fouling paints.

2.5.3.1 Air Compressor Rooms

Air compressor rooms will be constructed to power blasting and painting operations. Pressurized air is directed to the blasting and painting shops through distribution lines to the points of usage, i.e. blasting, painting, and other shops requiring compressed air.

2.5.3.2 Gas Station

A gas station with corresponding distribution system will also be constructed to supply the gas needs required for the processing of materials, i.e. cutting and welding, etc., and other shops requiring said gases.

2.5.3.3 Blasting Shops

These shops are equipped with abrasive blasting equipment to prepare metal/steel sheets and similar components for the application of primers and painting as protection from corrosion.

2.5.3.4 Painting Shops

The painting shops are designed to allow for a dust-free painting and drying, irregardless of the weather. Ventilation systems are installed to protect workers health.

2.5.3.5 Hull Shops

Hull Shop (Cutting)

These are specially designed to house the cutting of metal/steel sheets into desired sizes. These shall be equipped with the appropriate equipment employed for cutting metal/steel sheets including collection systems for fumes and particulates generated in the process.

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Hull Shop (Bending)

These are specially designed to house the bending of metal/steel sheets cut already to desired sizes into a two-dimensional curved shell or according to required form with the use of roller press machines.

2.5.4 ASSEMBLY

Sub-assemblies, panel assemblies, matrix assemblies, and curved unit assemblies, as well as, block assemblies will be done in the assembly shops.

2.5.4.1 Hatch Cover Assembly Shops

Accordingly, these shops will be established initially, as during the first years of operations will be devoted to the fabrication of hatch covers. Parts/components are assembled to form hatch covers in this shop.

2.5.4.2 Assembly Shops

These shops are specially designed for the joining of cut or bent parts are to form sub-assemblies, panels, matrices, outfit sections, and curved shell assemblies. These are then joined together to form blocks where steel parts and small subassemblies from parts manufacturing are assembled into blocks, grand blocks, and erection units.

2.5.4.3 Pre-Outfitting Shops

These shops are specially designed for the outfitting of piping works in block in advance of erection on the dock.

2.5.4.4 Outfitting Shops

At these shops, erection units are outfitted with propulsion equipment and support equipment, such as plumbing, electrical installations, etc. Processes associated with outfitting include painting, plumbing and electrical installation, installation of engines and boilers, completion of super structure and deck equipment and rigging, etc.

2.5.5 PRE-ERECTION

2.5.5.1 Pre-Erection Area

Block and unit erection will be done at the pre-erection area. The blocks which constitute the ship hull are built in a series of production process, and transferred to the pre-erection area for the preparation works. These are areas constructed adjacent to the dry docks and are designed to accommodate pre-erection work, including the correction of distortion as induced by welding and is accumulated according to the sequential fabrication process, as well as, fitting of related equipment and/or attachments.

2.5.6 ERECTION/TESTING

Erection is primarily done at the dry dock (see description under site preparation) where the blocks and erection units are joined together to form the ship and where it will be tested for its performance on water, primarily for buoyancy.

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2.5.7 OTHER SUPPORT/UTILITY COMPONENTS

2.5.7.1 Wastewater collection and treatment system

Wastewater generated from both domestic sources (apartments/offices) and from operations (including storm water) in the facility will be directed through a network of pipe lines (see **Figure 2-3** for the Waste Water Treatment Plan) to a wastewater treatment plant located just a bit south of the middle of the site and along the river. The plant has a rated capacity of 1,200 m^3/day. The wastewater treatment system is of typical design (see **Figure 2-4** for the Wastewater Treatment Diagram), consisting a wastewater-collection system and primary and secondary treatment at a wastewater-treatment plant where raw wastewater undergoes a series of physical and biological treatment until sufficient for disposal (discharged into a surface-water body) or reuse. The collection system consists of 1,201.9 m of 250-mm diameter pipe lines (open channel) and 1,114.5 m of 150-mm diameter pipe lines (pressurized). Sludge generated will be transported offsite, more likely to the landfill located at the Freeport which by then may also be already operational, or if unlikely, at disposal sites of licensed contractors engaged by the proponent. Given the limited availability of water in the area, there is a need to reuse water, in addition to addressing discharge of polluted/contaminated wastewater.

2.5.7.2 Offices (main and administration)

Buildings will be constructed onsite to serve as the main and administration offices.

2.5.7.3 Production center/central tool station/utility station (restaurant and change lockers)

Buildings will be constructed to serve as production center, central tool station – where all the tools and equipment will be stored/kept, and a utility station accommodating a restaurant and change lockers (for the use of workers/personnel).

2.5.7.4 Maintenance shop

A maintenance shop will be constructed for the purpose.

2.5.7.5 Training center and a gymnasium

A training center will be constructed for the purpose, while a gymnasium will be erected for the purpose, particularly as a recreational area for workers and for holding important company events.

2.5.7.6 Apartment (personnel lodging/quarters)

Buildings will be constructed to accommodate personnel to be engaged by the proponent.

2.5.7.7 Fence/Gates

The whole compound will be fenced and gates will be constructed in strategic areas. The main gate is located at the northern tip of the site while a second gate on western side.

2.5.7.8 Access Roads

Access roads leading to the project site will be built (**Figures 2-5** and **2-5a**). The access road is

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DPWH responsibility. This is part of the agreement entered into by Hanjin between the Philippine Government and the SBMA. As such, DPWH will be responsible in complying with all the necessary permits, clearances and other government regulations for any option that may be done for the access roads of the project.

Option 2 of the proposed access road was chosen. The access road will be a 4-lane, 8 km asphalted road from the existing road in Brgy. Cawag, Subic to the project site in Agusuhin. A 200 m long bridge will be constructed in Brgy. Cawag as part of the access road. The access road will be plain with no slopes and s-curves. Target date of completion is June 2007.

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Figure 2-3. Wastewater Treatment Plan (Collection System)

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Figure 2-4. Wastewater Treatment Diagram

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Figure 2-5. Proposed Access Road Leading to the Project Site

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Figure 2 - 5-a. Traffic Management Plan within the Leased Area

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2.6 MANPOWER REQUIREMENTS

The new information we got from HHIC- Phil Inc. indicates that for the construction and operation of the facility, a total of 6,000 to 6,300 workers will be engaged for Phases 1 and 2 starting year 2006 to 2015, while 6,000 shipbuilding workers will be engaged for Phase 3 starting 2020 to 2025.

Below is an updated labor requirement for the proposed project (Source: HHIC- Phil Inc.).

Phase	Phase 1					Phase 2					Phase 3	
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025
Construction	1500	1500	1000	500	300	200	200					
Operation	150	2000	3000	5000	6000	6500	6500	6500	6000	6000	6000	6000
Total	**1650**	**3500**	**4000**	**5500**	**6300**	**6700**	**6700**	**6500**	**6000**	**6000**	**6000**	**6000**

For clarification, in phase one 2006, the term operation includes the technical personnel such as engineers, draftsmen, computer operators and administrative staff.

The operation phase will start in June 2007. The project will start hiring employees for the operation phase during the first year of operation. HHIC- Phil Inc. will hire them for training.

2.7 PROJECT COST

Based on the project's new estimates the following investment cost will be made for each phase: Phase 1- 300 million USD; Phase 2- 200 million USD; Phase 3 -300 million USD. The project has then an estimated total cost of up to 800 million USD.

2.8 SCHEDULE OF ACTIVITIES

2.8.1 PRE-CONSTRUCTION PHASE

Land Survey and Hydrographic Survey

Soil Investigation

Relocations of Settlers

Temporary Access Road

Supply of Power, Water, and Communication Lines

2.8.2 CONSTRUCTION AND OPERATION PHASE (TABLE 2-4)

Phase 1 (2006-2007 (Table 2-5)

Fabrication of Hatch Cover (30,000 ton/year)
Preparation for Construction of Full Container

Phase 2

Construction of Full Container Ship (3,400 TEU) (2008-2009)
Construction of Full Container Ship (3,400 to 5,100TEU) (2010-2010)
Construction of Panamax and Bulk Container (95,000 DWT)

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Phase 3

Construction of Cape Size Bulk Container (170,000 DWT) and Aframax Tanker (115,000 DWT) (2011-2013)
Construction of Very Large Crude Carrier Shipbuilding (24 ships/year)
Construction of LNG Carrier (150K) (2014-2015)
Construction of LNG Carrier Full Container (8100TEU)
Construction of Very Large Crude Container (300,000 DWT)

Table 2-4. Schedule of Activities

Phases	Start	Finish	Remarks
Phases 1 to 2	Mar. 1, 2006	Dec. 30, 2010	To construct shipbuilding related parts To construct and operate medium-sized shipyard
Phase 3	Jan.1, 2011	Dec. 31, 2015	To construct and operate large-sized shipyard

2.8.3 A BANDONMENT

The project has a 50-year lifetime but is expected to continue operating and expanding beyond this time period. In the event, that there will be a need for abandonment and decommissioning of the facility a corresponding plan will be developed once the project is operational.

An Environmental Site Assessment shall be undertaken during the abandonment phase. HHIC Phil Inc. shall implement all the appropriate mitigating measures that will be required by the study. HHIC- Phil Inc. and SBMA shall explore the possibility of the use of the facility for same or other purposes beneficial to SBMA. Likewise, all structures that will not be considered in the SBMA- HHIC- Phil Inc. agreement shall be removed and corresponding clean-up operations will be done. Prior to the implementation of the abandonment plan, said abandonment program shall be approved by SBMA and DENR-EMB.

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Table 2-5. Construction Schedule (phase 1)

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Table 2-5 (cont.). Construction Schedule (phase 1)

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Table 2-5 (cont.). Construction Schedule (phase 1)

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This section describes the existing environmental conditions at the project area and its immediate vicinities based on primary information gathered from 21 September to 09 October 2005 and from secondary or previous studies. The environmental conditions are classified into three major types: the physico-chemical (land, air and water) environment; the biological (terrestrial and aquatic) environment; and the socio-economic (people) environment.

3.1 PHYSICO-CHEMICAL ENVIRONMENT

3.1.1 TOPOGRAPHY AND PHYSIOGRAPHY

Zambales Province has a rugged and mountainous topography. The Zambales Mountain Range, the most prominent topographic feature with maximum elevations of 2000 meters above sea level (masl), runs roughly NE-SW and forms the western limits of the vast Central Luzon plains along the provincial borders with Tarlac, Pampanga and Bataan to the east and Pangasinan to the north. A majority of the municipalities, however, lie along the coastal plains at the western footslopes of the mountain range facing the South China Sea.

The project site is located on the gently sloping alluvial fan deposits which are characterized by less than 3 % slopes. The alluvial fan is roughly 1.8 kilometers (km) long and 1km wide at the shoreline and is surrounded by moderate to rugged topography of Mount Redondo (elevation 611 masl – **Plate 1- Appendix 8**) on the north and Cinco Picos (elevation 929 masl) on the west and south. Slope along ridgeline is from 10 to 15% while valley slopes are steeper at 20 % to 45 %. **Figure 3-1** and **Figure 3-2** are the topographic map and a slope analysis map of the project area and the surrounding uplands respectively. Detailed topographic (spot elevation) and bathymetry maps are shown in **Appendix 3**.

3.1.2 SOILS AND LAND USE

The Bureau of Soils and Water Management (BSWM) classified soils in the project area as Hydrosol and Mountain soils undifferentiated.

The Hydrosol, which occupies the Sitio Agusuhin flatland, is limited to wildlife and is suitable for fishpond, salt bed site or recreation uses. It is very poorly drained, marshy or swampy are considered its dominant features.

The surrounding Mountain soils undifferentiated are limited to pasture or forest of which if cultivated, severe erosion would feasibly take place. The dominant features of these kinds, are steep, welldrained and shallow soils.

Figure 3-3 is regional erosion map published by the BSWM that classifies the project area as a no apparent erosion zone (E0) and the surrounding highlands as areas with moderate erosion (E2).

The Sitio Agusuhin community occupies most of the alluvial plain where the most of the land is dedicated to fruit trees (**Plate 2**). Few rice farms are found in the central part of the plain while fishponds are located near the shore. North of the plain at Redondo Peninsula is a 100-hectare community forest land managed by the Agusuhin Community Reforestation Association (ACRA). South of the project area facing the Subic Bay is a five-hectare rock aggregate quarry (**Plate 3**). The rest of the highlands are predominantly grasslands.

The sedimentary fill at the project area is provided primarily by Agusuhin River and the North Agusuhin Creek. Airfall deposits of the July 1991 eruption of Mt. Pinatubo also provided

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sediments at the project area and surrounding highlands. Located only 33 km to the northeast, the eruption directly introduced at least 10 to 20 cm-thick volcanic ash and pumice grains to the bay (PHIVOLCS, 1991).

Pyroclastic materials deposited along the slopes are still being reworked by streams leading to the present elevated river sediment yields. In some portions of the bay, coral reef organisms such as foraminiferas, corals, echinoderms and mollusks also provide sediment. Suspended sediments from regions farther to the south are also transported towards Subic Bay through the northwesterly shallow water currents of the South China Sea (URS - Woodward-Clyde, 2002). **Figure 3-4** is a map showing sediment sources.

Figure 3 - 1. Topographic Map Showing the Project Area.

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Figure 3 - 2. Slope Analysis Map

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Figure 3 - 3. Regional Erosion Map Showing Project Area.

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Figure 3 - 4. Sediment Source Map

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3.1.3 GEOLOGY

3.1.3.1 Regional Tectonic Setting

Luzon Island is situated at the western margin of the Circum-Pacific region, centered roughly at 15°N Latitude and 121°E Longitude. The region is characterized by active convergence between the Eurasian and Pacific plates. The complex plate interaction is reflected in the geology and structure of the island, which consists of splinters of allocthonous terrain that were accreted into an evolving island arc system as early as late Cretaceous time (Karig *et al.*, 1986; Arcilla *et al.*, 1989). Two active subduction systems of opposing polarity border Luzon: the eastward-dipping Manila trench on the west (Ludwig *et al.*, 1967; Fitch and Molnar, 1970; Cardwell *et al.*, 1980), and the incipient, northward-propagating, westward-dipping East Luzon trench (Cardwell *et al.*, 1980; Hamburger *et al.*, 1983; Taylor and Hayes, 1983) along the east.

Along the Manila Trench, the absence of shallow seismicity related to underthrusting suggests that subduction may be either ceasing, or shifting towards the East Luzon trench as a consequence of ongoing plate reorganization (Cardwell *et al.*, 1980). The presence of deformed sediment on the upper sedimentary carapace of both the trench and accretionary prism of the west Luzon arc system, however, suggests that subduction is still ongoing (Hamburger *et al.*, 1983). The region south of Manila Trench is marked by a prominent structural suture marking the collision boundary of the Palawan-Mindoro micro-continental fragment with the west Luzon Island arc system (Karig, 1983; Merchadier and Rangin, 1990). In contrast, the eastern subduction zone has neither a forearc basin nor a volcanic arc because of the relative youth of the east Luzon trench. **Figure 5** shows the major tectonic features of Luzon Island.

3.1.3.2 Regional Seismicity

The distribution of historical earthquakes with >Ms 5.0 in the region for the period from 1907 to September 1999 is shown in **Figure 6**. Compared with other seismogenic zones in the archipelago, seismic activity within the area is fairly moderate (PHIVOLCS, 1999). Earthquakes originate either from the Manila Trench, or from active and potentially active faults in the region. The latter include the East Zambales fault, Iba Fault, Subic Bay Fault, and the San Antonio Fracture Zone. Distant faults that may still affect the region include Philippine, Casiguran, Marikina and Lubang faults.

Most earthquakes felt on the site originate from subduction process along the Manila Trench. Focal mechanism solution of offshore historic earthquakes west of the site had a dominant thrust component, thus indicate a strong genetic link to subduction processes along the Manila Trench (Cardwell *et al.*, 1980). Identification of disturbed sediments from seismic reflection transect profiles in the immediate vicinity provides supportive evidence (Ludwig *et al.*, 1967; Lewis and Hayes, 1984). Foci of these seismic events extend to depths of more than 300 km. The most recent felt seismic event was an Ms 6.1 earthquake on 23 August 1998 located roughly 47 km west of the area.

Preliminary work by PHIVOLCS, on the basis of geomorphic evidence, suggests active faulting along the northern segment of the East Zambales fault. Epicentral plots of some recent felt seismic events (e.g. July 18, 1959) in the region, however, show a strong spatial association with the southern segment of the fault. Review of seismic catalogues, however, is inconclusive in relating any historic destructive earthquakes to this earthquake generator.

Indicative seismicity for the Iba Fault is associated with the 1991 eruptions of Pinatubo Volcano (Bautista *et al.*, 1996). Focal mechanism solutions of pre-eruption seismic events indicate left-lateral movement with minor tensional component. Clustering of events along the strike projection of the fault and near the summit region of the volcano suggest a volcano-tectonic

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origin. Earthquakes generated during the 1991 eruption of Pinatubo Volcano were relatively strong (>Ms 5) as to be felt within the Subic Bay area.

Seismicity at the Manila Trench – Arc System accounts for 6.61% of the total seismic events that occur in the country (Balce, 1985). Seismic events are largely associated with the eastward subduction of the Manila Trench. The Manila Trench dips 45° to 100 km depth where is steepens to almost vertical. Very few large shallow earthquakes originate from the Manila Trench (Balce, 1985). Lewis and Hayes (1984) pointed out that a low convergence rate could explain the low level of seismicity.

From 1589 to 1983, two destructive earthquakes were believed to have been attributed to movements along the Manila Trench. These were the December 7, 1677 and the June 3, 1863 earthquakes (SEASEE, 1985). The 1863 earthquake measured Intensity X under the Modified Mercalli Intensity Scale.

Seismic events that occurred in the South China Sea facing Zambales and Bataan provinces from 1973 to 2005 with magnitude Ms > 5 were shallow with depths of <70 km (NEIC). Three of these earthquakes were recorded to have registered magnitudes of Ms > 6, with the nearest earthquake (Ms=6.1) about 44 km southwest of the project area. One earthquake registered an Ms 7.3 (Dec., 1999) some 185 km west northwest of the project area.

A deterministic approach for estimating peak horizontal ground acceleration using the attenuation relation was formulated by Fukushima and Tanaka (1990). Adopting Ms 7.5 as the maximum probable earthquake with an epicenter 40 kilometers west of the project area, the estimated peak horizontal ground acceleration amplitude at the site is 0.31g in areas underlain by soft soils and 0.14g in areas underlain by rock. This estimated ground-shaking intensity should be factored in the design of structures in the project area.

Seismic activity along Subic Bay Fault is not well constrained. High-resolution seismic reflection profiles of the bay area showed en-echelon gravity faults cutting through recent bay marine sediment sequences (Cabato *et al.*, 1997). Correlation with regional sea level strand lines suggests faulting events with a possible recurrence interval between 1,000 to 2,000 years with the last event occurring 1,000 years ago (Cabato *et al.*, 1997). No historic destructive earthquake activity has been associated with this structure. Despite the long earthquake recurrence interval along this structure, its proximity and presence within the bay area has implication on the potential occurrence of seismic hazards such as tsunami, liquefaction, and earthquake-triggered mass movements.

Detailed geologic studies of the San Antonio Fault Zone revealed no offsets of recent alluvium along the main fault trace (EBASCO, 1977). Several historic earthquakes in the area have been associated with this structure.

Estimates of recurrence interval for earthquakes of a given range of magnitude (Ms) can be calculated from the annual rates of earthquake activity values derived by Thenhaus *et al.*, (1994). Results are summarized in **Table 3-1**. Projected magnitude and recurrence intervals have a 10 % chance of being exceeded in 50 years.

Table 3 - 1. Estimated Recurrence Interval for Earthquakes in the Region

Magnitude (Ms)	Annual Rate (Frequency/year)	Interval (years)
5.2 to <5.8	0.32081	3
5.8 to <6.4	0.12024	8

6.4 to <7.0	0.04505	22
7.0 to <7.3	0.01689	59
7.3 to <8.2	0.00633	157

(Adapted from Thenhaus et al., 1994).

3.1.3.3 Regional Geomorphology

The Zambales Mountain Range, the main geomorphologic feature in the region, is a 220 km long 40 km wide, N-S trending mountain range that extends from Lingayen Gulf on the north and Bataan Peninsula on the south (**Figure 3- 6a**). It forms the western limits of the vast Central Luzon plains along the provincial borders with, Pampanga and Tarlac to the east and Pangasinan to the north. Most of the municipalities, however, lie along the coastal plains at the western footslopes of the mountain range bordering the South China Sea. The mountain range is somewhat truncated towards the south (in the vicinity of Castillejos, San Marcelino and San Antonio municipalities) by the San Antonio Fracture Zone reflected by the extensive floodplains of the Santo Tomas and Pamatawan Rivers (Javellosa, 1995). The mountain chain continues where it reaches the Silanguin Peninsula that encloses most of Subic Bay. Farther south, it forms the Bataan Peninsula where it ends at Mariveles.

The mountain range consists of high peaks and rugged ridges. Prominent peaks are the High Peak (2037 m), Iba (1606 m), Pinatubo (1485 m) and Natib (1287 m).

Figure 3 - 5. Major Tectonic Features of Luzon Island.

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Figure 3 - 6. Regional Seismicity Map.

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Figure 3-6a. Regional Geomorphologic Map.

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3.1.3.4 Regional Geology

The core of the Zambales Mountain Range is a massive series of ultramafic rocks forming what is known as the Zambales Ophiolite Complex. This Cretaceous to Late Eocene formation is a classic exposure of massive to layered peridotites and gabbro intruded by diabase dike swarms and overlain by spilitic basalt flows and undifferentiated volcanics. This geologic terrain was formed in a mid-oceanic ridge setting and is uniquely juxtaposed with Quaternary pyroclastics, volcanic feed channels and lava domes contrastingly formed in an island arc setting (Yumul *et al.*, 1990).

Unconformably overlying these basement rocks are Late Miocene to Pliocene volcanic rocks and epiclastic sediments occurring as basal volcanic units beneath the dissected volcanic landforms such as Mount Balakibok. Intruding into these older rock units are granodiorite to diorite porphyries. Some of these intrusions host economic mineral (e.g. gold and copper) deposits such as in the Dizon Mines.

Pliocene to Pleistocene volcanism is represented by several contemporaneous satellite vents deposits occurring as isolated eroded andesite to dacite plugs and domes near the summit regions of mounts Cuadrado, Negron, Bituin and Mataba. The flanks these volcanic remnants are blanketed by extensive aprons of Pleistocene andesitic to dacitic pyroclastic low and lahar deposits, with minor interbeds of andesitic lavas. The eastern part of the Subic Bay Metropolitan Authority (SBMA) is underlain by interbedded pyroclastic flow, lava flow and epiclastic sediment deposits associated with volcanic activity centered at Natib Volcano. Natib's volcanic activity has been on going since Lower Pliocene – roughly more than 2 million years ago (de Boer *et al.*, 1981; Ruaya and Panem, 1991), the last major eruption occurring 27,000+630 years ago (Torres, 1992).

Quaternary sediments consisting of thick sand and gravel deposits unconformably overlie the older formations especially along river channels and deltas. While these detrital deposits are localized along river and stream channels, the Sto.Tomas River and the Pamatawan River channels are major depositional areas covering a wide area that have been drastically altered with the extrusion and large-scale transport of volcanic sediments from the recent eruption of Mt. Pinatubo, some 40 km to the northeast. The lithology and stratigraphy of the region is summarized in the table below.

Table 3 - 2. General Stratigraphy of the Zambales Range

Time Period	Formation/Group	Description
Recent	Alluvium	Unconsolidated river, beach, intertidal flats, back swamp and 1991 Pinatubo airfall tephra deposits.
Pliocene to Holocene	Natib Volcanics	Interbedded and relatively indurated andesitic to dacitic pyroclastic flow and fall deposits, lavas, and their epiclastic derivatives (e.g. lahars), including deposits from satellite eruptive centers.
Upper Miocene to Pliocene	Mount Balakibok Volcanics and Intrusives	Andesitic to dacitic volcanic domes, plugs, pyroclastic flow and proximal fall deposits, and their epiclastic derivatives. Associated with dissected, remnant strato-volcano (e.g. Mt. Balakibok, Mt. Cuadrado). Basal sections are intruded by granodiorite to diorite porphyrys, some with associated mineralization.
Eocene	Zambales Ophiolite Complex	Mainly peridotite and gabbro, with minor diabase dikes and pillow basalts.

(Modified from BMG, 1981; Ruaya and Panem, 1991; Newhall et al., 1996).

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3.1.3.5 Fault Systems

Four major fault systems transect the region: the Iba Fault, East Zambales Fault, San Antonio Fracture Zone, and Subic Bay Fault (**Figure 3-7**).

The Iba Fault System

The Iba Fault System comprises a pair of NW-trending faults passing through the vicinity of Iba and Botolan, Zambales. Previous geologic studies (Mines Bureau, 1961) suggest a predominantly normal movement, forming a graben structure within the Bucao River valley. The southern terminus of the fault is inferred to extend northwestward to the upper slopes of Mount Pinatubo (EBASCO, 1977), joining with the Maraunot Fault of Delfin (1983). The Maraunot Fault is a normal fault with the southern block acting as the footwall (Delfin, 1983). The fault transects the length of Maraunot River valley, its trace marked by thermal manifestations (Delfin, 1983). The southeastern extension of the fault from the summit region of Mount Pinatubo is less conspicuous. Surface fault rupture documented along the Maraunot segment of the Iba Fault System coincident with the early phase of the 1991 eruptive activity of Mount Pinatubo (Bautista *et al.*, 1996), and location of historical earthquake events along the fault suggest that it is active.

The East Zambales Fault

The East Zambales Fault is a major NW-trending structural boundary separating the Zambales Range and the Central Plains of Luzon. Aside from geomorphic consideration, the structure is reflected in geophysical anomaly maps of the area (De Boer *et al.*, 1981). The trace of the fault is well defined along its northern segment, which display a predominant left-lateral and minor normal sense of displacement as indicated by youthful, fault-related geomorphic features. Pervasive high rates of sedimentation of rivers draining from Pinatubo Volcano during the last 30,000 years has masked possible traces of its southern extension, particularly as it passes the eastern lower flanks of the volcano. Epicentral plots of some recent felt seismic events (e.g. July 18, 1959) in the region, however, show a strong spatial association with the southern segment of the fault. Seismicity and geomorphic evidence strongly suggest that the East Zambales fault is potentially active.

The San Antonio Fracture Zone

The San Antonio Fracture Zone corresponds to a series of faults comprising the graben structure bounding the Santo Tomas alluvial plain (Villones, 1980; Yumul *et al.*, 1990; Javellosa, 1995). It follows a WNW trend, and aside from a predominantly normal component of displacement also exhibits a strike-slip component. The eastern extension of the fracture zone is cut by a north-south trending fault (Linament 2 of Javellosa, 1995), though some authors infer a possible extension of the fault into the Balakibok volcanic complex (EBASCO, 1977). Detailed geologic (trenching) studies showed absence of recent movement along the main fault trace (EBASCO, 1977). Several felt earthquakes in the area have been related to this structure.

The Subic Bay Fault

The Subic Bay Fault is a north-south trending structure initially identified from seismic reflection profiles offshore into the Subic Bay area. A possible northern trace of the fault was recognized from geomagnetic anomaly maps (Dimalanta, 1995), which coincides with north-south trending faults that cut through the southern portion of the

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San Antonio Fracture Zone. The offshore southern portion of the fault is well defined in existing bathymetric maps and more recent bathymetric surveys of the bay. Correlation with regional sea-level strand lines suggests faulting events with a possible recurrence interval between 1,000 to 2,000 years with the last event occurring 1,000 years ago (Cabato *et al.*, 1997). However, as the last major faulting episode occurred during the last 1,000 years, and since 10,000 years is typically the time frame used for classifying faults as active, this structure is provisionally classified as potentially active.

3.1.3.6 Site Geology

The project site is underlain by recent alluvial deposits overlying an igneous (gabbro) bedrock. The alluvial deposits consist primarily of alternating sand and gravel layers with intercalations of silt and clay typical of alluvial sediments. These materials were transported and laid by the Agusuhin River and gradually grades with littoral deposits towards the Subic Bay shoreline as shown by coralline sands and associated mud and shell fragments encountered in some boreholes near the bay. Thickness of the alluvial deposits, based on geotechnical boreholes is from 3.5 m to more than 44 m.

The current shoreline has been drastically changed by pyroclastic material from Pinatubo Volcano by fluvial transport. Most of the surface cover of the area is of the same material forming a thin layer a few centimeters thick (**Plate 4**).

Local structures in the vicinity of the project area from Mines and Geosciences quadrangle geologic map consists predominantly of N-S, steeply dipping layers of the cummulate sequence of gabbro and peridotites (**Plate 5**). The nearest major structure in the project area is the offshore continuation of Subic Bay Fault, based on the geology of the islands in Subic Bay, is west of Pequeña and Mayanga Islands and east of Grande and Maricha Islands (Yumul *et al.*, 1999). The Subic Bay Fault, at its nearest approach, is about 2 km east of the project area. **Figure 3-8** and **Figure 3-9** show the geologic map and idealized geologic cross section of the project area.

3.1.3.7 Surficial Deposits

Geoscience Technologies, Inc. undertook the geotechnical investigation of the project area, as well as the laboratory testing on the soil samples, in August to October 2005. The field investigation consisted of drilling of one hundred eleven (111) boreholes.

In general, the site subsoil is generally characterized by sedimentary deposits consisting of silts and sands of varying thickness and relative condition.

Bearing layer consists of very dense sands, which were encountered at varying depths, generally exceeding 18 meters. Gravels and coralline formation were also encountered.

Water level on onshore areas is generally shallow, ranging from 1.0 to 5.0 meters from ground surface.

Borehole locations, soil profiles and laboratory testing results are shown in **Appendix 4**.

Figure 3 - 7. Major Fault Systems in the Region.

Figure 3 - 8. Geologic Map Showing the Project Area.

Figure 3 - 9. Geologic Cross-Section Showing Project Area

3.1.4 NATURAL HAZARDS

The Philippines, owing to its geographic and geologic location, it is susceptible to natural hazards which have to be considered and integrated in on-going and future development plans. On the basis of geomorphic and geologic study, the proposed project site is susceptible to seismic, volcanic hazards, typhoons and storm surges, and flooding.

3.1.4.1 Seismic Hazards

Regional seismicity suggests vulnerability of the area to earthquake hazards. Intense ground shaking is the main hazard associated with earthquakes, with liquefaction, landslides and tsunami as collateral hazards.

Intense Ground Shaking

In general, the intensity of ground shaking is magnitude-dependent, and gradually decreases with distance from the source. Difference in ground conditions, however, may cause deviations from this expected norm, particularly in areas underlain by recent alluvium.

Of the known major tectonic structures in the region, the nearest earthquake generator to the project site is the offshore extension of the Subic Bay Fault which is approximately two kilometers east of the project site.

Geotechnical information indicates that the underlying materials in the project area consist of comprised mainly of loose to medium dense gravelly sands to silty sands, clayey sands to gravelly to bouldery clay/ clayey gravels and boulders. The thickness of this layer varies from 3.5 m to more than 22 m. The thickness generally increases towards the east and south. This aquifer extends from around 22 meters below ground level (mbgl) to more than 44.5 mbgl towards the south. Static water level measurements in the borehole logs (Woodward-Clyde, 1998) show a shallow groundwater at the project site with water elevations ranging from 30 cm to more than 3 meters below the surface.

The above-mentioned geotechnical properties indicate ground condition similar to soft soils as defined by Fukushima and Tanaka (1990), and subsequently adopted by Thenhaus *et al.*, (1994) for the Philippines. Expected ground shaking intensity for this type of ground, considering a modeled earthquake event of Ms 8.2 with a 10 percent probability of exceedance in 50 years, is 0.6g, where g is the acceleration due to gravity (**Figure 3-10**). Such ground shaking intensity and duration would be sufficient for loose to compact sediment layers to liquefy and structures resting on such ground foundations would sustain damages due to differential settling or fail by lateral spreading.

Liquefaction

Soil liquefaction is a phenomenon that occurs mostly in medium to fine-grained sands wherein a mass of soil loses a large percentage of its shear resistance when subjected to monotonic, cyclic or shock loading, and flows in a manner resembling a liquid. Much of the damage on substructures and foundation during earthquake is attributed to this phenomenon.

The project area is susceptible to liquefaction. This is based on the following environment and conditions that favor liquefaction (Torres *et al.*, 1990):

- young age of the Holocene alluvial deposits (<10,000 years old);
- grain size which consist of fine to coarse sand with some clay; and
- critical depth of the water table at which liquefaction may reach the surface is 2-3 m in areas where the saturated sand layer were 2-10 m. thick (Tokida, 1992).

One or combination of the following liquefaction-related hazards may be experienced in the event of an earthquake with magnitude greater than 5.

- Flow slides or large translational or rotational site failures mobilized by existing static stresses.
- Lateral spreads triggered and sustained by the earthquake ground shaking.
- Ground settlement and surface manifestation of underlying liquefaction, such as sand boils.

Site failures mobilized by existing static stresses includes cracking, tilting and even sinking of the structure. Lateral spreads could occur along the riverbank as the liquefaction of a soil increases the horizontal force on river retaining wall. Whilst this may be more prevalent when liquefied, such a state is not absolutely necessary and lateral spreading can occur solely due to the increased horizontal forces brought about by the shaking.

Despite the apparent liquefaction proneness of the project site, there are no historical accounts, which we are aware of its occurrence in the area. This can be attributed to two main factors:

- historically strong earthquakes sufficient to cause liquefaction were generated from distant seismic generators; thus the intensity of ground shaking was sufficiently attenuated as not to cause liquefaction at the site; and
- the recurrence interval of strong earthquakes from nearby source earthquake generators (e.g. Subic Bay Fault, Iba Fault, and East Zambales Fault) appears to be significantly long (e.g. 1,000 years; Cabato, 1999) as not to be documented even in oral histories of indigenous tribes in the region.

However, evidences of pre-historic strong earthquake events are not lacking in the rock records of the area – an example would be outcrops of disturbed and deformed lakebeds along Tipo Road. In addition, the presence of coralline debris interbedded with intertidal deposits was identified in borehole sited an uplifted alluvial terrace of Agusuhin River upstream of the present shoreline of Mt. Redondo. Absence of similar deposits in boreholes adjacent to this site suggests either a remnant tsunamigenic deposits or uplifted coralline terrace.

Assessment of Liquefaction Potential

An assessment of liquefaction potential of the project area was performed by Geosceince Technologies Inc. The JSCE (Japan Society of Civil Engineers) method was adopted in assessing the liquefaction potential of the site. Based on its 1980 Specifications, saturated sandy layers within 20 meters from ground surface and the groundwater table within 10 meters from the ground surface, and with D_{50} values on the grain size accumulation curve between 0.02 and 2.0 mm, should be considered vulnerable to liquefaction.

The parameter which approximates the liquefaction potential of a soil layer is the liquefaction resistance factor F_L, which is defined by the equation

$$F_L = \frac{R}{L}$$

where: F_L = liquefaction resistance factor
R = resistance of soil elements to dynamic loads
L = dynamic load to soil elements induced by earthquake motion.

Soil layers with liquefaction resistance factor F_L less than 1.0 are judged to liquefy during earthquakes. For those soil layers within 20 meters of the actual ground surface which are judged to liquefy by the above estimation, bearing capacities and other soil constants should either be neglected or reduced in the seismic design, by multiplying the skin friction resistance (or bearing capacity in the case of shallow foundation) by reduction factors D_E which are determined in accordance with F_L values and tabulated as follows:

F_L	*Depth, z (m)*	*Reduction Factor, D_E*
$F_L \leq 0.6$	$0 \leq z \leq 10$ $10 \leq z \leq 20$	0 1/3
$0.6 < F_L \leq 0.6$	$0 \leq z \leq 10$ $10 \leq z \leq 20$	1/3 2/3
$0.8 < F_L \leq 1.0$	$0 \leq z \leq 10$ $10 \leq z \leq 20$	2/3 1
$1.0 < F_L$	---------	1

In general, the results of the liquefaction analysis using the JSCE Method indicate that the saturated loose sands (SM / SC / SP with SPT N-values < 10) found within the site subsurface (depth between 0 to 18.0 meters) are potentially liquefiable. These layers, however, are relatively scant and generally intersperse with the layers of stiff silts and medium dense to dense sands. As such, the liquefaction vulnerability of the site is highly diminished. Nevertheless, necessary precautions shall be taken by ensuring the integrity of the foundation system and utilizing pile foundations for heavy and critical structures.

Landslide

Although the project area lies in a valley with relatively flat terrain, the adjacent valley slopes north and south of the project site have moderate to steep slopes susceptible to mass movements. Mass movement is a general geologic term describing processes that involves the transport or movement of earth material. It covers a spectrum of geologic processes that includes heaves, slides and flows, that are best described and categorized by Varnes (1978). Debris materials cover a wide range of physical and chemical properties, and move at rates ranging from being imperceptible to extremely rapid. Hazards include burial by debris and impact from large fragments. Contributory factors for its incidence include high relief, steep slopes, high rainfall conditions, deep-weathering profile and high seismicity.

The Manila Observatory through its Socio-Environmental Geomatics Program applied remote sensing and geographic information systems (RS-GIS) to map out social and environmental information needed to guide the sustainable development agenda of local communities. One of the projects under the program is the Mapping Philippine

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Vulnerability to Environmental Disasters. The project classified the area as no present risk to earthquake-induced shallow landslides (**Figure 11**).

Tsunami

Tsunamis can be generated along faults extending into the sea, provided that the earthquake originated at shallow depths and its magnitude is sufficiently high (e.g., Ms 7.0). The western coast of the Bataan Peninsula has been known as a tsunami prone area (**Figure 3-12**). The earliest recorded tsunamigenic earthquake in this area occurred in December 7, 1677 (NOAA / NESDIS / National Geophysical Data Center / World Data Center) and generated a magnitude and intensity 1 tsunami. Based on the work of Uy and Punzalan (1984), this tsunami, with a height of at most 5 m, impinged on the western coast of the Bataan Peninsula. However, it was not able to penetrate into Subic Bay. In September 16, 1852, a magnitude 7.5 earthquake off the coast of Cavite generated a <5-m high intensity 1.5 tsunami. The latest event was revealed from the anecdotal accounts of local residents of Morong, Bataan. According to them, a tsunami event in 1969 devastated the town of Bagac, some 17-km southeast of Morong, Bataan. Presently, cobble to boulder-size coral fragments are seen strewn roughly 15 m from the swash zone along a gently sloping beach area. These could have been swept up to the coast by large waves associated with tsunamis or storms.

Seismicity data for southwestern Luzon also show that numerous earthquakes occur in the vicinity of Subic Bay (see **Figure 3-6**). These are typically generated along the Manila Trench to the west, the Zambales Fault and its splay to the north and east, and the Verde Passage Zone to the south.

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Figure 3 - 10. Peak Ground Acceleration for Soft Soils.

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Figure 3 - 11. Earthquake-Induced Shallow Landslides.

Figure 3 - 12. Tsunami-prone areas in Luzon (Uy and Punzalan, 1987)

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3.1.4.2 Volcanic Hazards

Similar to earthquakes, the degree and extent of vulnerability of an area to volcanic hazards depends on its proximity to an active volcano. Eruption-related hazards include airfall tephra, base surge, fissuring and ground subsidence, seiches/tsunami and flooding (Arboleda and Ruelo, 1986). Of the volcanic hazards, airfall tephra is considered as more likely to affect the project area.

PHIVOLCS classified Philippine volcanoes into Active, Potentially Active and Inactive. An active volcano has historical record of eruption or has erupted in the past 10,000 years. Potentially active volcanoes have no documented record of eruption but are geologically young (possibly erupted <10,000 years). These volcanoes have fresh looking rocks, young vent features, thin soil cover and sparsely vegetated with low degree of erosion and dissection. The volcanoes also have a strong connection with subduction zones and external tectonic settings. Inactive volcanoes have no record of eruption and its form is beginning to change by the agents of weathering and erosion via formation of deep and long gullies.

The nearest active volcano is Pinatubo Volcano which is located some 40 km northeast of the project site. The volcano's eruption in 1991 blanketed the area with more than 15 cm of tephra deposits. This eruption is a repetition of explosive dacitic plinian eruptions that commenced sometime 35,000 years BP, and marked in between by century- to millennium-long repose periods (Delfin, 1983; Newhall *et al.*, 1996). Eruptions in the near future (e.g. years to decades) are most likely less explosive dome-building eruptions followed by centuries-long periods of quiescence, if volcanic activity were to follow previous eruptive patterns (e.g. Buag period) identified for Pinatubo Volcano and similar analogue volcanoes (e.g. Mount St. Helens and Santa Maria Volcano) elsewhere.

Mount Natib, situated some 22 km east-southeast of the project area, is considered by PHIVOLCS as a potentially active volcano. Volcanic activity within the Mount Natib Volcanic Complex has been going on for more than two million years ago. Eruptions range from relatively quiet emissions of andesitic lava to more explosive dacitic caldera-forming events. On the basis of geomorphic, geochronologic and geochemical considerations eruptions can be grouped into two: those associated with an ancestral volcano – Old Natib, and those centered at the present day Mount Natib (Young Natib).

Airfall Tephra

Tephra is a general term for fragments of volcanic rock and lava regardless of size that are blasted into the air by explosions or carried upward by hot gases in eruption columns or lava fountains. Tephra includes large dense blocks and bombs, and small light rock debris such as scoria, pumice, reticulite, and ash.

Tephra falls may consist of pumice, scoria, dense lithic materials or crystals or combination of the four. Tephra can be classified according to particle size:

- ash - less than 2 mm diameter
- lapilli - 2-64 mm diameter
- blocks and bombs – more than 64 mm diameter

As tephra falls to the ground with increasing distance from a volcano, the average size of the individual rock particles becomes smaller and thickness of the resulting deposit becomes thinner. Small tephra stays aloft in the eruption cloud for longer periods of time, which allows wind to blow tiny particles farther from an erupting volcano.

Tephra falls at the project area consists of ash and lapilli (**Plate 6**) of dacitic composition. The phenocryst-rich pumiceous clasts are strongly porphyritic and vesicular pyroclastic rocks composed of euhedral and fragmented or fractured phenocrysts set in a vesicular, glassy groundmass that contains single glass shards and, to a lesser extent, fragments of the phenocryst assemblage (Bernard *et al.*, 1996).

Figure 3-13 is an isopach map showing the thickness of tephra fall of the June 15 1991 climactic eruption of Pinatubo Volcano.

3.1.4.3 Tropical Cyclones and Storm Surges

Tropical cyclone occurrence is quite frequent in most areas of the Philippines including the project site. There is an average of about 19 tropical cyclones that pass the Philippines each year. The Subic Bay area is not exempted from the devastating effects of tropical cyclones. However, the frequency of tropical cyclone occurrence in the vicinity of the project site is just about 5 cyclones every 3 years (**Figure 3-14**). This frequency depends on whether an El Niño (corresponding to dry months) or La Niña (rainy months) occurs during the year (Anglo 1999 as cited in de las Alas 2001). During an El Niño, the frequency of tropical cyclone occurrence in the Subic Bay Freeport Zone is about 1.1 cyclones per year. On the other hand, this frequency increases during the occurrence of La Niña with about 1.5 cyclones per year. This is quite fortunate because as a tourist or recreational destination, severe weather conditions do not occur very frequently in the area.

The hazards associated with storm surges include inundation and flooding of coastal areas due to an abnormal rise in sea level arising from wave pile-up during the passage of a typhoon. **Figure 3-15** is a modeled storm surge map of the Subic Bay Area.

3.1.4.4 Flooding

As no historical data on the site was available, information was gathered from the local residents on flooding events in the area. According to Larry Nebres, the most recent flooding event that occurred in Green Beach was in July 2005 where the overtopping of the Agusuhin River produced 3 feet floodwaters. The flood however subsided soon after the strong rain event and the high tides.

Figure 3 - 13. Isopach Map of Thickness of Tephra Fall - June 15 1991 Climactic Eruption of Pinatubo Volcano.

Figure 3 - 14. Tropical Cyclone Map of the Philippines

Figure 3 - 15. Modeled Storm Surge Elevations at Subic Bay

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3.1.5 HYDROLOGY

3.1.5.1 Methods and Procedures

In the conduct of the study, various methods and procedures were adapted based on primary and secondary information and its applicability to the existing conditions.

The conventional catchment approach was applied to delineate and describe the surface water hydrology of the project area. Planemetric measurements of the catchment areas and the natural drainage systems were made by using the 1:50,000 topographic maps prepared by the National Mapping and Resource Information Authority (NAMRIA). This was later verified during the field investigations. Secondary data such as rainfall, soil type and land use were inputted to generate streamflow and flood magnitudes.

The geologic quadrangle map of the Mines and Geosciences Bureau was referred to and validated in the field for the hydrogeological units in the study area. An inventory of nearby wells and springs at the vicinity of the project area was conducted to identify groundwater users. The inventory includes well data gathering and field interviews supplemented by previous well inventories and groundwater studies. Aquifer characteristics at the project site were obtained from previous studies made for the Shell Philippines Exploration (SPEX) Concrete Gravity Structure (CGS) Project.

3.1.5.2 Study Sources

Primary and secondary sources of information regarding the project area were gathered during the field investigation conducted from 21-24 September 2005. Primary data consists of walkovers of the project area, stream traverses, and visits to nearby wells. During the visits, interviews with barangay officials and residents, and concerned officers of the industrial establishments were conducted to assess the water supply situation.

Secondary information was derived from previous studies and references, notably:

- Woodward-Clyde Phil., Inc. Environmental Impact Assessment (EIA) for the Shell Philippines Exploration's(SPEX) Concrete Gravity Structure, June, 1999; and
- Mines and Geosciences Bureau (MGB). Geology and Mineral Resources of the Philippines, Volume 1, 1982.

Other sources of secondary data include:

- National Mapping and Resource Information Authority (NAMRIA);
- Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA);
- Hanjin Heavy Industries and Construction Co., Ltd.

3.1.5.3 Catchment Morphometry

The project site is on the southern part of the Zambales Province centered approximately at geographic coordinates 14° 49' 07" North Latitude and 120° 12' 11" East Longitude. The project site which faces the western side of Subic Bay is within two catchments, namely: the Agusuhin Catchment that covers the southern portion of the project site; and an unnamed catchment which covers the northern part of the project site. For reporting purposes, the unnamed

catchment will be referred to as the North Catchment. **Figure 16** is a map showing the catchment boundaries in relation to the project area.

The Agusuhin Catchment is approximately 13.934 square kilometers (km^2), about 94% of which exhibit moderate to rugged terrain and the remaining 6% is flat to gently sloping terrain. It is a fan-shaped basin about 6 kilometers (km) long and up to 4.7 km at its widest breadth. It consists of three (3) sub-catchments: the Main Agusuhin Sub-catchment (AG-1), the North Agusuhin Sub-catchment (AG-2) and the Agusuhin River Downstream Sub-catchment (AG-3) from the confluence of AG-1 and AG-2 to the coast. From sea level at the eastern side, the catchment attains maximum elevations of 760 meters (m.) at Cinco Picos and 600 m. at Mount Redondo.

The North Catchment, with an area of about 2.358 km^2, is an elongated basin 3.6 km. long and 0.8 km wide. With Mount Redondo as a common summit with the North Catchment has a general slope of 0.16.

3.1.5.4 Drainage System

The catchments are drained by two main drainage systems: the Agusuhin River and the North Agusuhin Creek. The drainage systems are also shown in the **Figure 3-16**.

The Agusuhin drainage system is well developed and exhibits fourth order streams. Its main channel, the Agusuhin River, has a stream length of about 6.6 km. The headwaters originate at Cinco Picos 760 meters above sea level (masl) where it descends easterly to the its outlet at Subic Bay. From 200 masl to 700 masl, the stream grades steeply between 30% and 35%. Between 20 masl to 200 masl, stream gradients become gentler from 6% to 10%. At the project site (0 to 20 masl) the stream develops few and small meanders. Coarse gravel and boulders dominate the streambed and streambanks of up to 5 meters high **(Plate 7)**. Channel width at the project area varies from 15 to 50 m near the mouth **(Plate 8)**. Perennial flows persist for most of the main stream becoming intermittent to ephemeral at the headwaters and tributaries.

The North Agusuhin Creek that drains the North Catchment is a minor drainage some 4 km with the headwaters at Mount Redondo some 600 masl to the river mouth. From Mount Redondo, the creek flows southerly until it reaches the project area where it shifts to an easterly flow towards Subic Bay. Stream gradient is from 20 to 25% from 100 to 600 masl becoming gradual at 10% between 10 to 100 masl and 1% at the project area.

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Figure 3 - 16. Topographic Map Showing Catchment Areas and Major Drainage in the Project Area.

3.1.5.5 Stream Flow

Establishment of any major facility will require an evaluation and estimate of available and dependable water supply. There are two approaches to evaluate water availability. The first consists of flow duration analyses from streamflow data and the second involves the development of a project area rainfall record and applying catchment yield factors.

The Agusuhin River is ungaged. The nearest streamflow data is at Pamatawan River in San Antonio, Zambales some 15 km northwest of the project area. Flow duration analysis performed for this river (Drainage Area = 163 km^2) yielded an average flow of 1.82 cubic meters per second (CMS) at 80 percent dependability.

Where there is no streamflow information for analysis, several runoff estimation techniques have been developed for these situations and used on ungaged catchments. Rainfall excess (volume of runoff) could be determined by using infiltration equations, one of which is the most commonly applied method developed by the U.S. Soil Conservation Service (SCS, 1972).

In this approach infiltration losses are combined with surface storage by the relationship:

$$Q = \frac{(P - Ia)^2}{(P - Ia + S)}$$

where Q is the accumulated runoff or rainfall excess in inches, P is the rainfall depth in inches, and S is a parameter given by:

$$S = \frac{1000}{CN} - 10$$

where CN is known as the curve number. The term Ia is the initial abstractions in inches and includes surface storage, interception, and infiltration prior to runoff and is commonly approximated as 0.2S. By substitution, the equation becomes:

$$Q = \frac{(P - 2S)^2}{(P + 0.8S)}$$

The SCS curve number is a function of the ability of soils to infiltrate water, land use, and soil water conditions at the start of a rainfall event. The U.S. SCS has divided soils into four hydrologic soil groups and are assigned curve numbers for corresponding land use. Prior to estimating rainfall excess for a storm event, the curve numbers should be adjusted based on the season and 5-day antecedent precipitation or Antecedent Soil Moisture Conditions (AMC).

Applying the principles above, deduced monthly rainfall values at Subic Bay were selected as rainfall depths (see **Table 3-16**). Soil and land use investigations showed that the area is generally underlain by clayey soils and is predominantly grassland/brushland with thin forest. The project area Island possess a Coronas Type I climate classification where there are two pronounced season with pronounced maximum rainfall from June to September. Antecedent soil moisture conditions AMC I (November to April) and AMC III (May to October) will therefore be applied in adjusting for the curve numbers.

For these conditions, curve numbers CN = 66.1 for AMC I and CN = 92.3 for AMC III were selected for the project catchments. The CN values represent a grass cover while the soil in the area represents a Group C soil with low infiltration rates and soils with a layer that impedes downward percolation.

Table 3-3 presents computed average monthly runoffs for Agusuhin River and North Agusuhin Creek.

Table 3 - 3. Computed Average Monthly Runoff (MCM)* at the Project Area

Month	Agusuhin River (D.A. = 13.934 km^2)	North Agusuhin Creek (D.A. = 2.358 km^2)
January	0.072	0.012
February	0.072	0.012
March	0.056	0.009
April	0.021	0.004
May	3.068	0.519
June	8.009	1.355
July	9.708	1.643
August	14.837	2.511
September	7.904	1.337
October	2.823	0.478
November	0.266	0.045
December	0.014	0.002
Annual	46.850	7.927

**MCM – Million Cubic Meters*

3.1.5.6 Peak Flow Analysis

General

Catchment areas have been defined from site surveys and available topographical plans of the area. These have been the basis for estimating the discharge or storm water runoff and in determining the size of drainage facilities.

An investigation was undertaken on surface hydrology to enable the design of stormwater runoff to be redirected around the major facilities.

Criteria/Assumptions

Design Storm Frequencies

The design mean rainfall intensity (i) is derived from intensity / duration graphs given the time of concentration. Published graphs for Manila Port have been used in this preliminary assessment. The peak flow has been assessed for a 25-, 50- and 100-year return period rainstorm.

Runoff Computation

The rational formula is the simplest and most widely used method for determining surface water runoff, giving a direct relationship between runoff and rainfall. This method gives satisfactory discharge results only on small catchment areas. Experiments show that it begins to lose its accuracy when the discharge area exceeds two square kilometers. In the absence of sufficient localized data, this method is also considered acceptable for larger catchment areas provided it is modified. This

modification takes into account the effect of non-uniformity of rainfall intensity. The formula in metric units is:

$$Q = .278CIA$$

Where:

Q = flow in m^3/s for a return period equal to that of the rainfall intensity, I

A = catchment area in sq km. This is one of the basic data required in the design of surface or cross drainage facilities. Well defined drainage or catchment areas may be delineated on the topographic maps and the surface area calculated by outlining the catchment contributing to the proposed structure site.

C = runoff coefficient expressing the fraction of the rainfall that is assumed to become direct runoff. All variations in slope, shape, soil type, initial soil saturation, water table condition and land use have to be taken into account in the selection of the coefficient.

Weighted $C = (area_1 \times C_1 + area_2 \times C_2) / \text{total catchment area}$

I = rainfall intensity in mm/hr for a duration or time of concentration of the catchment area with a return period appropriate for the project condition. The time of concentration is computed by this formula:

$$Tc = L^{1.15}/51H^{0.385}$$

Where:

Tc = time of concentration, the time it takes for a water particle to travel from the farthest point in the catchment to the point of interest, in minutes.

L = length of flow path, in m

H =difference in elevation between the most distant ridge in the catchment and point under review in meters.

The method has many limitations and is based on the following assumptions:

(a) that rainfall occurs uniformly over the drainage area;

(b) peak rate of runoff can be reflected by the rainfall intensity, averaged over a time period equal to the time of concentration of the drainage area;

(c) time of concentration is the time required for flow to reach the point in question from the hydraulically most remote point in the discharge area; and

(d) frequency of runoff is the same as the frequency of the rainfall used in the equation.

Runoff Coefficient, C

For steep to rolling grassed areas, coefficient values range from 0.5 to 0.7. A runoff coefficient of 0.5 will be used for this analysis.

Meteorological Data

The meteorological data relevant for design consists of rainfall-intensity-duration-frequency (RIDF) charts prepared by PAGASA Hydrometeorological Investigations and

Special Studies Section (HISSS). The RIDF chart is available for the PAGASA Station at Manila Port Area some 80 km southeast of the project area. The RIDF data for Manila Port Area based on 26 years of record is presented in **Tables 3-4** and **3-5** are the computed rainfall extreme values and corresponding intensities.

Table 3 - 4. Computed Extreme Values (in millimeters) of Precipitation PAGASA Port Area Station

Return Period (years)	5 mins	10 mins	15 mins	30 mins	60 mins	2 hrs	3 hrs	6 hrs	12 hrs	24 hrs
2	13.1	21.6	28.4	42.6	58.5	72.4	80.9	102.1	127.0	161.8
5	16.8	28.0	37.0	55.5	73.6	94.6	106.2	138.4	178.1	235.4
10	19.2	32.2	42.7	64.1	83.6	109.2	122.9	162.4	212.0	284.2
15	20.6	34.5	45.9	68.9	89.2	117.5	132.3	175.9	231.1	311.7
20	21.6	36.2	48.2	72.3	93.2	123.3	138.9	185.4	244.5	330.9
25	22.3	37.5	49.9	74.9	96.2	127.8	144.0	192.7	254.8	345.7
50	24.6	41.4	55.2	82.9	105.6	141.5	159.7	215.2	286.5	391.4
100	26.9	45.3	60.5	90.8	114.9	155.1	175.2	237.6	318.0	436.8

Table 3 - 5. Rainfall Intensities (in millimeters/hour) of Computed Extreme Values PAGASA Port Area Station

Return Period (years)	5 mins	10 mins	15 mins	30 mins	60 mins	2 hrs	3 hrs	6 hrs	12 hrs	24 hrs
2	157.2	129.6	113.6	85.2	58.5	36.2	27.0	17.0	10.6	6.7
5	201.6	168.0	148.0	111.0	73.6	47.3	35.4	23.1	14.8	9.8
10	230.4	193.2	170.8	128.2	83.6	54.6	41.0	27.1	17.7	11.8
15	247.2	207.0	183.6	137.8	89.2	58.8	44.1	29.3	19.3	13.0
20	259.2	217.2	192.8	144.6	93.2	61.6	46.3	30.9	20.4	13.8
25	267.6	225.0	199.6	149.8	96.2	63.9	48.0	32.1	21.2	14.4
50	295.2	248.4	220.8	165.8	105.6	70.8	53.2	35.9	23.9	16.3
100	322.8	271.8	242.0	181.6	114.9	77.5	58.4	39.6	26.5	18.2

Existing Catchments

The drainage catchment plan in **Figure 3-16** shows the catchments that impact the project area.

The design flows for each catchment, based on the design criteria is presented in **Table 3-6**.

Table 3 - 6. Design Flows

Catchment	Tributary Area (sq.km.)	Increment Area (sq.km.)	Tc $L^{1.15}/51H^{0.385}$ (min.)	Rainfall Intensity (mm/hr)			Length (m)	Diff. in Elev. (m)	Peak Discharge (CMS)		
				25-yr	50-yr	100-yr			25-yr	50-yr	100-yr
AG-1	6.593	6.593	27.39	158.5	175.4	192.1	4750	650	145.2	160.7	176.1
AG-2	6.161	6.161	30.10	149.6	165.6	181.4	4690	490	128.1	141.8	155.3
AG-3	1.180	13.934	40.10	131.8	145.5	159.1	6650	660	255.2	281.9	308.2

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NAC	2.358	2.358	23.08	172.8	191.2	209.5	3940	580	56.6	62.6	68.6

Reference Figure: Figure 3-16
Data used in the above computation:
Rainfall Intensity-Duration-Frequency data of 26 years
Design Storm Frequency = 25,50, 100 years
Runoff Coefficient "C" = 0.5

3.1.5.7 River Uses

The Agusuhin River and the North Agusuhin Creek are both utilized to provide irrigation to small farms. Other uses are for support of domestic needs such as washing and bathing, and for livestock.

3.1.6 HYDROGEOLOGY

3.1.6.1 Regional Hydrogeology

Based on the regional hydrogeologic map prepared by the Mines and Geosciences Bureau (MGB, 1997), the project area is underlain by gabbro and peridotite which have limited potential. These rocks have low to moderate permeability with shallow water yields of 0.01 to 0.3 lps confined to leached or fractured zones. **Figure 3 – 17** presents the hydrogeologic map showing the project area.

3.1.6.2 Hydrogeologic Units

The hydrogeologic units at the study area are based from the local geology which was discussed in Section 3.1.3.6 (Site Geology). A brief description of each unit with emphasis on the groundwater occurrence and aquifer potential is presented below.

Two hydrogeologic units can be considered the project area:

Quaternary Alluvium. The quartenary alluvium are recent unconsolidated alluvial deposits that consist of clays, silts, sands and gravels along river beds and floodplains. It also includes beach sand and coral reefs along the narrow shore areas. This unit underlies the entire project area where groundwater movement is intergranular.

Geotechnical investigation for the CGS (1999) revealed extensive coralline deposits to the north of the casting basin area. These were shown during drilling of boreholes and deep wells to be very permeable in local areas. Wellpoints installed into the coralline deposits in one particular area yielded very high flows initially, of brackish water.

Site investigation and monitoring of water quality and flows indicated that although there were areas of highly permeable coral, there was evidence that in general this stratum was not continuous, and much fragmented and weathered coral within a sandy and clayey matrix was also encountered. Salinity of water being pumped from the corals did not increase with time, and flow rates eventually reduced.

The groundwater regime in this area varied from elsewhere around the basin, in that it appeared that there was hydraulic connectivity between all strata. Water levels were observed to drop in the bedrock and colluvium as well as in the upper deposits during dewatering.

Mafic and Ultramafic Rocks. These are a sequence of peridotites, gabbros, minor diabasic dike. This bedrock unit which underlies the alluvial deposits outcrops and surrounds the project site as valley slopes. The groundwater in this group occurs in sufficiently leached or weathered zones

and locally fractured zones and, thus, aquifer portions of these units are localized and generally less productive.

3.1.6.3 Well Inventory

Survey conducted at the project area (Sitio Agusuhin) indicated about 250 hand (pitcher) pumps. All the wells tap the shallow unconfined aquifer comprised of unconsolidated alluvial deposits that overlay the older marine sediments. Most of the wells in the area are less than 6 meters (20 ft) deep. Water in some of the wells is not potable and there are reports of sea water intrusion in wells located less than 50 m from the shoreline. Three (3) wells were installed by the Malampaya CGS Alliance (MCA) for public use. These wells were tested and found the water potable.

Five deep wells were installed in 2000 during the construction of the CGS for domestic use. The total volume of extraction from these deep wells is about 350 m^3/day. However, none of these wells are now operating.

3.1.6.4 Aquifer Characteristics

The project area is characterized by two aquifers, which are described as the upper aquifer and the lower aquifer. A brief description of the two aquifers is given below.

Upper Aquifer

The upper aquifer is mainly alluvium/beach deposits with a thickness of 4m to 10m based on borehole logs. The thickness generally increases towards the south and east. From geotechnical investigations performed for the CGS (1999), the alluvium deposits are comprised mainly of loose to medium dense gravelly sands to silty sands while the beach deposits are made up of medium dense to dense, locally loose gravelly sands. The average permeability of this layer is 3×10^{-4} m/sec as indicated by falling head tests conducted for this layer.

The water level in the upper alluvium/beach deposits was originally at approximately mean sea level across the site. Observations in piezometers when wells were airlifted and wellpoint dewatering showed that water levels in the underlying marine deposits were affected by dewatering the upper alluvium. Thus the upper aquifer is considered unconfined, extending to around 22 meters below sea level (mbsl).

The nature of the soils changes from more gravelly at the surface, to clayey silt or silty clay at depth, implying a reduction in aquifer permeability with depth.

Lower Aquifer

A layer of alluvium/colluvium occurs below the marine and coralline deposits. The formation varies across the site from gravelly to clayey sands to gravelly to bouldery clay/ clayey gravels and boulders. The thickness of this layer varies from 3.5 m to more than 22 m. The thickness generally increases towards the east and south. This aquifer extends from around 22 mbsl to more than 44.5 mbsl towards the south. Piezometric water levels prior to pumping were at sea level.

The permeability of the lower alluvium is higher than the overlying, marine deposits. As the marine deposits become less permeable, the water pressures with in the lower alluvium are semi-confined. The average permeability of this layer is 3 x 10-6 m/sec as indicated by falling head tests conducted for this layer.

Water in this aquifer was fresh, even towards the sea. It was concluded that the aquifer was not connected directly to the sea. Recharge of this layer was very rapid.

3.1.6.5 Well Yield

A single pumped groundwater well was performed by Ove Arup & Partners (1998) for a preliminary assessment to determine the potential well yields from the groundwater aquifer. The method used in the calculation is valid for a uniform, unconfined aquifer and is based on the equation:

$$Q = \frac{1.366k\,(H^2 - h^2)}{\log R/r} \qquad \text{(Driscoll, 1986)}$$

Where:
- Q = well yield
- K = permeability
- H = static water level from the bottom of the aquifer
- h = depth of water in the well during pumping
- R = radius of influence
- r = radius of the well

The assumptions used to carry out the assessment include:

- K = 1 x 10 –5 m/sec.
- H = 10 m
- h = 5 m
- R = 250 m
- r = 250 mm

Based on the results, well yields of about 50 m^3/day can be expected from a single well.

3.1.6.6 Groundwater Discharge

Groundwater discharge at the study area can be estimated by the use of Darcy's Equation. The flow *Q* through any vertical section of an aquifer is expressed by the equation:

$$Q = T \times I \times w$$

where *T* is the transmissivity of the aquifer; *I* is the piezometric gradient; and *w* is width of the aquifer. Transmissivity is given by the equation:

$$T = Kb$$

where *K* is hydraulic conductivity estimated at 3 x 10^{-5} m/sec (2.59 m/day) and *b* is the average thickness of the lower aquifer of 25 m. The transmissivity of the lower aquifer is therefore:

$$T = 2.59 \text{ m/day} \times 25 \text{ m} = 64.75 \text{ m}^2\text{/day}$$

With a average piezometric gradient of 0.006 based on geotechnical drillholes and an aquifer width of 750 m the groundwater flow at the study area is therefore:

$$Q = 64.75 \text{ m}^2\text{/day} \times 0.0075 \times 750 \text{ m} = 364.21 \text{ m}^3\text{/day}$$

The computed groundwater underflow can be used as an initial estimate of the groundwater available for exploitation.

Preliminary estimates of surface and groundwater resources indicated that:

- during dry periods, there is insufficient surface water to supply all industrial water requirements; and
- there is insufficient groundwater available to meet all domestic water requirements.

Figure 3 - 17. Regional Hydrogeologic Map

3.1.7 WATER AND SEDIMENT QUALITY

3.1.7.1 Methodology

Location of Sampling Stations

Four (4) river sampling stations and 1 groundwater sampling station were considered for this study (**Plates 9, 10, 11**). **Table 3-7** shows the locations, type of substrates and coordinates of the sampling stations. The positions of these stations were taken with GPS (global positioning system) Garmin-Model Etrex. The approximate locations of these sampling stations are shown in **Figure 3-18.**

Table 3 - 7. Type of Substrates and Coordinates of the River Water and Sediment Quality and Groundwater Sampling Stations in Agusuhin (24 September 2005)

Station No. / Name	Type of Bottom Sediment	Coordinates	
		North Lat.	East Long.
R1- Agusuhin River Downstream	Sandy	14° 48' 56.9"	120° 12' 45.9"
R2- Agusuhin River Upstream	Gravelly-Sandy	14° 49' 29.2"	120° 12' 09.1"
R3- Agusuhin Creek Downstream	Sandy	14° 48' 52.8"	120° 11' 39.5"
R4- Agusuhin Creek Upstream	Gravelly-Sandy	14° 49' 20.3"	120° 11' 58.9"
GW- Agusuhin Proper (Hand Pump)	-	14° 49' 02.1"	120° 12' 25.2"

Three marine sampling stations were also considered for this study. **Table 3-8** shows the locations, type of substrates and coordinates of the sampling stations. The approximate locations of these sampling stations are also shown in **Figure 3-18**.

Table 3 - 8. Locations, Depth, Type of Substrates and Coordinates of the Marine Water and Sediment Quality Sampling Stations in Agusuhin (24 September 2005)

Station No. / Name	Location	Approx. Depth (m)	Type of Bottom Sediment	Coordinates	
				North Lat.	East Long.
M1- Off Petambu	N of Malampaya CGS Casting Basin (Petambu Point)	3	Sandy	14° 49' 15.9"	120° 12' 51.3"
M2- Off Agusuhin Pier/Pontoon	S of Malampaya CGS Casting Basin (In front of Agusuhin Pier/Pontoon)	6	Sandy - muddy	14° 49' 24.0"	120° 12' 35.1"
M3- Off Agusuhin Rivermouth	Farther S of Malampaya CGS Casting Basin (Front Side of the Mouth of Augusuhin River)	5	Sandy - muddy	14° 49' 56.5"	120° 12' 45.9"

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Figure 3 - 18. Biotope Map of Sito Agusuhin and Vicinities Shopwing Sampling Stations

Parameters, Field Sampling and Analytical Methods

Table 3-9 below depicts the physico-chemical and biological parameters determined for this study.

Seawater temperature and dissolved oxygen (DO) parameters were measured in situ using an Orion Oxygen Meter (Model 840).

Water samples were collected from each station to determine baseline values or background concentration levels of the other parameters listed in **Table 3-9**. Standard plastic and glass bottle containers were used to collect water and sediment samples. While in the field, water samples were preserved in a cooler with ice.

Sediment sampling was also carried out using the Ekman bottom grab sampler from all marine sampling stations. However, due to the compacted nature of the bottom substrate in most of the sampling stations, use of the grab sampler was not always possible. Instead the grab sampler was lowered to the bottom by SCUBA diver and pushed into the substrate.

In the laboratory, standard analytical test specific for each parameter was used (**Table 3-10**). Chemical analyses were done by CRL Environmental Corporation (Clarkfield-CSEZ, Pampanga). Certificate of water quality and sediment quality analysis are attached in **Appendix 5**.

Table 3 - 9. Physico-Chemical and Bacteriological Parameters Taken at Various Locations in Agusuhin (24 September 2005)

Parameter	River/Creek		Ground-water	Marine	
	Water	Sediment		Water	Sediment
1. Temperature	X		X	X	
2. Dissolved Oxygen	X			X	
3. Salinity			X	X	
4. Hydrogen-ion Concentration (pH)	X		X	X	
5. Total Suspended Solids (TSS)	X		X	X	
6. Total Dissolved Solids (TDS)			X		
7. Biological Oxygen Demand (BOD_5)				X	
8. Total Coliform	X		X	X	
9. Fecal Coliform	X		X	X	
10.Nitrate	X			X	
11.Chloride			X		
12.Total Hardness			X		
13.Oil & Grease	X	X		X	X
14.Arsenic (As)	X	X	X	X	X
15.Cadmium (Cd)	X	X	X	X	X
16.Copper (Cu)	X	X	X	X	X
17.Chromium, Hexavalent (Cr^{+6})	X	X	X	X	X
18.Lead (Pb)	X	X	X	X	X
19.Mercury (Hg)	X	X	X	X	X
20.Zinc (Zn)	X	X	X	X	X

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Table 3 - 10. Analytical Methodologies Employed for Water and Sediment Quality Parameters

Parameter / Sample Type	Methodology
Hydrogen-ion Concentration, pH (Marine/Freshwater/GroundWater)	Glass Electrode (pH @ 25°c)
Salinity (Marine/Freshwater/Groundwater)	Argentometry (Salinity as NaCl)
Total Suspended Solids, TSS (Marine/Freshwater/Groundwater)	Gravimetry
Total Dissolved Solids, TDS	Gravimetry
Oil & Grease (Marine/Sediment)	Gravimetry-Pet. Ether Extraction
Biological Oxygen Demand, BOD_5 (Marine)	Azide Modification
Nitrate (Marine)	Colorimetry- Brucine
Chloride (Groundwater)	Argentometry
Total Hardness as $CaCO_3$ (Groundwater)	EDTA Tritration
Total Arsenic, As (Marine/Freshwater/Groundwater)	Colorimetry- SDDC
Total Arsenic, As (Sediment)	AAS- Hydride Generation
Total Cadmium, Cd (Marine/Freshwater/Groundwater/Sediment)	Flame AAS
Total Chromium, Hexavalent Cr^{+6} (Marine/Freshwater/Groundwater/Sediment)	Colorimetry-Diphenylcarbazide
Total Copper, Cu (Marine/Freshwater/Groundwater/Sediment)	Flame AAS
Total Lead, Pb (Marine/Freshwater/Groundwater/Sediment)	Flame AAS
Total Zinc, Zn (Marine/Freshwater/Groundwater/Sediment)	Flame AAS
Total Mercury, Hg (Marine/Freshwater/Groundwater/Sediment)	AAS- Cold Vapor

3.1.7.2 Results and Discussion

Freshwater and Sediment Quality

River Water Quality

All the data for water quality parameters observed in different stations during the survey are summarized in **Table 3-11**.

Water temperature ranged from 25.4 to 26.4°C with an average of 25.9°C. Dissolved oxygen levels (range of 6.6 to 8.4 mg/L, or an average of 7.6 mg/L) exceeded the 5 mg/L criterion of DENR Class C waters (i.e., waters for fishery for propagation and growth of fish and other aquatic resources).

Hydrogen-ion concentration (pH) ranged from 7.90 to 8.40, which were well within the normal limits for river and marine/estuarine waters. The DENR water quality standard to pH of Class C waters is 6.5 to 8.5. Total suspended solids (TSS) include both inorganic and organic substances present in the water and are retained in a 0.45 um filter paper. The detected TSS levels varied from 3 to 24 mg/L with an average of 12 mg/L. The DENR declared that TSS limits should not be more than 30 mg/L increase for Class C waters. Total coliform levels were relatively lower (500 –900 MPN/100 mL) in Agusuhin River compared to that in Agusuhin Creek (1,600- 2,400 MPN/100 mL). The DENR water quality standard to total coliform of Class C waters is 5,000 MPN. Fecal coliform *Escherichia coli* levels, on the other hand, were relatively low which ranged from 240 to 500 MPN/100 mL. Nitrate content was not detected in all sampling stations (i.e., below the reporting limit of 0.007 mg/L).

The present survey showed that oil & grease, which often come from industrial discharge and urban run-offs, ranged from 0.3 to 0.5 mg/L (average of 0.4 mg/L), which were way below the 2 mg/L criterion of DENR Class C waters.

Of the 7 metals analyzed, arsenic, cadmium, chromium (hexavalent) and lead were not detected from all river water samples (i.e., below the reporting limit of 0.005, 0.003, 0.009 and 0.01 mg/L, respectively). In contrast, mercury showed detectable levels in all stations, which ranged from 0.0001 to 0.001 mg/L, with the highest value recorded at Station 1 (Downstream of Agusuhin River). DENR Class C waters are required to maintain mercury concentration of up to 0.002 mg/L.

Copper and zinc were also not detected in all the sampling stations except at Station R1 (Downstream of Agusuhin River), which showed detectable levels of 0.04 and 0.03 mg/L, respectively.

Table 3 - 11. Water Quality Data for River Waters of Agusuhin (24 September 2005)

Parameter	Unit	Agusuhin River		Agusuhin North Creek		Mean	DENR Water Quality Class C Standards
		Stn. R1 (Downstream)	Stn. R2 (Upstream)	Stn. R3 (Downstream)	Stn. R4 (Upstream)		
Temperature	°C	26.4	25.7	26.0	25.4	25.9	3°C rise
Dissolved Oxygen	mg/l	6.6	7.8	7.8	8.4	7.6	5
Hydrogen-ion Concentration (pH)	-	8.03	8.40	7.90	8.25	8.14	6.5 – 8.5
Total Suspended Solids (TSS)	mg/l	24	14	8	3	12	Not >30 mg/L increase
Total Coliform	MPN/100 ml	900	500	2400	1,600	1,350	5,000
Fecal Coliform	MPN/100 ml	500	300	300	240	335	-
Nitrate	mg/l	<0.007	<0.007	<0.007	<0.007	<0.007	10
Oil & Grease	mg/l	0.40	0.40	0.50	0.30	0.40	2
Arsenic (As)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Cadmium (Cd)	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	0.01
Copper (Cu)	mg/l	0.04	<0.02	<0.02	<0.02	-	0.05
Chromium (hexavalent, Cr^{+6})	mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	0.05
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Mercury (Hg)	mg/l	0.001	0.0011	0.0011	0.0011	0.0011	0.002
Zinc (Zn)	mg/l	0.03	<0.03	<0.03	<0.03	-	-

Legend: - Method Detection Limits: As = 0.005, Cd = 0.003, Cu = 0.02, Cr+6 = 0.009, Pb = 0.01, Hg = 0.0001, Zn = 0.03, Oil & grease =0.70, Nitrate = 0.007

°C= Degrees Celsius; ppt = Parts per Thousand; mg/l = Milligram per Liter; MPN = Most Probable Number

Class C = Fishery Water for Propagation and Growth of Fish and Other Aquatic Resources

River Sediment Quality

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Examination results of heavy metal concentrations and oil & grease in bottom sediments in all river stations are given in **Table 3-12**. Cadmium, chromium (hexavalent), lead and oil & grease were not detected in all the sediment samples (i.e., below the reporting limit of 1.0, 0.045, 3.0, and 0.70 mg/kg, respectively).

Arsenic ranged from not detectable levels at Stations 1 and 2 (Downstream and Upstream of Agusuhin River) to a range of 0.04-0.05 mg/kg at Stations 3 and 4 (Downstream and Upstream of Agusuhin Creek). Detectable concentrations of copper (range of 2.9- 12 mg/kg) and zinc (range of 4.2- 6.2 mg/kg) were obtained in all stations. Similarly, mercury was also detected in all stations, which ranged from 0.31 to 0.36 mg/kg.

Table 3 - 12. Heavy Metal Concentration and Oil & Grease (mg/kg) Data for Agusuhin River Bottom Sediments (24 September 2005)

Stn.	Type of Sediment	Arsenic (As)	Cadmium (Cd)	Chromium Hexavalent (Cr^{+6})	Copper (Cu)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Oil & Grease
R1	Sand	ND	ND	ND	10	ND	6.2	0.34	ND
R2	Gravel-Sand	ND	ND	ND	12	ND	5.3	0.31	ND
R3	Sand	0.05	ND	ND	2.9	ND	4.2	0.32	ND
R4	Sand	0.04	ND	ND	9.7	ND	5.6	0.36	ND

Legend: Method Detection Limits: As =0.025; Cd= 1.0; Cu = 1.0; Cr^{+6} = 0.045; Pb= 3.0; Zn= 1.5; Hg= 0.10; Oil & Grease = 0.70

Groundwater Quality

Table 3-13 provided to show the result of the groundwater (hand pumped well) analysis. When appropriate, measured values were compared to the Philippine National Standards for Drinking Water (PNSDW), which are based on World Health Organization (WHO) standards.

The water temperature measured during this survey was 26°C. Salinity value (6.4 ppt) obtained indicates saltwater intrusion. The pH (7.2) obtained was within the range specified in the NSDW standard, which is 6.5 to 8.5. The water sample analyzed had low concentration of total suspended solids (TSS). The total dissolved solids (TDS, 294 mg/L) and chloride (13 mg/L) concentrations were way below the NSDW standards. An elevated concentration of total hardness (201 mg/L) was found in the sample.

Elevated levels of total coliform and fecal coliform with values of 2,400 MPN each were also found in the groundwater (well) sample.

The potential source of the high level of fecal coliform in the groundwater is the existing conventional sewage systems and the human waste disposal practices in the community. These sewage systems are not lined and such the human wastes leached directly into the groundwater. Moreover, the usual practice of defecating on the ground added to the contamination.

If such practices cease to exist, the ground water may slowly rejuvenate and in time the groundwater will normalize its coliform level.

It is expected that the future wells will yield low fecal coliform reading. The absence of the community, which is the main source of this pollutant, will greatly reduce the

coliform level. During the construction and operation stage, appropriate sewage system and mitigating measures will be installed to ensure that no contaminants will migrate to the groundwater.

Of the 7 heavy metals analyzed, only mercury (0.003 mg/L) was detected in the water sample, which exceeded the NSDW limit for mercury. The other heavy metals such as arsenic, cadmium, copper, chromium hexavalent, lead and zinc were not detected (i.e., below the reporting limits of 0.005, 0.003, 0.02, 0.009, 0.01 and 0.03 mg/L, respectively).

Table 3 - 13. Groundwater Physical and Chemical Characteristics of Agusuhin (24 September 2005)

Parameter	Unit	Stn. GW	PNSDW Standard
Temperature	°C	26.0	NS
Salinity	ppt	6.4	NS
Hydrogen-ion Concentration (pH)	-	7.2	6.5-8.5
Total Suspended Solids (TSS)	mg/l	4.0	NS
Total Dissolved Solids (TDS)	mg/l	294	500
Chloride	mg/l	13	200.00
Total Hardness	mg/l	201	100
Total Coliform	MPN/100 ml	2,400	0
Fecal Coliform	MPN/100 ml	2,400	0
Arsenic (As)	mg/l	<0.005	0.01
Cadmium (Cd)	mg/l	<0.003	0.003
Copper (Cu)	mg/l	<0.02	1.0
Chromium (hexavalent, Cr^{+6})	mg/l	<0.009	0.05*
Lead (Pb)	mg/l	<0.01	0.01
Mercury (Hg)	mg/l	0.003	0.0001
Zinc (Zn)	mg/l	<0.03	5.0

Legend: Method Detection Limits: Chloride = 0.20, Hardness as $CaCO_3$ = 0.20, As = 0.005
Cd = 0.003, Pb = 0.01, Cu = 0.02,
Cr^{+6} = 0.009, Hg = 0.0001, Zn = 0.03
PNSDW = Philippine National Standards for Drinking Water; NS = No Standards
°C = Degrees Celsius; ppt = Parts per Thousand; mg/L = Milligram per Liter;
MPN = Most Probable Number; (*) = Permissible Limit for Total Chromium

Marine Water and Sediment Quality

Water Quality

The physico-chemical properties of the nearshore surface waters along the Agusuhin coastline in the present survey are summarized in **Table 3-14**. Levels obtained for the various parameters showed little variation among the three marine sampling stations. Water temperature ranged from 27.0 to 27.5°C with an average of 27.3°C. Salinity in all stations had a similar pattern of normal values, which ranged from 21.0 to 24.9 ppt with an average of 22.9 ppt. The pH of the water ranged from 8.17 to 8.31 with an average of 8.26. Dissolved oxygen levels (ranged of 8.20 to 9.34 mg/L, or an average of 8.96 mg/L) exceeded the 5 mg/L criterion of DENR for Class SC waters. Total suspended solids (TSS) ranged from 9 to 13 mg/L with an average of 11 mg/L.

The levels of biological oxygen demand (BOD_5), oil & grease and total coliform, were consistently way below the limits set for Class SC waters by DENR for all stations. Nitrate content was not detected. Similarly, the concentrations of heavy metals arsenic, chromium hexavalent and lead were not detected in all stations. Elevated content of cadmium (range of 0.02 to 0.07 mg/L, or an average of 0.05 mg/L) was noted in all stations, which exceed the prescribed 0.01 mg/L for Class SC waters. Mercury was also detected in all stations and their concentrations ranged from 0.001 to 0.0013mg/L, with the highest value recorded at Station M3 and the lowest at Station M1. Copper ranged not detectable to 0.05 mg/L. Zinc also ranged from not detectable to 0.08 mg/L.

Table 3 - 14. Water Quality Data for Nearshore (Surface) Marine Waters of Agusuhin (24 September 2005)

Parameter	Unit	Stn. M1	Stn. M2	Stn. M3	Mean	DENR Water Quality Standard (CLASS SC)
Temperature	°C	27.4	27.5	27.0	27.3	3°C rise
Salinity	ppt	22.8	24.9	21.0	22.9	-
Dissolved Oxygen	mg/l	9.34	9.34	8.20	8.96	5
Hydrogen-ion Concentration (pH)	-	8.31	8.30	8.17	8.26	6.5 – 8.5
Total Suspended Solids (TSS)	mg/l	9.0	13.0	11.0	11.0	Not >30 mg/L increase
Biological Oxygen Demand (BOD_5)	mg/l	<2	2	5	-	7
Total Coliform	MPN/100 ml	900	240	N/S	570	5,000
Fecal Coliform	MPN/100 ml	500	80	N/S	290	-
Nitrate	mg/l	<0.007	<0.007	N/S	<0.007	-
Oil & Grease	mg/l	0.30	0.20	0.30	0.26	3
Arsenic (As)	mg/l	<0.005	<0.005	<0.005	<0.005	0.05
Cadmium (Cd)	mg/l	0.06	0.07	0.02	0.05	0.01
Copper (Cu)	mg/l	0.05	0.10	<0.02	-	0.05
Chromium (hexavalent, Cr^{+6})	mg/l	<0.009	<0.009	<0.009	<0.009	0.1
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	0.05
Mercury (Hg)	mg/l	0.001	0.0011	0.0013	0.001	0.002
Zinc (Zn)	mg/l	0.05	0.08	<0.03	-	-

Legend: Method Detection Limits: As = 0.005, Cd = 0.003, Cu = 0.02, Cr+6 = 0.009, Pb = 0.01, Hg = 0.0001, Zn = 0.03, Oil & grease =0.70

N/S = No Samples; °C= Degrees Celsius; ppt = Parts per Thousand; mg/l = Milligram per Liter; MPN = Most Probable Number; Class SC = Waters Used for Boating and Commercial and Sustenance Fishing

Sediment Quality

Examination results of heavy metal and oil & grease concentrations in bottom sediments are given in **Table 3-15**. Oil & grease, cadmium, chromium hexavalent and lead were not detected in all stations. In contrast, copper (range of 4 to 13 mg/kg), zinc (range of 2.7 to 8.2 mg/kg) and mercury (range of 0.31 to 0.35 mg/kg) were detected in all stations. Arsenic ranged from not detectable to 0.25 mg/kg.

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Based on known impact of metals on aquatic life (NOAA, 1991), measure of concentration of said metals have been proposed to provide means of determining relative degrees of possible impact.

The sediment metal data from this survey were compared to the NOAA apparent effects threshold (AET) and the effect range-low (ER-L) criteria proposed by Long and Morgan (1991), and to the no observed effects level (NOEL) proposed by MacDonald (1993).

AET is "the concentration of a substance above which a statistically significant effect on marine organisms (usually benthic or bottom dwelling organisms) has been demonstrated. ER-L is "the concentration of a substance where less than 10% of all the sediment toxicity studies report no biological effect". A NOEL is "the highest value of a total metal contaminant that is not expected to cause any biological effects". The AET, ER-L and NOEL values are based on the total metal concentrations, yet toxicologists are divided on the relevance of total metal concentrations to harm animals.

The detected levels of arsenic, copper and zinc in all stations are way below their respective AET, ER-L and NOEL

Mercury concentrations in bottom sediments in all stations are also way below the AET level but exceed the ER-L and NOEL levels.

Table 3 - 15. Heavy Metal Concentration and Oil & Grease (mg/kg) for Agusuhin Nearshore Marine Bottom Sediments (24 September 2005)

Stn.	Depth (m)	Type of Sediment	Arsenic (As)	Cadmium (Cd)	Chromium Hexavalent (Cr^{+6})	Copper (Cu)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Oil & Grease
M1	3	Sand	0.25	ND	ND	8.4	ND	8.2	0.35	ND
M2	6	Sand-Mud	ND	ND	ND	4.0	ND	2.7	0.31	ND
M3	6	Sand-Mud	0.08	ND	ND	13.0	ND	7.5	0.34	ND
NOAA (1991) and MacDonald (1993)										
AET			50.0	5.0	145	300	110	260	1.00	
AR-L			33.0	5.0	80	70	35	120	0.15	
NOEL			8.0	1.0	33	28	21	68	0.10	

Legend: Method Detection Limits: As = 0.025; Cd = 1.0; Cu = 1.0; Cr+6 = 0.045; Pb = 3.0; Zn = 1.5; Hg = 0.10; Oil & Grease = 0.70

3.1.8 PHYSICAL OCEANOGRAPHY

3.1.8.1 Bathymetry

Subic Bay is relatively narrow and elongated from north to south. Grande Island, located near the mouth of Subic Bay provides an obstacle to the general circulation within the Bay. At the eastern control position of the Bay, one could find several enclosed coves where most of the existing wharves and piers are located.

The Bay is relatively shallow particularly in its northern portion with depths ranging from 1-20 m. This area is particularly affected by sediment discharges from a number of rivers. The bathymetric contours of the bay increase southward with deeper portions located towards the mouth of the bay. Relatedly, the maximum chartered depth of the bay is about 60 m which is located south of Grande Island (Rivera/Woodward-Clyde, 2001). **Figure 3-19** presents the

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bathymetric map of the entire Subic Bay area. **Figure 3-19a** shows the nearshore bathymetry within the project site.

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Figure 3 - 19. Bathymetric Map of Subic Bay.

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Figure 3-19a. Bathymetric/Bottom Topography Map

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3.1.8.2 Tides in the Study Area

The observed tide in Subic Bay is normally mixed with a predominantly diurnal character. **Figure 3-20** shows this characteristic tidal pattern in the bay. In general, the semi-diurnal constituents which are responsible in the observed two high and two low water levels in the area occur almost every after two weeks. These hourly data were used in a harmonic analysis and the derived amplitudes and phases of the dominant tidal constituents namely O1, K1, M2 and S2, were used in a Fourier series of water level in the open boundary condition of the numerical model.

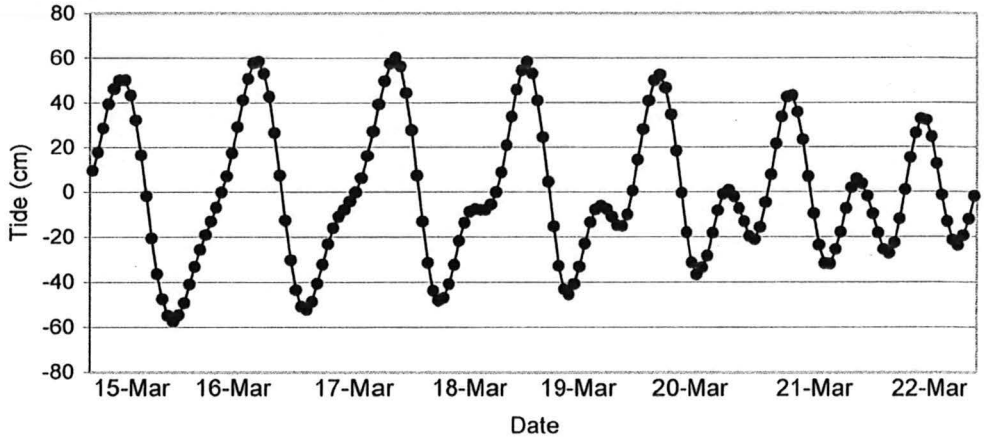

Figure 3 - 20. Observed Tidal Variation in Subic Bay (SBPAMPP, 2002)

3.1.8.3 Extreme Waves

During the passage of typhoons in the area, extreme waves such as that due to storm surge may occur. This is an abnormal rise in the sea surface elevation associated with the strong winds of a storm. To determine the possibility of occurrence of this coastal hazard in Subic Bay, a storm surge model was run during the SBPAMPP (2002) with storm winds as input. It should be noted that the storm surge model is basically the same circulation model discussed above. By virtue of the equation of mass continuity, the temporal evolution of the sea surface elevation throughout the area can be determined.

In general, a southerly wind direction was considered as posing a surge threat in the area due to the orientation of the bay with one opening towards the south. When typhoons crosses the Philippine Islands and passes south of Subic Bay, storm winds with a southerly orientation may result.

The results of the SBPAMPP (2002) study showed that a typhoon with storm winds of about 150 KPH would generate a surge height exceeding 1.0 m in some parts of the bay. Higher sea surface elevation would be confined at the head of the bay. It should be noted that a surge is considered disastrous when it inundates low-lying coastal areas especially when it coincides with high tide. The study showed that with a 150 kph storm wind, most of the areas around the bay would not be threatened by extreme storm surge height even when it coincides with high tide. This is because most of the areas north of Subic Bay are high enough, e.g. well above sea level. However, the low lying areas east of the bay such as the SBMA may be inundated.

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3.1.8.4 Currents in the Study Area

Dry Season

Previous observation in Subic Bay showed that during the dry season (NE Monsoon) with winds ranging from 3-6 meters per second (m/s), currents may range from 3-21 centimeters per second (cm/s) at the surface. In addition, observed current directions do not necessarily go with the direction of the wind due to the influence of the complex coastal geometry and bottom topography of the bay. The observed wind during this season showed occasional changes in orientation but the prevailing wind comes from the northeast to the east with speed that ranges from 2–5 m/s. The average surface current was observed to be about 9.6 cm/s during ordinary wind conditions (no storms) in the dry season (SBPAMPP, 2002). This is slightly above 3 % of the average wind speed (about 3 m/s) during this season and this is a pretty common observation in many coastal areas.

The result of the numerical model shows that the wind-driven circulation in Subic Bay during the dry season (e.g. Northeast Monsoon Season) is characterized by the presence of several small-scale eddies. The simulated coastal currents at various phases of the tide during this season are shown in **Figure 3-21** and **Figure 3-22.** At the head of the bay, a cyclonic circulation is evident. South of this is another cyclonic formation with about the same size but apparently of weaker magnitude. Small-sized anti-cyclonic eddies are located near the airport and an inward flow is evident towards Port Olongapo. Near the mouth of the bay, a counterclockwise circulation appears around Grande Island, with a relatively strong southwestward flow east of the island that is balanced by a northward flow west of it. These features of the mean surface currents are mainly attributed to the complex bottom topography (e.g. bathymetry) and coastal geometry of the bay. The bay, which is small and semi-enclosed, generally hampers the propagation of long-gravity waves. The absence of a strong sea surface gradient due to the wind stress during ordinary winds, such as that of average monsoon winds, results to the characteristic surface currents.

In **Figure 3-21** the simulated results show that at flood tide, a maximum mid-depth current velocity of about 5.0 cm/s directed towards the head of the bay may occur. A very weak current is noted during this season at flood tide at the proposed project site. The seemingly weak currents during the northeast monsoon season is generally attributed to the opposing tides and winds (e.g. winds coming from the opposite direction at flood tide). This translates to a surface current of about 7-8 cm/s. Previous observations during the dry season also showed comparable ranges of surface currents (SBPAMPP, 2002).

At ebb tide, the currents in the bay appear to be reversed in direction. At the same time, the current magnitudes in some parts of the bay increases **Figure 3-22** shows the simulated currents during the ebb phase of the tide. As shown, stronger currents occur near Grande Island as the ebb tide exits the bay. At the project site, currents tend to be slightly stronger with magnitudes of 2-4 cm/s and directed southwards towards the mouth of the bay. The maximum simulated mid-depth current during this condition was about 7.3 cm/s. At the surface, currents tend to be stronger due to the influence of the wind. The simulated maximum current magnitude at the surface during this condition is about 11 cm/s. This was also confirmed by surface current measurements using drogues in the bay during the dry season (SBPAMPP, 2002).

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Figure 3 - 21. Simulated Depth-Averaged Currents in Subic Bay During the Dry Season (Flooding).

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Figure 3 - 22. Simulated Depth-Averaged Currents in Subic Bay During the Dry Season (Ebbing).

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Wet Season

Depending on the wind speed, the current magnitude during the wet season may range from 3 to about 20 cm/s which is also the order of current magnitude observed during the dry season (SBPAMPP, 2002). It should be noted that the wind speed in the area during the wet season without storm may range from 2-5 m/s. The wind effect is normally noticeable in the shallow areas located extreme north of the bay. In addition, a reversal of currents may occur with the change of wind conditions during the southwest monsoon season (i.e. wet season).

The simulated coastal current pattern during the wet season and at flood tide is shown in **Figure 3-23**. It was predicted by the model that the depth-averaged currents may range from 2 -7 cm/s during the wet season. In addition, eddies which appeared during the dry season were also present during the wet season with a change in their direction of rotation. Near the project site, the coastal waters appear to be generally weak with depth-averaged magnitudes of less than 4 cm/s. As shown, the general tendency of currents during this season at tidal flooding is to rush northwards.

At ebb tide, the currents reversed almost in the opposite direction. Remarkably, the current magnitudes appeared to be slightly stronger during ebbing. The model result is shown in **Figure 3-24**. However, the project site appears to have calm waters during this tidal phase.

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Figure 3 - 23. Modeled Current Patterns in Subic Bay During the Wet Season (Flooding).

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Figure 3 - 24. Modeled Current Patterns in Subic Bay During the Wet Season (Ebbing).

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3.1.9 METEOROLOGY

3.1.9.1 Climate

The climate at the project site belongs to Type 1 according to Corona's Climate Classification as compiled by PAGASA. The climate map of the Philippine is shown in **Figure 3-25**. In this classification, the project site (and the whole Subic Bay) has two pronounced seasons, the wet and dry seasons. These correspond to the southwest monsoon season that prevails in the area from June to September and the northeast monsoon season that prevails during the months of November to April. May and October are transition months between the seasons. Reversal of wind direction from northeast to southwest seasons and vice-versa occur during these months. In general, the project site experiences about 4 months of rainy period. The average rainfall during the rainy months of June-September ranges from 591.8 mm to 1089.7 mm. Peak rainfall occurs in August. The mean monthly temperature ranges from 26.7 to 30.0 °C. The warmest period occurs during the months of April and May. The minimum temperature occurs on January each year. The climatological normals at the project site deduced from the data presented in the Subic Bay Protected Area Management Plan Project (De las Alas, 2001) are shown in **Table 3-16**.

Table 3 - 16. Climatological Normals at Subic

Month	Rainfall (mm)	No. of Rainy Days	Temperature (°C)	Relative Humidity (%)	Cloudiness (oktas)
January	2.5	1	26.7	68.0	4.1
February	2.5	1	27.2	65.8	3.4
March	5.1	2	28.3	65.7	3.4
April	12.7	2	30.0	68.6	3.9
May	243.8	10	30.0	75.1	5.1
June	599.4	20	28.3	78.3	5.5
July	721.4	23	27.8	81.8	6.3
August	1089.7	25	27.2	82.8	6.3
September	591.8	21	27.8	84.5	6.5
October	226.1	13	28.3	77.5	5.2
November	86.4	7	27.8	74.1	4.7
December	15.2	3	27.2	69.3	4.6
Annual	3596.6	128	28.1	74.2	5.0

Source: Subic Bay Protected Area Management Plan Project (2001)

Relative Humidity

Relative humidity is generally high in the Philippines. It ranges from 65 to 84 % with an annual mean of about 74.2 %. The most humid month is generally experienced in September. The sky over the project site is generally cloudy. Cloudiness has an annual average of about 5 oktas where 1 okta refers to 1/8 of the sky covered with clouds. Cloudy skies prevail in September whereas clear skies are generally experienced during the months of February to April.

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Prevailing Winds

The surface wind in the project site is known to be affected by synoptic systems such as the northeast and southwest monsoon. However, as the coastal area and the adjacent seawater develop a thermal and pressure difference especially in the afternoon, the sea-breeze wind occurs almost everyday. This often masks the effect of the monsoon winds. As shown by the annual wind rose diagram in **Figure 3-26** (US Naval Archive), surface winds prevail from the east-northeast direction with an annual frequency of 25% and with magnitudes ranging from 1 to 21 knots. Winds prevail from this direction in Subic Bay most of the time with about 25 % frequency. This is followed by easterly wind direction with over 15% frequency. During the year, the winds in the area predominantly range from 1 to 16 knots. However, the annual average wind speed is only 6.4 knots (equivalent to about 3 m/s).

The temporary power station that will be run by generators will only last at most for 6 months from the start of the construction period. The generators will run at a maximum of < 2 MW. This amount of power is significantly less than 50 MW. Therefore a monthly wind rose and air quality modeling will not be needed.

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Figure 3 - 25. Climate Map of the Philippines

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Figure 3 - 26. Wind Rose

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3.1.10 AIR AND NOISE QUALITY

3.1.10.1 Sampling Stations

Four ambient air and noise sampling stations were established within the area. One-hour grab samples were collected in all 4 stations. The criteria pollutants measured were Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Total Suspended Particulate (TSP) and Particulate Matter less than 10 µg (PM_{10}). **Table 3-17** shows the location and coordinates of the sampling stations. The locations of these ambient air/noise sampling stations are presented in **Figure 3-27**.

Table 3 - 17. Air and Noise Sampling Stations

Station No.	Geographic Coordinates		Location
	North Latitude	East Longitude	
1	14° 49' 02.3"	120° 11' 37.3"	Upstream of Agusuhin River
2	14° 48' 52.2"	120° 12' 09.7"	Downstream of Agusuhin River (Nebres Residence)
3	14° 49' 07.2"	120° 12' 38.7"	Sitio Agusuhin Basketball Court
4	14° 49' 14.1"	120° 12' 34.5"	Near North Footbridge

3.1.10.2 Objectives of the Survey

The purpose of the air quality survey is to provide baseline air quality data that will determine existing condition of the area's air resource and establish benchmark values for ambient concentrations of air pollutants upon which future concentrations will be compared.

3.1.10.3 Methods of Sampling and Analysis

Ambient Air Quality Sampling

The methods of sampling and analysis of TSP, SO_2, NO_2 and PM10 for the ambient air monitoring are based on the DENR standard. The methodology is discussed in this section and a summary is presented in **Table 3-18**.

Total Suspended Particles

The TSP sampling employed the High Volume - Gravimetric Method. Air is drawn through a glass-fiber filter paper and desiccated for 24-hours after sampling. The concentration of TSP in ambient air is calculated by dividing the total particulates collected by the total normal volume of air sampled.

Sulfur Dioxide

Sulfur dioxide in ambient air is collected into a solution of sodium tetrachloromercurate, TCM, by aspirating air through an impinger and treated in the laboratory with formaldehyde and especially purified, acid-bleached pararosaniline containing phosphoric acid to control the pH. The SO_2 concentration is then determined by the difference between the absorbance of the sample and blank multiplied by the calibration factor divided by the total volume of air sampled corrected to normal temperature and pressure.

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Figure 3 - 27. Air and Noise Sampling Stations

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Nitrogen Dioxide

Nitrogen dioxide in ambient air is analyzed using the Griess Saltzman Reaction method. NO_2 is absorbed in an azo dye forming reagent, which produces a stable red-violet color and read on site by a spectrophotometer at 550 nm. The difference between the absorbance of the sample and blank multiplied by the calibration factor divided by the total volume of air sampled gives the concentration of NO_2 in ambient air.

Particulate Matter Less than 10 Microns

The method employed for sampling is by the use of a high volume sampler with 10 microns particle size inlet and using the gravimetric method afterwards. Air is drawn through a quartz filter paper and desiccated for 24 hours after sampling prior to weighing. The concentration of PM10 in ambient air is the amount of particulate collected divided by the total normal volume of air sampled.

Table 3 - 18. Methods of Air Sampling and Analysis

Parameter	Methodology
Total Suspended Particulates (TSP)	High Volume - Gravimetric Method
Sulfur Dioxide (SO_2)	Impinger - Pararosaniline Method
Nitrogen Dioxide (NO_2)	Impinger - Griess Saltzman Reaction
Particulate Matter < 10 microns (PM_{10})	High Volume - Gravimetric Method

Certificate of air quality analysis is attached as **Appendix 6**.

Noise Level Sampling

Ambient noise levels are determined by using a sound level meter. It is in accordance with the provision provided in the NPCC Memorandum Circular 002 (1980), which sets the median of seven maximum readings comparable to the standard and the sampling procedure outlined by Wilson (1989). Fifty readings are recorded per station wherein the median of the seven maximum-recorded noise levels gives the noise level comparable to the standard.

3.1.10.4 Results and Discussions

Ambient Air Quality

The observed Ground Level Concentrations (GLC's) ranged from 24.0 to 76.9 µg/Ncm for TSP, from <3.0 to 23.4 µg/Ncm for SO_2, from 25.4 to 37.6 µg/Ncm for NO_2, and from 7.3 to 20.8 µg/Ncm for (PM10). The summary of results is presented in **Table 3-19**.

These results are compared with the National Ambient Air Quality Guideline Values for the 24-hour monitoring and the National Ambient Air Quality Standards (NAAQS) for source specific air pollutants for the 1-hour monitoring.

Table 3 - 19. Ambient Air Sampling Results (µg/Ncm)

Sta. No.	Date / Time of Sampling	Parameters			
		TSP	SO_2	NO_2	PM_{10}
1	September 24, 2005 / 1325 hrs.	24.0	<3.0	26.4	7.3
2	September 24, 2005 / 1530 hrs.	68.0	23.4	26.0	10.7
3	September 25, 2005 / 0945 hrs.	76.9	19.9	25.4	20.8
4	September 25, 2005 / 1100 hrs.	39.9	18.8	37.6	11.9
DENR NAAQS Standards		**300**	**340**	**260**	**200**

The high concentrations of TSP at Stations S2 and S3 was due to the fugitive dust emitted by the nearby quarry located 500 to 700 meters SE of the sampling stations. The DENR Standard for ambient air quality in µg/Ncm is 300 for TSP, 340 for SO_2, 260 for NO_2 and 200 for PM_{10}.

Observed Meteorological Data

During the monitoring, the average ambient air temperature was between 27.0°C and 30.0°C. The prevailing wind direction was southwesterly with light to moderate wind conditions. The observed meteorological conditions during the monitoring activity are presented below.

Table 3 - 20. Observed Meteorological Data

Sta. No.	Wind Direction	Ave. Ambient Temp. (°C)	Wind Condition (Beaufort Force)	Cloudiness (Octa)
1	SE	27.0	BF 1	8/8
2	SE	27.0	BF 2	8/8
3	SE	29.0	BF 1	7/8
4	SE	30.0	BF2	7/8

Noise Level

The digital sound meter was calibrated before the noise measurement program was started. The survey was conducted during daytime. During each noise sampling, wind direction and wind speed were noted. Noise level was measured every 50 times at an interval of 10 seconds. The observed values were recorded on the data sheet. The value exceeded by 10% of the readings was also recorded. The background noise level in Sitio Agusuhin was calculated. The background noise field was used to identify significant noise sources. As observed, most of the major sources of noise came from the neighboring community near the sampling station.

The ambient noise levels recorded were consistently low (> 55 dBA) around the vicinity of proposed project site. During daytime periods, observed noise level ranged from 49.0 to 54.0 dBA. A slight increase in the noise level measurement was observed in station 2 due to the ongoing quarry operation located SE of the monitoring station.

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The results of the noise level sampling are tabulated in **Table 3-21**.

Table 3 - 21. Noise Level Results (dBA)

Sta. No.	Date / Time of Sampling	Noise Level
1	September 24, 2005 / 1325 hrs.	49.0
2	September 24, 2005 / 1530 hrs.	54.0
3	September 25, 2005 / 0945 hrs.	52.0
4	September 25, 2005 / 1100 hrs.	51.0

The standard for Class A (a section which is primarily used for residential purposes) is 55 dBA for daytime, 50 dBA for morning and evening, and 45 dBA for nighttime. As for Class C (a section which is primarily reserved for light industrial area), the standards are 70 dBA for daytime, 65 dBA for morning and evening, and 60 dBA for nighttime.

3.1.10.5 Previous Air Sampling Activities

Previous air sampling activities have been done on or near the site at the Armour Rock Project and CGS Project. The locations of sampling stations are shown in **Figure 3-28**.

Armour Rock, Filling Materials and Boulders Quarry Project

The Armour Rock Project of Monark Constructors Corporation borders the south portion of the project area. The results of their analyses are presented in **Table 3-22**.

Table 3 - 22. Armour Rock Project Ambient Air Quality Monitoring Results (Sampling Date: March 7, 2005)

Station No.	Location	TSP (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)
1	Northern part of the site	18.83	10.42	5.33
2	Eastern part of the site	11.77	7.47	2.43
3	Southern part of the site	16.79	3.73	Nil
DENR Standards		**300**	**340**	**260**

Source: Environmental Monitoring Report, Armour Rock, March 2005

Concrete Gravity Structure (CGS) Project

The CGS Project of SPEX was located at the east side of the project area. During the construction period from 1999 to 2000, TSP concentration was monitored in 4 stations. The sampling results are presented in **Table 3-23**.

Table 3 - 23. TSP (in µg/Ncm) Monitoring During the CGS Project

Date	Sta. 1	Date	Sta. 2	Date	Sta. 3	Date	Sta. 4
2-Jul-99	4.30	2-Jul-99	6.40	2-Jul-99	10.70	2-Jul-99	14.80
10-Aug-99	4.00	10-Aug-99	6.00	10-Aug-99	154.00	10-Aug-99	18.10

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Date	Sta. 1	Date	Sta. 2	Date	Sta. 3	Date	Sta. 4
3-Dec-99	129.90	3-Dec-99	117.00	3-Dec-99	113.00	3-Dec-99	76.50
7-Jan-00	47.10	7-Jan-00	150.10	7-Jan-00	34.10	7-Jan-00	58.90
10-Mar-00	4.30	10-Mar-00	12.90	10-Mar-00	38.70	10-Mar-00	2.10
7-Apr-00	15.00	7-Apr-00	49.30	14-Apr-00	64.90	14-Apr-00	56.40
5-May-00	103.50	5-May-00	134.30	5-May-00	120.30	5-May-00	144.10
30-Jun-00	22.00	30-Jun-00	10.00	30-Jun-00	18.00	30-Jun-00	30.10
24-Jul-00	9.88	24-Jul-00	3.95	24-Jul-00	5.93	24-Jul-00	3.95
DENR	300		300		300		300

Source: SBMA Ecology Centre

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Figure 3 - 28. Previous Air Sampling Stations (Armour Rock and CGS Projects).

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3.2 BIOLOGICAL ENVIRONMENT

3.2.1 TERRESTRIAL ECOLOGY

Findings on the distribution of plant and animal species were based from previous regional resource inventory and limited ocular inspection and field sampling of the proposed shipyard site. Results showed that plant and resident faunal species at the site are common. Some endangered animal species (e.g. bats and avian fauna) described in subsequent sections below have been observed to use the site as their habitat and access corridors to nearby mountain ranges (e.g. Mount Redondo).

3.2.1.1 Regional Flora

Review of Previous Relevant Work

A rapid forest resource appraisal was conducted in 1990 by the Legislative-Executive Council of the Philippine Government. Results showed that white lauan *(Shorea contorta)* and apitong *(Dipterocarpus grandiflorus)* were the dominant species. Among the non-dipterocarps, kupang (*Parkia roxburghii*) was the most prominent. Buho *(Schizostachyum lumampao)* was the most abundant non-timber species. Other plant species recorded included rattan, other palms, ferns, and vines. Woodward Clyde conducted an ecological baseline survey in 1997 for SBMA. The survey focused on the Naval Magazine area of the Subic Bay Freeport Zone (SBFZ). The survey identified four plant associations as follows:

- dipterocarp forest with white lauan as the dominant species, and consisting of other dipterocarps, non-dipterocarps, buho, grasses and shrubs;
- dipterocarp forest with white lauan and buho as dominant species, and consisting of other dipterocarps, non-dipterocarps and palms;
- dipterocarp forest with white lauan and apitong as dominant species and consisting of other dipterocarps, non-dipterocarps, buho and palms; and
- dipterocarp forest with white lauan and kupang as dominant species, and consisting of other dipterocarps, non-dipterocarps, buho and palms.

The University of the Philippines in Los Baños College of Forestry (UPLBCF), Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and SBMA from 1995 to 1998 (Fernando *et al.*, 1998), conducted a Resource Inventory and Assessment of Biodiversity of SBMA. Results of this study showed that the Subic Bay Forest Reserve contained diverse ecosystems for both flora and fauna. A total of 745 plant species belonging to 429 genera in 122 families were recorded. For fauna, 118 species of wildlife vertebrates were identified belonging to 99 genera in 57 families. Among the plant families, Euphorbiaceae was the most dominant, composed of 53 species in 26 genera. Among the tree species, the five most dominant ones were: white lauan *(Shorea contorta),* apitong *(Dipterocarpus grandiflorus), Cleistanthus blancoi, Strombosia philippinensis,* and *Myristica philippinensis.* Buho *(Schizostachyum lumampao)* was the most dominant non-tree species.

A PCARRD-UPLB study team assessed the potential of the Subic Bay Freeport for ecotourism in 1997 (Pollisco *et al.* 1997). The team evaluated the flora and faunal resources in three sites in the NAVMAG (now known as Ilanan Forest) area representing the forest ecosystem and two sites under a grassland ecosystem. Results

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showed a high diversity index for vegetation in both ecosystems (Shannon-Weaver index of 3.0 and 3.6 for forestland, grassland ecosystems, respectively). Under the forest ecosystem, kupang, white lauan and buho were the dominant species in the upper canopy layer; pamulaklakin vine *(Symphorema luzonicum)* and climbing bamboo *(Schizostachyum dielsianum)* were dominant in the intermediate layer, while a grass species and ooko *(Mikania cordata)* dominated the ground layer. In the grasslands, the dominant species were cogon *(Imperata cylindrica),* aguingay *(Rottboellia exaltata)* and amorseco *(Chrysopogon aciculatus)*, binayuyu *(Antidesma ghaesembilla),* and akleng-parang *(Albizia procera).*

The local DENR CENRO conducted a Protected Area suitability assessment of the Olongapo Watershed (DENR, 1995). Accordingly, grass was the predominant vegetation, interspersed with remnants of established nursery under the former Bureau of Forest Development that include species such as: teak *(Tectona grandis)*, *Gmelina arborea,* giant ipil-ipil, narra, and acacia. Other vegetation includes fruit trees planted by settlers, and patches of second-growth forest.

The SBFZ is rich in plant species. The flora resource inventory conducted by Dalmacio in 2001 recorded 283 plant species in 80 plant families within the Subic Watershed Forest Reserve (SWFR). In a more intensive study, Fernando et al. (1998) recorded a total of 745 plant species belonging to 122 families from an area of approximately 17.5 hectares within the NAVMAG portion of the SWFR.

The resource inventory and assessment of biodiversity conducted by Fernando et al. (1998) described the Subic Bay Forest Reserve as second-growth forest. On a landscape level, the forest and grass/scrubland matrices are highly fragmented. There are five vegetation types identified in the area these are:

Lowland Dipterocarp Forest – Occupying most of the uncleared uplands of the SBFZ. *Shorea contorta, Dipterocarpus grandiflorus, Shorea polysperma, Dipterocarpus gracilis* and *Anisoptera thurifera* are some of the prominent species seen in the area. Non-dipterocarp species include *Strombosia philippinensis, Chisocheton petandrus, Diospyrus pilosanthera, Sandoricum koetjape,* and *Ervatamia mucronata* among others.

Limestone Forest – Located in the Redondo Peninsula, an indicator for this type of forest is the presence of some limestone species such as *Vitex parviflora, Alstonia macrophylla, Antidesma ghaesembilla, Casuarina equisetifolia,* and *Syzygium spp.*

Mangrove Swamp Vegetation – In tidal areas. Among the abundant species found are *Rhizophora apiculata, Bruguiera gymnorrhiza, Sonneratia Alba, Avicennia marina* and *A. officinales.*

Beach Forest – Found in shoreline areas of the SBFZ. Species such as *Pongamia pinnata, Intsia bijuga, Terminalia catappa, Barringtonia asiatica, B. acutangula* and *B. racemosa* are common.

Parang grassland – Open area where bamboo, binayuyu, and other grass species are present. Saging butuhan, talahib, tambo, cogon, kupang are also found. This type of vegetation is generally located between the middle and upper elevation of the area.

In the natural forest of SWFR, White lauaun (*Shorea contorta*) is the most dominant tree species. Other important species include Bolong-eta (*Diospyros pilosanthera*), Anyatan (*Cliestanthus blancoi*), Pandakaki (*Ervatamia pandacaqui*), Alupag (*Litchi chinensis subspecies philippinensis*), Apitong (*Dipterocarpus grandiflorus*), Tamayuan (*Strombosia philippinensis*), Fire tree (*Delonix regia*), Tibig (*Ficus nota*), Mali-mali (*Leae*

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guineensis), Kupang (*Parkia roxburgii*), and Tangisang bayawak (*Ficus variegate*). Among the non-tree species, Bikal (*Dinochloa acutiflora*), Buho (*Schizostachyum lumampao*), Pamulaklakin (*Symphorema luzonica*), and Ooko (*Mikamia cordata*) predominate.

The dominant tree species in brushlands in the SWFR are Banaba (*Lagerstroemia speciosa*), Pandakaki, and Ipil-ipil (*Leucaena leucocephala*). They are growing in association with *Chromolaena odorata, Centrosema pubescens*, Ooko, Nito (*Lygodium circinatum*) and Buho. In grasslands, the grass Cogon (*Imperata cylindrica*) is most dominant. Also common are Chromolaena and Talahib (*Saccharum spontaneum*). Binayuyu (*Antidesma ghaesambilla*) is the common tree species.

3.2.1.2 Site Flora

Methodology

A systematic cluster sampling, with 20 m x 20 m quadrats (for trees and arborescent species) and 2 m x 2 m quadrats (for ground vegetation), was used in the study. Plots were established every 100 m of the transect lines. The project site was stratified into upper, middle and lower elevations/portions; the lower portion comprises the coastal zone including Sitio Agusuhin proper. An additional transect was established along the coastline of the project site. A map of the vegetation transects is shown in **Figure 3-29**.

In situ identification of plant species were classified within the established quadrats. Trees and bamboos more than 3 m in height and at least 10 cm in diameter were included under the canopy/overstorey layer. Saplings, shrubs, vines and other species below 3 m in height but not lower than 0.70 m were included under the intermediate layer. Other plants with heights below 0.70 m were included under the ground layer.

Species dominance of the plant communities within quadrats and sub-quadrats along transect lines was assessed in terms of the estimated total cover (EC), relative ground cover (RC), number of times the individual species (i) occurred, absolute frequency (AF), and relative frequency (RF) of individual species encountered in the sampling plots. The summation of these two parameters for a particular species i (RC + RF) will reflect the importance value (IV) for that species. Individuals with high IV are considered as the dominant species in a given plant community. The formulas below were used in assessing the different ecological parameters in vegetation:

Estimated Cover (EC) = area occupied by a species (I) expressed in m^2

$$\text{Relative Cover (RC)} = \frac{\text{cover of species (I)}}{\text{cover of all species}}$$

$$\text{Absolute Frequency (AF)} = \frac{\text{number of plots species (I) encountered}}{\text{total number of sample plots established}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{frequency of species (I)}}{\text{frequency of all species}}$$

Importance Value (IV) = relative cover + relative frequency

Species Diversity (Shannon Weaver Formula):

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$$H = 1 - \sum\left[\frac{n_i}{N}\log\left(\frac{n_i}{N}\right)\right]$$

where:

H = the Species Diversity Index

n_i = total count of specific species per transect line

N = total count of species per transect line

$$\text{Evenness Index (E)} = \frac{H}{\log S}$$

where:

S - no. of species

$$\text{Dominance Index (C)} = \sum\left(\frac{n_i}{N}\right)$$

Based on the preceding categories of vegetation types, the plant species in forest vegetation were stratified into tree vegetation which is the overstorey and lower vegetation which is also correspond to the ground layers. Each species was assessed in terms of its importance values (IV), which refers to the dominance and frequency of each species.

Findings and Observations

Vegetation Types

Generally, in terms of physiognomy, the project area is predominantly an herbaceous plant community with woodland vegetation confined in the riverine areas and the coastal zone of the project site where majority of human settlement converges. In preponderance are the grasses in association with forage species. Sparse tree species are present in the middle upper portion of the project site which is the middle riparian part of the Agusuhin River Basin.

The surrounding ridges are almost devoid of trees. In terms of number, agoho is the dominant tree in these areas. Agoho tolerates the poor, metals-rich lateritic soils in the area. The ground vegetation is dominated by hardy grasses like samsamon (*Themeda triandra*) and cauacauayan (*Apluda mutica*).

Channels of upper catchment areas of the tributaries of Agusuhin River are predominantly covered by bocawe (*Dinochloa scandens*) and very few trees.

The Agusuhin River Basin was formerly agoho-dominated woodland with the riparian areas having mixed species agoho, bamboos and other riparian trees. The current fire-climax vegetation is a result of logging and eventual agricultural land conversion with fire as the main tool for vegetation management. **Figure 3-30** is a map showing the existing vegetation.

Figure 3 - 29. Map Showing Location of Vegetation Transect Lines.

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Figure 3 - 30. Vegetation Map of Lower Agusuhin (Project Area).

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Parang Grassland Vegetation. The project area is generally covered by parang vegetation type, an open area where bamboo, binayuyu, and other grass species are present. This type of vegetation is generally located between the middle and upper elevation of SBFZ (see **Figure 3-30**).

About 140 species, belonging to at least 52 families and 125 genera, were encountered in the project site. Of these, 4 are epiphytes, 1 is thallophyte, 50 are herbs, 1 is palm, 19 are shrubs, 7 are vines and 58 are tree species in different growing stages (seedlings, juveniles and trees) (**Figure 3-31**). Most of the species encountered have economic and medicinal values, many of which are exotic. Except for dilang baka (*Nopalea cochenillifera*), prickly narra (*Pterocarpus indicus forma echinatus*) and the orchids, no other endangered species was encountered. These species were seen in the backyards/gardens.

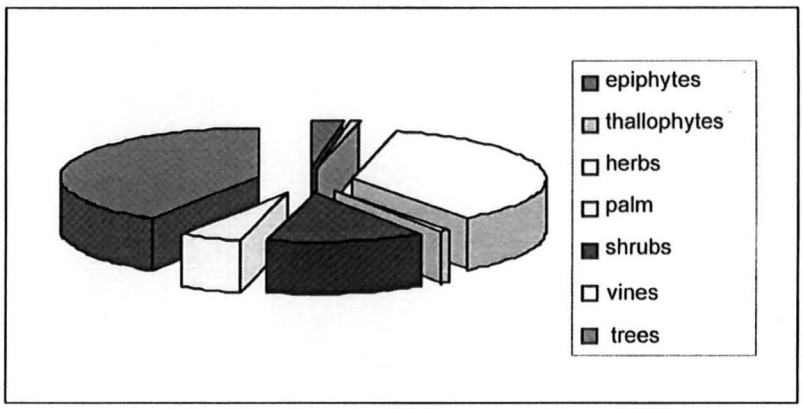

Figure 3 - 31. Distribution of Plants by Form

A very small patch of mangrove (about 200 m^2) can be seen in Sitio Agusuhin Proper. It is dominated by bungalon (*Avicennia marina*).

With respect to arboreal vegetation, the whole of project site is dominated by agoho (*Casuarina equisetifolia*) with an Importance Value (IV) of 53.190. It is followed by mango (*Mangifera indica*) with IV of 35.997. Binayuyu (*Antidesma ghaesembilla*) is third with IV of 18.245. Next is kasoy (*Anacardium occidentale*) with 9.830 while ipil-ipil (*Leucaena leucocephala*) follows with 8.587. Except agoho (RF = 48.438%), all other species mentioned have the same Relative Frequency (RF) of 6.25% which indicates that they appear almost the same in the transects established. On the other hand, mango has the highest Relative Dominance (RD) of 29.747% since it has the biggest diameters at breast height (DBHs). Being a small tree, binayuyu is only second has only 11.995% RD value. RD is a measure of the total basal area of a tree species. Agoho is third with 4.752%. **Table 3-24** shows the importance values and diversity indices of the tree vegetation.

The ground vegetation of the project site is dominated by grasses. The most dominant species is talahib (*Saccharum spontaneum*) with a very high IV of 39.014. Next is cogon with 19.617 IV value. The third dominating species is a coastal vine, lambayong (*Ipomoea pes-caprae*), with IV of 15.503, followed very closely by the grass, bagibuk (*Eragrostis tenella*), with IV of 15.026. In terms of expanse, talahib is likewise on top with Relative Cover (RC) of 27.073%, followed by cogon with 12.154%, then by lambayong with 9.533%. Moreover, talahib is likewise the most distributed plant species with RF of 11.940%, followed by cogon 7.463%, and then by lambayong and bagibuk

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(*Eragrostis tenella*) with 5.970%. **Table 3-25** shows the importance values and diversity indices of the lower vegetation.

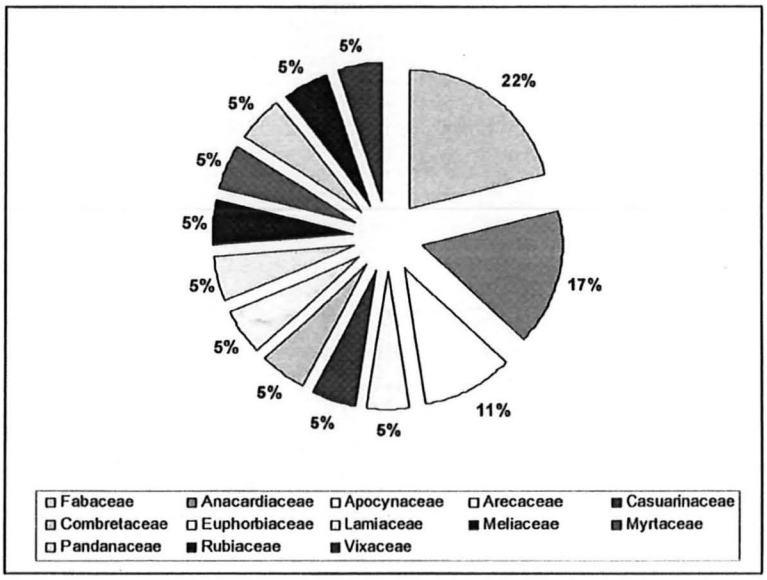

Figure 3 - 32. Tree Families Found at the Project Area

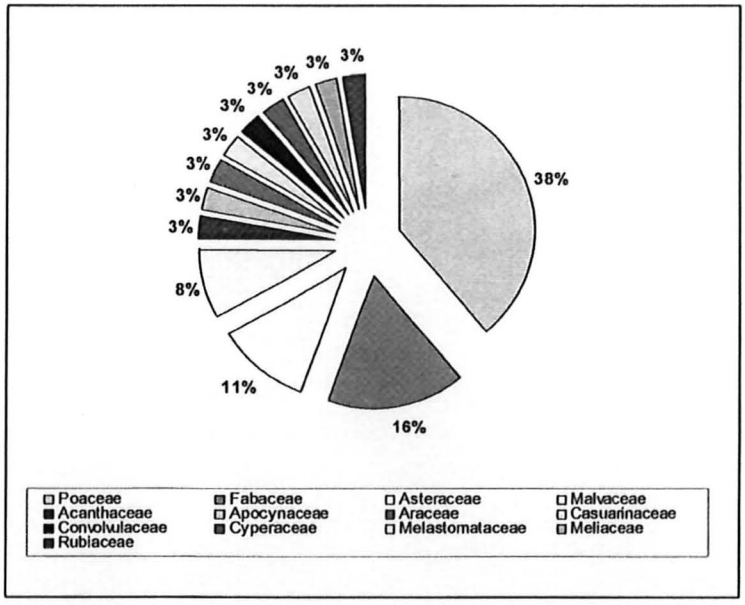

Figure 3 - 33. Lower Plant Families Found at the Project Area

By stratification, the dominant tree species in the upper portion of the project area is binayuyu. There are very few trees in the middle portion as most of the area is devoted to rice production, sparse settlement, and planting of cash crops. The dominating tree in the lower portion of the project site is agoho. Following tree dominance is mango since it is the major cash crop species of the community. Next to it is kasoy.

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In terms of species richness and equitability, the arboreal plant community of the project site has a Shannon-Wiener Index (H') of 3.568 bits/individual and Evenness Index (e) of 0.84. The site has a low diversity in trees. On the other hand, the lower vegetation has a slightly higher diversity with H' of 4.507 and e of 0.865.

Rice Paddies

At the central portion of the project area, approximately 5 hectares (ha) of rice paddies are being maintained by some of the residents (**Plate 12**). Three farmers were interviewed during the visit. Accordingly, they have been tilling the land for more than 10 years. The paddies are irrigated by water from the Agusuhin North Creek diverted through man-made channels. Cropping was being maintained twice a year. Harvest is around 100 sacks palay per hectare per cropping. The farmers employs the usual practice of applying 14-14-14 and urea fertilizers and do not introduce organic fertilizer and other environment-friendly practices. The common rice pests are the stem borers which can be controlled using commercial insecticides. Neither extension work nor assistance has reached their farm ever since they tilled the paddies according to one of the respondents.

Reforestation Project

A 100-ha reforestation project is situated just at the north-eastern section of the proposed project (**Plate 13**). This project coined as ACRA (Agusuhin Community Reforestation Assistance) was funded by Pilipinas Shell Foundation Inc. (PSFI). During the construction of the CGS and was contracted to the People's Organization of Agusuhin. Accordingly, the area was planted starting in August 2000 and was turned over to SBMA in February 2001. Ten thousand (10,000) mangos and 45,000 Eucalyptus were established during the said period.

Site observations revealed that the plantation survival is barely 10%. A few spots of eucalyptus were found in the area. The field guide and a resident of Agusuhin said that the area was regularly burned by wildfires from the grasslands which were ignited by hunters to enhance growth of grass species to wild deers. With this periodic burning, the reforestation area is practically reverting back to grassland ecosystem with patches of fire-resistant species such as agoho and binayuyu sporadically scattered.

Ecological Status of Plant Species

The plant species identified in the area are considered common which means they can be found in similar habitats in other parts of the country. It can be inferred, therefore, that no endangered species can be sacrificed in the process of developing the area. However, it must be noted that the cutting and utilization of other hardwood and fruit bearing trees should be regulated per DENR Administrative Order (DAO) No. 78, series 1987 and DAO 18 series 1994. On the other hand, portions of private lands are required to be reforested of planted tree pursuant to Presidential Decree (PD) 953 and 1153 and other existing laws (i.e. PD 1559). None of this ecologically significant plant species and habitat occurs in the proposed project site.

Economically Important Species

In the project area, mango and rice are agricultural crops which contribute in part on the sustenance of the community of Agusuhin. However, they are raised in small scale and therefore not deterrent to the survival of the local people. Ipil-ipil is also important as a

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multi-purpose tree species; however this tree is very common and widely distributed in the country. Eucalyptus trees were planted as reforestation species and can be sourced of electricity posts if they had been protected well.

A list of species found in the Lower Agusuhin Basin is attached as **Appendix 7**.

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Table 3 - 24. Importance Values and Diversity Indices of the Tree Vegetation

SPECIES	SCIENTIFIC NAME	DOM. (SQ.M.)	RELATIVE DOM. (RC)	SPECIES APPEARED PER PLOT	ABSOLUTE FREQUENCY (AF)	RELATIVE FREQUENCY (RF)	IMPORTANCE VALUE (IV)	n_i/N	$(n_i/N)(\log_2 n_i/N)$	$n_i/N\ (\log_2 n_i/N)^2$	e
Agoho	*Casuarina equisetifolia*	0.072	4.752	31	20.363	48.438	53.190	0.266	-0.508	0.971	0.120
Mangga	*Mangifera indica*	0.453	29.747	4	2.628	6.250	35.997	0.180	-0.445	1.102	0.105
Binayuyu	*Antidesma ghaesembilla*	0.183	11.995	4	2.628	6.250	18.245	0.091	-0.315	1.089	0.074
Kasoy	*Anacardium occidentale*	0.055	3.580	4	2.628	6.250	9.830	0.049	-0.214	0.929	0.050
ipil-ipil	*Leucaena leucocephala*	0.036	2.337	4	2.628	6.250	8.587	0.043	-0.195	0.886	0.046
Auri	*Acacia auriculiformis*	0.102	6.686	1	0.657	1.563	8.249	0.041	-0.190	0.873	0.045
Niog	*Cocos nucifera*	0.096	6.320	1	0.657	1.563	7.882	0.039	-0.184	0.858	0.043
Bangkal	*Nauclea orientalis*	0.096	6.320	1	0.657	1.563	7.882	0.039	-0.184	0.858	0.043
Talisai	*Terminalia catappa*	0.067	4.385	2	1.314	3.125	7.510	0.038	-0.178	0.842	0.042
Santol	*Sandoricum koetjape*	0.080	5.283	1	0.657	1.563	6.845	0.034	-0.167	0.811	0.039
Aroma	*Acacia farnesiana*	0.052	3.384	2	1.314	3.125	6.509	0.033	-0.161	0.795	0.038
Molave	*Vitex parviflora*	0.066	4.339	1	0.657	1.563	5.901	0.030	-0.150	0.762	0.035
Kamachile	*Pithecellobium dulce*	0.049	3.224	1	0.657	1.563	4.787	0.024	-0.129	0.694	0.030
bayag usa	*Voacanga globosa*	0.023	1.506	2	1.314	3.125	4.631	0.023	-0.126	0.683	0.030
Ligas	*Semecarpus cuneiformis*	0.042	2.729	1	0.657	1.563	4.292	0.021	-0.119	0.659	0.028
Lanete	*Wrightia bubescens ssp. laniti*	0.031	2.064	1	0.657	1.563	3.626	0.018	-0.105	0.607	0.025
alas-as	*Pandanus odoratissimus*	0.011	0.743	1	0.657	1.563	2.305	0.012	-0.074	0.478	0.017
Bayabas	*Psidium guajava*	0.006	0.418	1	0.657	1.563	1.980	0.010	-0.066	0.439	0.016
Achuete	*Vixa orellana*	0.003	0.186	1	0.657	1.563	1.748	0.009	-0.060	0.409	0.014
		1.522	**100.000**	**64.000**	**42.040**	**100.000**	**200.000**	**1.000**	**-3.568**	**14.743**	**0.840**

S = 19

(H') = $-SUM((n_i/N)*\log_2(n_i/N))$

(H') = 3.568

EVENNESS INDEX (e) = $H' / \log_2 S$

(e) = 0.840

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Table 3 - 25. Importance Values and Diversity Indices of the Lower Vegetation

SPECIES	SCIENTIFIC NAME	EST.TOTAL COVER (SQ.M.)	RELATIVE COVER (RC)	SPECIES APPEARED PER PLOT	ABSOLUTE FREQUENCY (AF)	RELATIVE FREQUENCY (RF)	IMPORTANCE VALUE (IV)	n_i/N	$(n_i/N)(\log_2 n_i/N)$	$n_i/N\ (\log_2 n_i/N)^2$	e
Talahib	*Saccharum spontaneum*	22.720	27.073	8	0.095	11.940	39.014	0.195	-0.460	1.085	0.088
Cogon	*Imperata cylindrica*	10.200	12.154	5	0.060	7.463	19.617	0.098	-0.329	1.101	0.063
Lambayong	*Ipomoea pes-caprae*	8.000	9.533	4	0.048	5.970	15.503	0.078	-0.286	1.055	0.055
Bagibuk	*Eragrostis tenella*	7.600	9.056	4	0.048	5.970	15.026	0.075	-0.281	1.048	0.054
Hagonoy	*Chromolaena odorata*	5.200	6.196	2	0.024	2.985	9.181	0.046	-0.204	0.907	0.039
Fantankuen	*Synedrela odorata*	2.800	3.337	3	0.036	4.478	7.814	0.039	-0.183	0.855	0.035
Borreria	*Borrerria ocymoides*	2.800	3.337	2	0.024	2.985	6.322	0.032	-0.158	0.785	0.030
salai-salai	*Arundinella ciliata*	2.600	3.098	2	0.024	2.985	6.083	0.030	-0.153	0.772	0.029
Gumi	*Cyperus iria*	1.320	1.573	3	0.036	4.478	6.051	0.030	-0.153	0.771	0.029
banig-usa	*Alyssicarpus nummularifolius*	0.800	0.953	3	0.036	4.478	5.431	0.027	-0.141	0.735	0.027
Grass	*Panicum sp.*	2.800	3.337	1	0.012	1.493	4.829	0.024	-0.130	0.697	0.025
Agingai	*Cenchrus echinatus*	1.000	1.192	2	0.024	2.985	4.177	0.021	-0.117	0.651	0.022
Tinitrigo	*Ischaemum rugosum*	1.000	1.192	2	0.024	2.985	4.177	0.021	-0.117	0.651	0.022
Natal grass	*Rhynchelytrum repens*	1.000	1.192	2	0.024	2.985	4.177	0.021	-0.117	0.651	0.022
taklang baka	*Malvastrum coromandelianum*	1.800	2.145	1	0.012	1.493	3.637	0.018	-0.105	0.608	0.020
Cauacauayan	*Apluda mutica*	1.600	1.907	1	0.012	1.493	3.399	0.017	-0.100	0.587	0.019
Waliswalisan	*Sida acuta*	1.600	1.907	1	0.012	1.493	3.399	0.017	-0.100	0.587	0.019
ipil-ipil	*Leucaena leucocephala*	0.280	0.334	2	0.024	2.985	3.319	0.017	-0.098	0.580	0.019
Bermuda grass	*Cynodon dactylon*	1.400	1.668	1	0.012	1.493	3.161	0.016	-0.095	0.566	0.018
Duranta	*Duranta repens*	1.400	1.668	1	0.012	1.493	3.161	0.016	-0.095	0.566	0.018
Makahiya	*Mimosa pudica*	0.800	0.953	1	0.012	1.493	2.446	0.012	-0.078	0.494	0.015
moradong dilaw	*Pseuderanthemum reticulatum*	0.800	0.953	1	0.012	1.493	2.446	0.012	-0.078	0.494	0.015
corazon de maria	*Caladium bicolor*	0.600	0.715	1	0.012	1.493	2.208	0.011	-0.072	0.467	0.014
Agoho	*Casuarina equisetifolia*	0.560	0.667	1	0.012	1.493	2.160	0.011	-0.071	0.461	0.014
Tambo	*Arundo donax*	0.400	0.477	1	0.012	1.493	1.969	0.010	-0.066	0.438	0.013

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SPECIES	SCIENTIFIC NAME	EST.TOTAL COVER (SQ.M.)	RELATIVE COVER (RC)	SPECIES APPEARED PER PLOT	ABSOLUTE FREQUENCY (AF)	RELATIVE FREQUENCY (RF)	IMPORTANCE VALUE (IV)	n_i/N	$(n_i/N)(\log_2 n_i/N)$	$n_i/N\ (\log_2 n_i/N)^2$	e
Rosal	*Gardenia jasminoides*	0.400	0.477	1	0.012	1.493	1.969	0.010	-0.066	0.438	0.013
Shrub	*Malvastrum sp.*	0.400	0.477	1	0.012	1.493	1.969	0.010	-0.066	0.438	0.013
Sampaloc	*Tamarindus indica*	0.400	0.477	1	0.012	1.493	1.969	0.010	-0.066	0.438	0.013
Karagain	*Cassia mimosoides*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
Korokorosan	*Chloris barbata*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
pakpak-langaw	*Desmodium trifolium*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
Malatabako	*Elephantopus tomentosus*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
Paragis	*Eleusine indica*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
Grass	*Fimbistylis sp.*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
large-leaf mahogany	*Swietenia macrophylla*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
bayag-usa	*Voacanga globosa*	0.200	0.238	1	0.012	1.493	1.731	0.009	-0.059	0.406	0.011
Malatungaw	*Melastoma malabathrycum*	0.040	0.048	1	0.012	1.493	1.540	0.008	-0.054	0.380	0.010
		83.920	**100.000**	**67.000**	**0.798**	**100.000**	**200.000**	**1.000**	**-4.507**	**22.551**	**0.865**

S = 37

(H') = $-SUM((n_i/N)*\log_2(n_i/N))$

(H') = 4.507

EVENNESS INDEX (e) = $H' / \log_2 S$

(e) = 0.865

3.2.1.3 Regional Fauna

Species Totals

Fifty-four species of mammals, birds, reptiles, and amphibians were recorded on the Redondo Peninsula as compared to 58 species at Mt. Balakibok (Eastside) and 65 species in the Boton Valley of the SWFR, the highest number of species among all sites (Resources Inventory of the Subic Bay Protected Areas Management Plan Project).

Table 3 - 26. Species Totals for Redondo Peninsula, Mt. Silanguin, Quinabucsan

Mt. Silanguin (Q)	Mammals	Birds	Reptiles	Amphibians	Total
Family	3	26	4	3	36
Genera	4	36	5	7	52
Species	4	40	5	5	54

Relative Abundance

The Species Relative Abundance was based from frequency counts generated from transect counts, point counts and trapped and netted species. The relative abundance (RA percent) value was estimated using the numerical abundance of one species to the Total Abundance of All Species. This may be interpreted as the relationship between abundance of individuals of a species and to the total number of individuals of species to denote the species occurrence and number in a relative manner.

Based on this analysis the most and least abundant species in the SBFZ are listed in the table below:

Table 3 - 27. Abundant and Rare Fauna Species Among Sites Sampled in the SBFZ

Abundant	Rare
Mammals:	Mammals:
Lesser Bamboo Bat (*Tylonycteris pachypus*)	Striped Shrew Rat (*Chrotomys mindorensis*)
Common Short-nosed Fruit Bat (*Cynopterus*	Philippine Warty Pig (*Sus philippensis*)
brachyotis)	
Musky Fruit Bat (*Ptenochirus jagori*)	
Birds:	Birds:
Philippine Bulbul (*Hypsipetes philippinus*)	Night Jar (*Caprimulgus sp.*)
Pygmy Swiftlet (*Collocalia troglodytes*)	Frogmouth (*Batrachostomus septimus*)
Glossy Swiftlet (*Collocalia esculenta*)	Stripe-headed Rhabdornis (*Rhabdornis mysticalis*)
Brown-backed Needle Tail Swift (*Hirundapus*	Quail (*Coturnix sp.*)
gigantea)	Blue Rock Thrush (*Monticola solitarius*)
Amethyst Fruit Dove (*Phapitreron amethystina*)	Yellow-bellied Whistler (*Pachycephala philippensis*)
White-eared Fruit Dove (*Phapitreron leucotis*)	Philippine Fairy Blue Bird (*Irena cyanogaster*)
Lesser Coucal (*Centropus bengalensis*)	
Reptiles:	Reptiles:

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Abundant	Rare
Philippine Gecko (*Gekko gecko*)	Wagler's Pit Viper (*Trimerisurus wagleri*)
Variable Malay Monitor Lizard (*Varanus salvator*)	
Amphibians:	Amphibians:
Puddle Frog (*Occidozyga laevis*)	Swamp Frog (*Rana leytensis*)
Common Forest Frog (*Platymantis dorsalis*)	Diminutive Forest Frog (*Platymantis mimulus*)
Variable-backed Frog (*Rana signata*)	
Everett's Frog (*Rana everetti luzonensis*)	

Diversity

SWFR contained the highest level of Species Diversity (H') for birds, reptiles, and amphibians, respectively. Mt. Balakibok had the highest H' for mammals. However, Mt. Balakibok and Redondo Peninsula generally had lower values than SWFR, perhaps reflecting that the sampled habitats at Balakibok and Redondo were more disturbed by humans than the habitats at SWFR. Values of the Species Richness Index showed a roughly similar contrast among the study areas, with the least disturbed area, SWFR, again having higher values.

Table 3 - 28. Species Diversity in the Sampled Sites of the SBFZ (Mar-May 2000)

Sampled Sites	Vertebrate Group	Species Diversity (H')	Species Richness (R)
SWFR	Mammals	1.17	1.26
	Birds	3.49	2.97
	Reptiles	1.47	1.73
	Amphibians	1.72	1.41
MT. Balakibok	Mammals	1.51	1.25
	Birds	3.04	1.87
	Reptiles	0.95	1.34
	Amphibians	1.07	1.41
Redondo Peninsula	Mammals	1.14	1.03
	Birds	3.40	2.35
	Reptiles	1.38	1.77
	Amphibians	0.97	0.79
Formulae used: Species Diversity Index -H': (Pi ln Pi), Where; Pi = number of individuals of the species / N, N = total number of individuals. Species Richness Index - R: (S / SQRT [N]), Where; S = no. of species, N = total number of individuals.			

Similarity of Species Composition Among Sites

Coefficient of similarity values was generally low between study areas. These are broken down by animal groups for comparison among the areas as shown below.

Table 3 - 29. Summary Table of Faunal Species Similarity Values Among Samples Sites at SBFZ

Study Areas	Mammals	Birds	Reptiles	Amphibian
SWFR – Mt. Balakibok	50.00 %	43.08 %	28.57 %	62.50 %
SWFR – Redondo	18.75 %	36.67 %	57.14 %	50.00 %
Redondo – Mt. Balakibok	11.76 %	47.46 %	60.00 %	33.33 %

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Species Endemism Among Sites

Endemic species are defined as those that are found only in the Philippines. Endemism, measured as the percentage of endemics among all species in an area, is high in the Philippine fauna overall (Heaney *et al.*, 1982, Dans 1997, Dickinson *et al.*, 1998). The table below reflects that the species inventoried in Redondo Peninsula has a lower endemism compared tp SWFR and Mt. Balakibok.

Table 3 - 30. Endemism Among Animals SBFZ Study Sites, Including Total Number of Endemic Species and Percentage of Total Species for the Area

Study Area	Total Endemic	Mammal Endemism	Bird Endemism	Reptile Endemism	Amphibian Endemism
SWFR	43 (66%)	2 (40 %)	34 (74 %)	6 (17 %)	3 (50 %)
Redondo	39 (60%)	1 (25 %)	34 (69 %)	3 (60 %)	4 (57 %)
Mt. Balakibok	43 (74%)	1 (17 %)	36 (77 %)	3 (67 %)	4 (80 %)

Threatened and Endangered Endemic Species in SBFZ

All four endemic species of mammal inventoried in the SBFZ are classified as threatened and endangered species under the PAWB-DENR list. Likewise, these species of mammals are also included in the 1988 IUCN Red List of Threatened Animals.

Among the 36 endemic species of birds identified in the inventory, 19 are listed either as endangered and vulnerable or near threatened to critically endangered. The reptilian group has two endemic species of near threatened status, while of the nine endemic amphibian species five belong to the endangered and vulnerable category, two species are near threatened, and one species is insufficiently known.

Table 3 - 31. List of Threatened and Endangered Luzon Endemic Species in SBFZ

Common Name	Scientific Name	Status	Habitat/Remarks
Amphibians			
Mountain Forest frog	*Platymantis montanus*	LI, EV	PF,SF ponds, streams, springs and creeks
Luzon Forest frog	Platymantis luzonensis	SL, EV	Same as above
Diminutive Forest frog	*Platymantis mimulus*	SL, EV	Same as above
Pygmy Forest frog	*Platymantis pygmaeus*	LI, EV	Same as above
Luzon Frog	*Rana (everetti) luzonensis*	GL, NT	Same as above
Woodworth's Frog	*Rana woodworthi*	SL, NT	Same as above and river system
Luzon Chorus Frog	*Kaloula (baleata) kalingensis*	LI, IS	Same as above
Luzon Narrow-mouthed Frog	*Kaloula rigida*	LI, EV	Same as above
Reptiles			
Philippine Pit-viper	*Trimeresurus flavomaculatus*	LI, NT	PF, SF
Flying lizards	*Draco (spilopterus, reticulatus)*	GL, NT	PF, SF
Green Sea Turtle	*Chelonia mydas*	IUCN E; CITES, I	Widely distributed in the Phil.
Birds			
Philippine Duck	*Anas luzonica*	L, EV, IUCN V	Mangroves,WL
Philippine Falconet	*Microhierax erythrogonys*	L, EV, EN, CITES II	PF, SF, FE
Philippine Serpent-Eagle	*Spilornis holospilus*	PE, EV, CITES II	PF, SF

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Common Name	Scientific Name	Status	Habitat/Remarks
Pink-bellied Imperial Pigeon	*Ducula poliocephala*	GL, NT, EN, IUCN K	PF, SF
Luzon Bleeding-heart	*Gallicolumba l. luzonica/rubiventris*	LI, EN, CITES II; IUCN K, NT	LPF&SF
Colasisi (LI race)	*Loriculus p. philippensis*	GL., EV, IUCN, V	PF, SF, FE, Agroecosystem
Guaiabero Fig-parrot (LI race)	*Bolbopsittacus l. lunulatus*	LI, NT, CITES II	PF, SF, FE
Luzon Montane Racquet-tail	*Prioniturus montanus*	LI, EN, V, IUCN K	PF
Blue-headed Racquet-tail	*Prioniturus platenae*	LI, EN, IUCN NT	LPF, Cu
Green Racquet-tail	*Prioniturus luconensis*	GL, EV, EN, IUCN K, V	FE,SF-PF&Cu
Scale-feathered Malkoha	*Phaenicophaeus cumingi*	GL, EV, CITES II	PF, SF, FE
Luzon Scop's owl	*Otus longicornis*	GL, EV, CITES II	PF, SF, FE
Jungle kingfisher	*Ceyx melanurus*	GL, EV, IUCN K	PF, SF, FE water bodies
Luzon Tarictic Hornbill	*Penelopides m. manillae*	GL, CE, CITES II	PF, SF, FE
Phil. Pygmy woodpecker	*Picoides maculatus*	LI, EV, CITES II	PF, SF
Sooty Woodpecker (GL race)	*Mulleripicus f. funebris*	GL, EV, CITES II	PF, SF
White-bellied Woodpecker (SLr)	*Dryocopus javensis confuses*	GL, EV, CITES II	PF, SF
Fishes			
Palos/ I-gat or River eels	*Anguilla*	EB	SBFZ 's River system
Tilapia	*Oreochromis nilotica/mosambicus*	EB	Same as above
Dalag/ Snakehead	*Ophiocephalus striatus*	EB	Same as above
Native catfish	*Clarias batrachus*	EB	Same as above
Freshwater shrimp	*Macrobrachium*	EB	Same as above
Talangka/ Terrestrial crabs		EB	Same as above

Key: GL - Endemic only to Greater Luzon faunal region LI - Endemic only to Luzon Island SL - Endemic only to southern Luzon biogeographical region PE - Philippine Endemic species IUCN –World Conservation Union (formerly International Union for the Conservation of Nature and Natural Resources): CE - Critically Endangered species: seriously threatened with extinction EV - Endangered or vulnerable species: threatened with extinction IS - Indeterminate or insufficiently known: threatened but data insufficient to determine status EN – Endangered V – Vulnerable K – Insufficiently known NT - Near-threatened or rare species CITES – Convention on International Trade of Endangered Species of Flora and Fauna: Appendix I – Commercial export/trade not allowed Appendix II – Commercial export/trade restricted EB - Ethno-biologically Significant species CU - Cultivated areas, root crops, banana plantation, orchard, agroecosystem PF – Primary forest SF – Secondary forest FE – Forest edge WL – Wetlands

The threatened and endangered species on the Redondo Peninsula are Philippine Warty Pig, Common Short-nosed Fruit Bat, Common Rousette Bat, Musky Fruit Bat, Pink-bellied Imperial Pigeon, Scale Feathered Malkoha, Philippine Hanging Parakeet, Green Racquet Tail Parrot, Guaiabero, Variable Monitor Lizard, and Variable Backed Frog.

3.2.1.4 Site Fauna

Methodology

Transecting/traversing was conducted to determine the species of birds and terrestrial animals. The line transect sample count technique under King's census method was used to estimate the population of wildlife which are active during the day. Species of wildlife were identified and recorded based on sightings (with the aid of binoculars), calls and presence of activity signs.

Mist nets were used to capture both nocturnal and diurnal animals. Two habitat types were considered for the survey of terrestrial wildlife; these are the grasslands and the

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areas dominated by binayuyu (*Antidesma ghaesembilla*) and agoho (*Casuarina equisitifolia*). Three mistnets were strategically set within these two habitat types with a total of 3 trap days and 4 trap nights for the whole duration of the survey.

Likewise, cage traps were also use to determine the presence of small mammals on the ground. A total of 18 cage traps (with roasted coconut as bait) were set strategically covering a total of 1 trap day and 2 trap nights. Traps (cage and mist nets) were monitored regularly during the whole sampling period.

Shannon Wiener Index of diversity (H') and Index of evenness was used to determine the degree of diversity of the species population.

In addition, interview with the local people were conducted to augment data. The activity also helped find existing wildlife that serves as pets for the local people and other species that are not found from the actual sampling. **Figure 3-34** shows the location of wildlife transect lines and cage traps.

Findings and Observations

Birds

Thirty-seven species of birds belonging to 25 families were recorded during the survey. (**Table 3-32**). Six which comprise 3% of the total number of species found in the area were endemic. These includes: *Anas luzonica, Phapitreron leucotis, Turnix ocellata, Centropus viridis, Hypsipetes philippinus and Zosterops meyeni.* One of these species (*Anas luzonica*) was classified as threatened species under the Red data Book published by Haribon Foundation and Birdlife International. Likewise, according to the book of Kennedy (A guide to the Birds of the Philippines) there were 1,200 individuals of these species were recorded in Subic Bay, Luzon. Although the bird was not found during the survey, its presence in the area was confirmed by the local people. Five other endemic species were not included in any special conservation status right now but may also be considered threatened due to loss of their habitats. Three species were classified as strictly migrants (*Lanius cristatus, Motacilla flava* and *Hirundo rustica*) while the rest were classified as either resident or resident/migrants populations.

Grasslands with patches of Agoho and Binayuyu were the dominant vegetation found in the area. Homogeneity of habitat reflected the types of bird species observed. Majority of the species found belongs to the group of munias, grassbirds, swallows, bulbul's and doves. These species are either insectivorous or granivorous. Munia's has the most number of individuals recorded followed by white-eye, swallows and doves (**Table 3-33**). Not surprisingly, these species are common inhabitant of grassland areas except for lowland white-eye which is commonly found in flocks atop of the agoho trees looking for insects. In addition, the presence of raptors like certain species of falcon and grass owls indicates that these habitats provide food for them.

Index of diversity has a value of 3.135359 for Shannon-Wiener Index and 0.87 for Evenness Index.

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Figure 3 - 34. Location Map of Wildlife Transects and Cage Traps

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Table 3 - 32. List of Birds Observed in the Beach and Lowland Habitats in Sitio Agusuhin, Subic, Zambales

Family	Common Name	Scientific Name	Status	Occurrence/ Trophic Level
Ardeidae	Purple heron	*Ardea purpurea*	R	Common/ C
Ardeidae	Cattle egret	*Bubulcus ibis*	R/M	Common/ C
Ardeidae	Cinnamon bittern	*Ixobrychus cinnamomeus*	R	Common/ Inv
Anatidae	Philippine duck	*Anas luzonica*	E	Common/ C,Vs, G
Accipitridae	Brahminy kite	*Haliastur indus*	R	Common/ C
Falconidae	Peregrine falcon	*Falco peregrinus*	R/M	Common/ C
Turnicidae	Spotted buttonquail	*Turnix ocellata*	E	Common/ G
Rallidae	Barred rail	*Gallirallus torquatus*	R	Common/ G,In,C
Rallidae	White-breasted waterhen	*Amaurornis phoenicurus*	R	Common/ G,Inv,C
Rallidae	Common moorhen	*Gallinula chloropus*	R/M	Common/ G,Inv,C
Columbidae	White-eared brown fruit-dove	*Phapitreron leucotis*	E	Uncommon/ F
Columbidae	Zebra dove	*Geopelia striata*	R	Fairly common/ G
Columbidae	Spotted dove	*Streptopelia chinensis*	R	Fairly common/ G
Columbidae	Common emerald dove	*Chalcophaps indica*	R	Common/ G,F
Cuculidae	Philippine coucal	*Centropus viridis*	E	Locally common/ I
Tytonidae	Grass owl	*Tyto capensis*	R	Common/ C
Caprimulgidae	Savanna nightjar	*Caprimulgus* sp.	R	Common/ I
Apodidae		*Collocalia* sp.	R	Uncommon/ I
Alcedinidae	White-throated kingfisher	*Halcyon smyrnensis*	R	Common/ C
Hirundinidae	Barn swallow	*Hirundo rustica*	M	Common/ I
Hirundinidae	Pacific swallow	*Hirundo tahitica*	R	Common/ I
Campephagidae	Pied triller	*Lalage nigra*	R	Common/ I,Inv
Pycnonotidae	Philippine bulbul	*Hypsipetes philippinus*	E	Common/ F
Pycnonotidae	Yellow-vented bulbul	*Pycnonotus goiavier*	R	Common/ F,Inv
Corvidae	Large-billed crow	*Corvus macrorhynchos*	R	Common/ F,Vs
Turdidae	Pied bushchat	*Saxiola caprata*	R	Locally common/ I
Sylviidae	Striated grassbird	*Megalurus palustris*	R	Common/ I,Pm
Sylviidae	Zitting cisticola	*Cisticola juncidis*	R	Fairly common/ I
Muscicapidae	Pied fantail	*Rhipidura javanica*	R	Common/ I
Motacillidae	Yellow wagtail	*Motacilla flava*	M	Uncommon/ I
Artamidae	White-breasted wood swallow	*Artamus leucorynchus*	R	Fairly common/ I
Laniidae	Long-tailed shrike	*Lanius schach*	R	Common/ I
Laniidae	Brown shrike	*Lanius cristatus*	M	Common/ I
Zosteropidae	Lowland white-eye	*Zosterops meyeni*	E	Locally common/ I,F
Ploceidae	Eurasian tree sparrow	*Passer montanus*	R	Common/ I,Inv

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Family	Common Name	Scientific Name	Status	Occurrence/ Trophic Level
Estrildidae	Scaly breasted munia	*Lonchura punctulata*	R	Fairly common/ G
Estrildidae	Chestnut munia	*Lonchura malacca*	R	Fairly common/ G

Legend for Status:
R = resident, M = migrant, E = endemic, R/M = resident and migrant
Legend for Occurrence and Trophic level:
C – carnivore, F – frugivore, G – graminivore, Vs – small vertebrates, I – insectivore, Pm – plant material, N – nectarivore, Inv – invertebrate

Table 3 - 33. List of Birds Species Found After the Survey with their Respective Index of Diversity

Common Name	Number of Individuals ni	Relative abundance ni/N	Shannon Index (H') ni/N x Ln(ni/N)
Purple heron	1	0.0055866	-0.0289798
Cattle egret	3	0.0167598	-0.0685270
Cinnamon bittern	1	0.0055866	-0.0289798
Philippine duck	1	0.0055866	-0.0289798
Braminy kite	1	0.0055866	-0.0289798
Perigrine falcon	1	0.0055866	-0.0289798
Spotted buttonquail	1	0.0055866	-0.0289798
Barred rail	1	0.0055866	-0.0289798
White breasted waterhen	1	0.0055866	-0.0289798
Common moorhen	1	0.0055866	-0.0289798
White-eared brown fruit-dove	1	0.0055866	-0.0289798
Zebra dove	9	0.0502793	-0.1503432
Spotted dove	9	0.0502793	-0.1503432
Common emerald dove	1	0.0055866	-0.0289798
Philippine coucal	6	0.0335196	-0.1138200
Grass owl	2	0.0111732	-0.0502150
Savanna nightjar	1	0.0055866	-0.0289798
Collocalia sp.	2	0.0111732	-0.0502150
White-throated kingfisher	2	0.0111732	-0.0502150
Barn swallow	3	0.0167598	-0.0685270
Pacific swallow	11	0.0614525	-0.1714211
Pied triller	1	0.0055866	-0.0289798
Philippine bulbul	2	0.0111732	-0.0502150
Yellow-vented bulbul	9	0.0502793	-0.1503432
Large-billed crow	1	0.0055866	-0.0289798
Pied bush-chat	5	0.027933	-0.0999428
Striated grassbird	2	0.0111732	-0.0502150
Zitting cisticola	10	0.0558659	-0.1611619
Pied fantail	1	0.0055866	-0.0289798
Yellow wagtail	12	0.0670391	-0.1811718

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	Number of Individuals	Relative abundance	Shannon Index (H')
White-breasted wood swallow	7	0.0391061	-0.1267615
Long-tailed shrike	4	0.0223464	-0.0849407
Brown shrike	5	0.027933	-0.0999428
Lowland white-eye	16	0.0893855	-0.2158478
Eurasian tree sparrow	11	0.0614525	-0.1714211
Scaly breasted munia	23	0.1284916	-0.2636508
Chestnut munia	11	0.0614525	-0.1714211
Total number of species = 37	**N=179**		**-3.135359**
Evenness Index			**0.87**

Mammals

Results for trapping small mammals in the area turn out to be low for bats. Only two individuals belonging to the same species (*Cynopterus brachyotis*) were captured during the whole sampling period. In contrast, 2 species of rats (*Rattus argentiventer* and *Rattus exulans*) were fairly common (**Plate 14**). Result of the trappings was shown in **Table 3-34**.

During transecting/traversing there was a very low or in fact none of these terrestrial mammals, lizards and snakes was sighted in the field during the whole sampling period. The data from Varanidae and Boidae were taken from the interview with the local people.

The low turn out for bats was probably because the area is severely disturbed. In addition of the absence of fruiting and flowering trees makes the area unfavorable for this species to thrive. Likewise, bats are very sensitive species; they are easily affected/react with the changes in microclimate in any given area. Unlike bats, rats are fairly common in the area. Two species (*Rattus argentiventer* and *Rattus exulans*) were found in this vast tract of grassland. The presence of raptor such as the Grass Owl (*Tyto capensis*) indicates that the populations of these rats are in good condition. To date this two species of rats does not belong to any special conservation status.

Table 3 - 34. List of Mammals, Reptiles and Snakes Found in the Area

Family	Common Name	Scientific name	Trap/ documented	Status	Occurrence/ Trophic level
Pteropidae	Short-nose fruit bat	*Cynopterus brachyotis*	2	R	Common/F,N
Muridae	Ricefield rat	*Rattus argentiventer*	2	R	Fairly Common/F,G,Pm
		Rattus exulans	4	R	Fairly Common/F,G,Pm
Varanidae	Monitor lizard	*Varanus salvator*	2	R	Common/C
Boidae	Reticulated python	*Python reticulatus*	1	R	Common/C

Legend for Status:
R = resident, M = migrant, E = endemic
Legend for Occurrence and Trophic level:
C – carnivore, F – frugivore, G – graminivore, Vs – small vertebrates, I – insectivore, Pm – plant material, N – nectarivore, Inv – invertebrate

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3.2.2 AQUATIC ECOLOGY

3.2.2.1 River/Freshwater Ecology

Methodology

Biological samples (*i.e.*, plankton and soft bottom benthos) from 4 stations within the study area were collected on 24 September 2005 distributed as follows: two stations along downstream (**Plate 15**) and upstream of the Agusuhin River and two stations along downstream (**Plate 16**) and upstream of North Agusuhin Creek). Sampling locations are also shown in **Figure 3-18**.

Duplicate 1-liter water samples were collected at each station for phytoplankton and zooplankton. Plankton samples were preserved in 10% formalin while in the field. The sample was made to stand undisturbed for one week to allow organisms to settle at the bottom of the container. The supernatant liquid was siphoned off and an aliquot was taken as subsample of the plankton catches for analysis. The samples in aliquot were then examined and counted using a Sedgwick-Rafter cell, and the total number of cells/organisms was determined. The counts of individuals in each phytoplankton and zooplankton groups were transformed to number of individual cells or organisms per liter of water sampled.

A metal frame that covers an area of 0.0225 m^2 (**Plate 17**) was used in collecting samples for benthos analysis. The frame was pushed at the bottom of the streambed and the sediments occupied within the frame were collected in duplicate samples for each station. The collected sediments were sieved into a 0.5 mm mesh right after each sampling. Retained sediments in the sieve were placed in a plastic container, stained with Rose Bengal and fixed in 10 % formalin. Samples were processed in the laboratory where they were washed with tap water to remove excess formalin. Sorting of organisms from the sediments was done with the aid of a stereo zoom microscope. Identified organisms were placed in vials containing 70 % alcohol and classified, if possible, to generic level. Specimens sorted from these sediment samples were counted to determine the organisms' density expressed as number of individuals per square meter.

Results and Discussion

Plankton

The phytoplankton and zooplankton taxa represented in the samples, its abundance, and their occurrences per sampling station are shown in **Table 3-35.** Since only one sampling episode was conducted, there is no temporal data to address seasonality in the variations of plankton composition and population density at these stations. A combined mean total 12,250 phyto-and zooplankton organisms were obtained. Phytoplankton population appeared to be the main constituent, comprising 84% (averaging 10,250 cells/L of the total plankton population). The phytoplankton population consists of 3 major groups: diatoms, blue-green algae and green algae. Blue-green algae were the most abundant phytoplankton organisms, averaging 37 %, consisting of 3 genera. *Oscillatoria* (20 %) and *Chroococcus* (12 %) were the leading blue-green algae in the aquatic habitats. The next most abundant were the green algae (24 %), represented with 5 genera dominated by *Cladophora* and *Oodegonium* (6 % each). The phytoplankton diatoms ranked third in abundance, averaging 22 %,

consisting of 6 genera dominated by *Navicula* (8%), followed by *Gyrosigma* and *Coscinodiscus* (4 % each).

Correlations between the stations sampled as shown in **Table 3-35** and plotted in **Figure 3-35** indicated that Station 2 (Upstream of Agusuhin River) had the most abundant phytoplankton count with 15,000 cells/L, followed by Station 3 (Downstream of Agusuhin Creek) with 13,000 cells/L. Relatively lower population densities were determined at Station 1 (Downstream of Agusuhin River) with 7,000 cells/L and Station 4 (Upstream of Agusuhin Creek) with 6,000 cells/L. The high phytoplankton population Upstream of Agusuhin River and Downstream of Agusuhin Creek may be due to the slow water flow, low water level and, in some instances, due to relatively standing water conditions observed at the time of sampling at these stations. Conversely, the relatively higher flow rates observed Downstream of Agusuhin River and Upstream of Agusuhin Creek during the time of sampling prohibited the development of new plankton and rapidly suppressed any existing organisms discharged from the associated standing waters. The literatures on the plankton as reviewed by Welcomme (1983, 1985) confirm that phytoplankton is more common in the still (lentic) waters of the river system than in running (lotic) waters. One of the most important factors that determines the presence and abundance of living organisms in the fluvial system is the rate of water flow. Phytoplankton organisms are sensitive to flow velocity and turbulence (Welcomme, 1983; 1985).

Only 1 animal group, the phytoflagellates represented solely by the genus *Phacus*, represented the zooplankton community, averaging only 16% of the total plankton population (**Table 3-35**). The total zooplankton of the downstream reaches of both Agusuhin River (3,000 organisms/L) and Agusuhin Creek (2,000 organisms/L) was relatively higher than their upper reaches (**Figure 3-36**). Existing studies indicate that similar factors that influence phytoplankton densities apply to zooplankton. Welcomme (1983) remarked that the occurrence of phytoplankton and zooplankton is closely related to the flow conditions. During floods, organisms may be present but are rare; whereas during the dry season or low waters, blooms form within the plain and in the river channels.

Table 3 - 35. Density and Abundance of Phytoplankton and Zooplankton Organisms at the Four Sampling Stations in Agusuhin River and Agusuhin Creek (24 September 2005)

PLANKTON SPECIES COMPOSITION	STA. R1 No./L	STA. R2 No./L	STA. R3 No./L	STA. R4 No./L	MEAN TOTAL DENSITY No./L	MEAN RELATIVE ABUNDANCE (%)
Phytoplankton						
Bacillariophyceae (Diatoms)						
1. Gyrosigma			2,000		500	4.08
2. Navicula	1,000	2,000		1,000	1,000	8.20
3.Fragillaria			1,000		250	2.04
4. Nitzschia	1,000				250	2.04
5. Surirella		1,000			250	2.04
6. Coscinodiscus		1,000		1,000	500	4.08
Sub-total	**2,000**	**4,000**	**3,000**	**2,000**	**2,750**	**22.48**
Cyanophycea (Blue-Green Algae)						
1. Oscillatoria	3,000	4,000	2,000	1,000	2,500	20.40

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PLANKTON SPECIES COMPOSITION	STA. R1 No./L	STA. R2 No./L	STA. R3 No./L	STA. R4 No./L	MEAN TOTAL DENSITY No./L	MEAN RELATIVE ABUNDANCE (%)
2. Chroococcus	1,000	2,000	2,000	1,000	1,500	12.24
3. Lyngbia		1,000		1,000	500	4.08
Sub-total	**4,000**	**7,000**	**4,000**	**3,000**	**4,500**	**36.72**
Chlorophyceae (Green Algae)						
1. Cladophora		1,000	2,000		750	6.12
2. Oodegonium	1,000		2,000		750	6.12
3. Pleurotaenium		1,000		1,000	500	4.08
4. Cosmarium			2,000		500	4.08
5. Pachycladon		2,000			500	4.08
Sub-total	**1,000**	**4,000**	**6,000**	**1,000**	**3,000**	**24.48**
TOTAL PHYTOPLANKTON	**7,000**	**15,000**	**13,000**	**6,000**	**10,250**	**83.68**
Zooplankton						
1. *Phacus*	3,000	2,000	2,000	1,000	2,000	16.32
TOTAL ZOOPLANKTON	**3,000**	**2,000**	**2,000**	**1,000**	**2,000**	**16.32**
TOTAL PLANKTON ORGANISMS (no. /L)	**10,000**	**17,000**	**15,000**	**7,000**	**12,250**	**100.00**

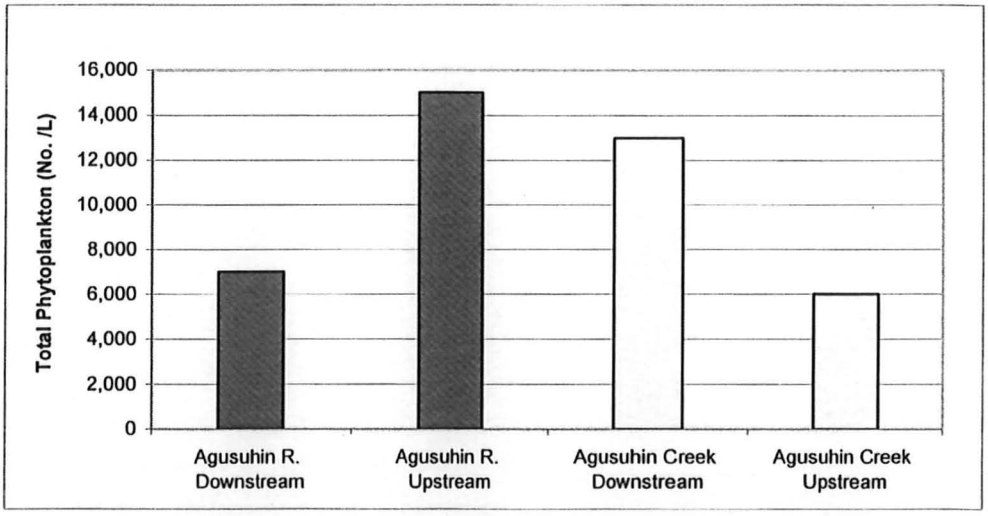

Figure 3 - 35. Density of Phytoplankton Sampled in Agusuhin River and Agusuhin Creek (24 September 2005)

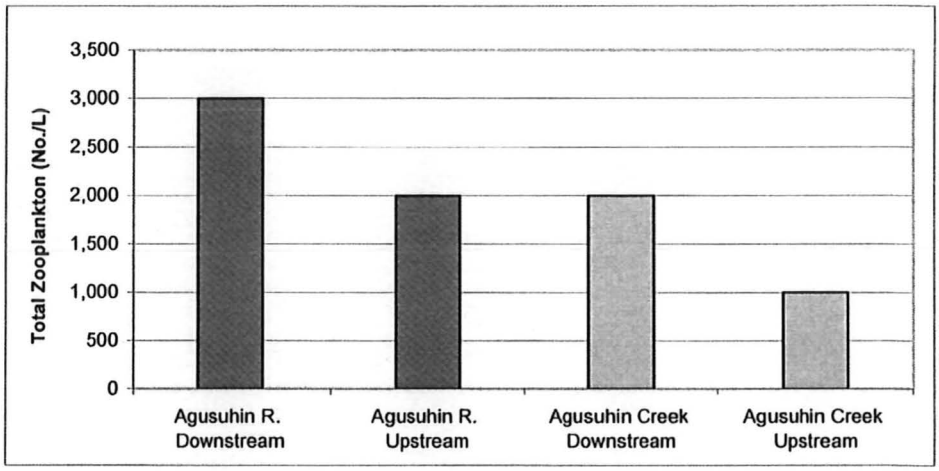

Figure 3 - 36. Density of Zooplankton Sampled in Agusuhin River and Agusuhin Creek (24 September 2005)

Soft Bottom Benthos

A total number of 10 benthic organisms were obtained from 4 samples taken in 4 sampling stations. These organisms were represented by 4 animal taxa. The various animal groups were represented in varying number of taxa. **Table 3-36** presents the total count and percentage composition of the major taxonomic groups sampled from the survey. The crustacea represented by the gammarids were the most abundant organisms collected comprising 40 % of the total collection, followed by the Insecta represented by the chironomids comprising 30 %, nematodes composing 20 % and polychaetes represented by a nereid worm constituting 10% (**Figure 3-37**).

Table 3 - 36. Total Count and Percentage Composition of Soft Bottom Fauna in Agusuhin River and Agusuhin Creek

Taxa	Count	Percent	Total Count	Total Percent
Insecta			**3**	**30**
Order Diptera				
Chironomidae				
Chironomus sp.	3	30		
Nematoda	2	20	**2**	**20**
Polychaeta			**1**	**10**
Nereidae	1	10		
Crustacea			**4**	**40**
Gammaridea	4	40		
Total	**10**	**100**	**10**	**100**

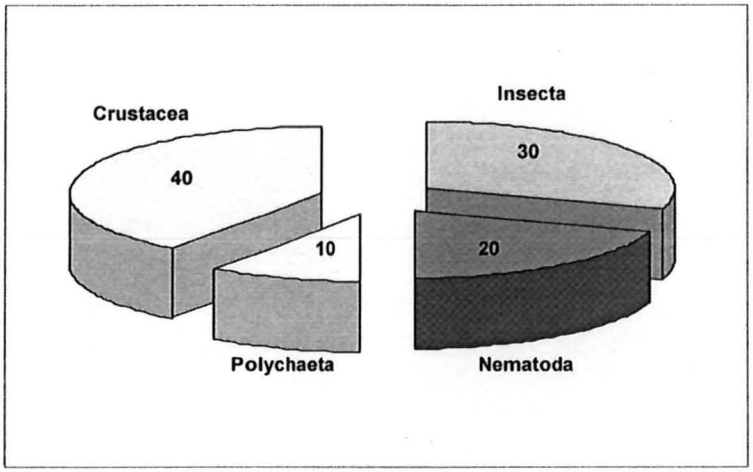

Figure 3 - 37. Mean Percentage Composition of Benthic Fauna Sampled in Agusuhin River and Agusuhin Creek

The total population density and number of taxa sampled at different sampling stations is shown in **Table 3-37.** The abundance of animals in the soft bottom community varied from 0 to 267 ind/m^2. The highest density of benthic organisms was sampled at Station 3 (Downstream of Agusuhin Creek) (**Figure 3-38**). The gammarids belonging to crustaceans were the most common organisms found. A nematode and a nereid worm were also collected. Station 1 (Downstream of Agusuhin River) and Station 4 (Upstream of Agusuhin Creek) have both a density of 89 ind/m^2. A chironomid and a nematode were found at Station 1 (Downstream of Agusuhin River) while only chironomoids were present at Station 4 (Upstream of Agusuhin Creek). No organisms were found at Station 2 (Upstream of Agusuhin River), which is characterized by a gravelly and sandy substrate.

Based on the number of identified taxa, Station 3 (Downstream of Agusuhin Creek) has 3 out of 4 taxa found, Station 1 (Downstream of Agusuhin River) has 2 taxa and Station 4 (Upstream of Agusuhin Creek) has only 1 taxon.

Table 3 - 37. Density (indv/m^2) of Soft Bottom Fauna Sampled in Agusuhin River and Agusuhin Creek

TAXA	STA. 1 Downstream of Agusuhin River	STA. 2 Upstream of Agusuhin River	STA. 3 Downstream of Agusuhin Creek	STA. 4 Upstream of Agusuhin Creek
Insecta				
Order Diptera				
Chironomidae				
Chironomus sp.	44			89
Nematoda	44		44	
Polychaeta				
Nereidae			44	
Crustacea				
Gammaridea			178	
Total	89	0	267	89
Number of Taxa	2	0	3	1

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TAXA	STA. 1 Downstream of Agusuhin River	STA. 2 Upstream of Agusuhin River	STA. 3 Downstream of Agusuhin Creek	STA. 4 Upstream of Agusuhin Creek
Substrate	Sandy	Gravelly -Sandy	Sandy	Sandy

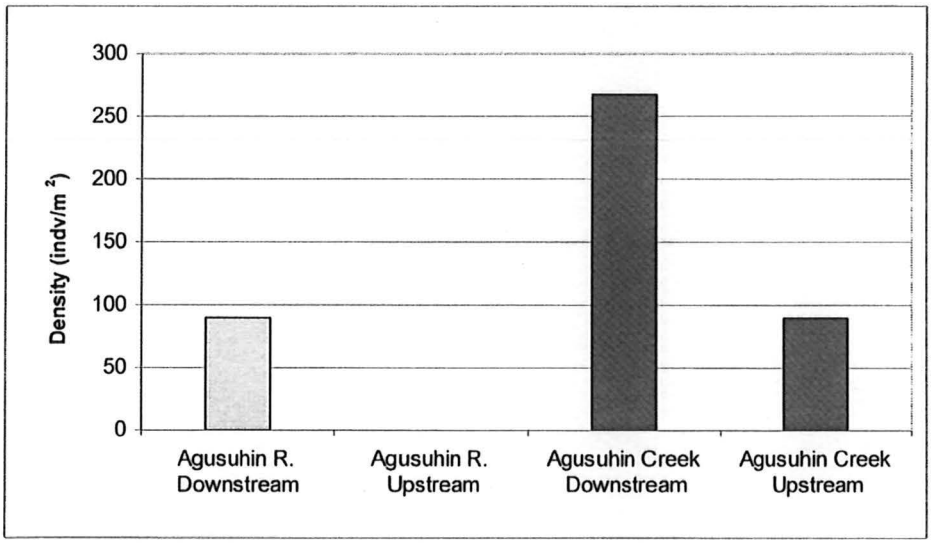

Figure 3 - 38. Density of Soft Bottom Fauna Sampled in Agusuhin River and Agusuhin Creek

3.2.2.2 Marine Ecology

Methodology

Plankton

Baseline plankton investigation was undertaken in the same 3 marine sampling stations established for water and sediment quality survey (see **Table 3- 8** and see **Figure 3-18**). Duplicate vertical samples were taken by hauling a 30-cm mouth diameter conical plankton net (**Plate 18**) with 20 microns mesh size at each station for phytoplankton and zooplankton, from approximately near the bottom to the surface to minimize then effect of variations brought about by diurnal vertical migration of plankton. In this manner, all levels of water column were sampled (Jillett, 1971). A calibrated flowmeter (**Plate 19**) was mounted in the mouth of the net to provide an estimate of the volume of water filtered by the net during each haul. All plankton samples were preserved in 10% formalin solution immediately after collection. The numerical density of plankton organisms was determined using an aliquot. The samples in the aliquot were examined microscopically and counted using a Sedgwick-Rafter cell and the total number of organisms was determined. The biomass of plankton was determined for each sample using "wet" displacement volume method (Ahlstrom, 1976).

Soft Bottom Benthos

Survey for soft bottom benthos was also conducted at the 3 marine sampling stations. Sediment samples were collected using an Ekman bottom grab sampler covering an area of 0.0225 m^2 (**Plate 20**) Sediment samples collected were sieved into a 0.5 mm

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mesh right after each sampling (**Plate 21**). Retained sediments in the sieve were placed in a plastic container, stained with Rose Bengal and fixed in 10% formalin. Samples were processed in the laboratory where they were washed with tap water to get rid of excess formalin. Sorting of organisms from the sediments was done with the aid of a stereozoom microscope. Identified organisms were placed in vials containing 70% alcohol and classified to family level if possible. Specimens sorted from the sediment samples were counted to analyze their density. Density was expressed in terms of individuals per square meter. Biomass of the benthic fauna for each station was also measured, and expressed in terms of wet wt g/m^2.

Coral

Following the methods recommended by English *et al.* (1994, 1997), the line intercept transect (LIT) was set to determine the percentage cover of living corals (both hard and soft), dead corals, algae and bare substrates. Two 50-meter Architect's fiberglass tapes were laid down on top of the patch reef under study parallel to the shore at 8 meters depth. All lifeforms intercepted by the transect line were recorded to the nearest centimeter. Taxonomic identification was done at the generic level, if possible to species level. The live coral cover was then classified into a 6-level scoring category (English *et al.*, 1994, 1997 and modified in Montebon, 1997). Zero for no cover, 1=1 up to 10% cover (very poor), 2 = 11-30 % cover (poor), 3 = 31-50 % cover (fair), 4 = 51-75 % cover (good), and 5 = 76-100 % cover (excellent). The data were then processed by adding up the intercept length of each life form category in each transect and dividing the sum by the total length of the transect.

Reef Fish

The reef fish survey was conducted in conjunction with the coral survey at the patch reef. The survey of the reef fish population was conducted using the standard Fish Visual Census Technique recommended by the ASEAN-Australia Living Coastal Resources Project. This was done by swimming along a laid 100m fiberglass architect field tape which served as the transect line and scanning all visible fish that are present within the 10m span of vision. Doing this along a transect line of 100m would total 1000m^2 of area observed. The targets were then identified at species level, counted using the category of log[4] estimate and their length estimates noted (English *et al.*, 1994, 1997). The estimated lengths were then converted to weight estimates using the formula and conversion constant from the length-weight relation table provided by Kulbicki *et al.*, 1993. The noted coral reef fishes were grouped into commercially important species, health indicator species and major species. The groups' rank and proportion were then calculated. The Species Diversity Index was based from the Shannon- Weaver (1968) formula.

Artificial Reef

The data describing baseline conditions of the artificial reef structures in Agusuhin comes from a survey report entitled "A baseline Survey on the Artificial Reef in Subic Bay Off Sitio Agusuhin, Barangay Cawag, Subic, Zambales" prepared for Shell Philippines Exploration (SPEX) by the Mr. E. Applied Environmental Sciences Consulting. The survey was carried out only last 28-29 April 2005.

Seagrass

The seagrass meadow (Lat. 14°49'15.4 N and Long. 120°12'43.0 E, see **Figure 3-18**) was first mapped, their length and width were measured and the area extrapolated. A

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0.25m^2 aluminum quadrat was used (English *et al.*, 1997). This quadrat was laid for sampling at 50 m interval. Considering that there were 5 sampling locations the length of the seagrass meadow was estimated at 250m. Its width of occurrence was within a 12m band thus the narrow band of the seagrass meadow has an estimated area of 3000m^2. Using tagged mesh bags, intensive quantitative harvesting was performed since the study requires exact measurement of the biomass. Harvested seagrasses from the quadrat were washed and dried in the laboratory and these were oven dried for two days in 100°C to get its dry weight. The number of individuals (abundance) and the dry biomass from the five samples were averaged and the result was used to estimate the abundance and biomass of the seagrass within the 3000m^2 area.

Fisheries

The information describing the location of fishing grounds and area restricted for municipal fishing in Subic Bay comes from a "Progress Report II- The Study on the Subic Bay Port Master Plan in the Republic of the Philippines" prepared by the Overseas Coastal Area Development Institute of Japan (OCDI) and Pacific Consultants International (PCI). The major sources used for describing the fisheries situation in Agusuhin were studies conducted by the Mr. E. Applied Environmental Sciences Consulting as part of the "Baseline Survey on the Artificial Reef in Subic Bay off Sitio Agusuhin, Barangay Cawag, Subic, Zambales" commissioned by Shell Philippines Exploration (SPEX).

Mariculture (Fish Cage)

The data describing the operation of fish cages in Subic Bay comes from a number of reports of marine ecological studies done in Oyon Bay in Masinloc (Zambales) and Binanga Bay in Barangay Mabayo, Morong (Bataan) by the Marine Survey Consultant last October 2004 and July 2005, respectively. In addition, Key Informant Interviews were also conducted during the present survey.

Marine Turtles

The major resources used for the information describing baseline conditions for marine turtles in Subic Bay were baseline studies conducted by the Manglares Coastal Resources Management Foundation Inc. for Penta –Shimizu-TOA Joint Venture as part of the Subic Bay Port Development Project- Marine Ecological Monitoring Program (MCRMFI, 2005a and 2005d).

Results and Discussion

Features of the Beach

Within the proposed project site area sandy beaches are found along the coastline. The outstanding features of this coastline is its "beach flat" of varying width, consisting of fine sand and coarse sand. Views of these beach features are shown in **Figure 3-39**.

Plankton

- Phytoplankton (Photosynthetic Microalgae)

The survey showed that phytoplankton population was composed of three major groups: diatoms, blue-green algae, and dinoflagellates (**Table 3-38**). Diatoms dominated all samples and were by far the most abundant phytoplankton organisms,

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averaging 54 % of the total phytoplankton collection. The diatoms were represented with 8 genera dominated by *Chaetoceros* (19 %), followed by *Skeletonema* (11 %), *Coscinodiscus* (9 %) and *Thalassionema* (8 %). In February 1998 (OCDI/PCI, 1998) and October 1999 (Woodward-Clyde, 2000), in the same study area, diatoms were also dominated by *Chaetoceros* (40 % and 38 %, respectively).

Dinoflagellates were next in abundance (41%) after diatoms, represented by only 3 genera dominated by *Noctiluca* (38%), followed by *Ceratium* (2%) and *Peridinium* (1%). Blue-green algae solely represented by *Trichodesmium* (5%) were never abundant.

Table 3 - 38. Density and Abundance of Phytoplankton Sampled at the Three Stations Along the Shores of Agusuhin (24 September 2005)

PHYTOPLANKTON TAXA	STA. M1 No./m^3	STA. M2 No./m^3	STA. M3 No./m^3	MEAN TOTAL DENSITY (No./m^3)	MEAN RELATIVE ABUNDANCE (%)
Bacillariophyceae (Diatoms)					
1. *Chaetoceros*	2,777	3,000	3,500	3,092	19.29
2. *Coscinodiscus*	1,111	2,000	1,250	1,454	9.07
3. *Navicula*	555	500		352	2.20
4. *Nitzschia*		500		167	1.04
5. *Pleurosigma*	555		500	352	2.20
6. *Rhizosolenia*		500		167	1.04
7. *Skeletonema*	1,111	2,000	2,000	1,704	10.63
8. *Thalassionema*		2,000	2,000	1,333	8.32
Cyanophycea (Blue-Green Algae)					
1. *Trichodesmium*	1,111	1,000	500	870	5.43
Dinophyceae (Dinoflagellates)					
1. *Ceratium*			1,000	333	2.08
2. *Peridinium*			500	167	1.04
3. *Noctiluca*	6,111	6,250	5,750	6,037	37.66
Total	**13,331**	**17,75**	**17,000**	**16,028**	**100.00**

Figure 3 - 39. View of the Beach Environment of Sitio Agusuhin, Brgy. Cawag, Subic, Zambales (24 September 2005)

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The total phytoplankton numbers varied between a minimum of 13,331 cells/m^3 at Station M1 to 17,750 cells/m^3 at Station M2 (**Figure 3-40**). An average of 16,028 cells/m^3 was calculated for the whole study area. This is very much lower compared with the result of the JICA Study in February 1998 at one particular station off Agusuhin in front of the CGS project with 3,353,868 cells/m^3 (OCDI/PCI, 1998) and also to that in October 1999 with 4,236,300 cells/m^3 (Woodward-Clyde, 2000).

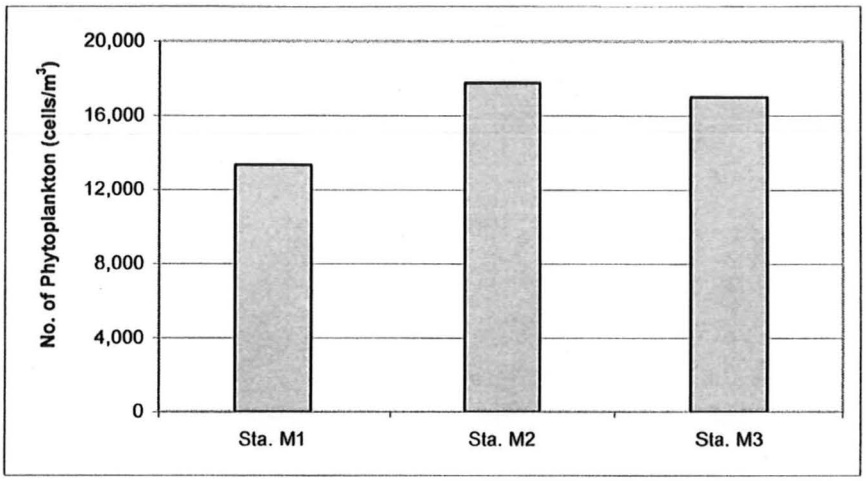

Figure 3 - 40. Density of Phytoplankton Sampled at the Three Stations Along the Shores of Agusuhin (24 September 2005)

• Zooplankton (Animal Plankton)

Six major taxonomic groups represented the zooplankton population (**Table 3-39**). The most abundant were the copepod nauplius larvae (23 %), followed by calanoid adult copepods (18%), ciliate *Tintinnopsis* (16%), foraminiferans (15 %) and appendicularians (11%). The trend was for the zooplankton to increase from Station M1 (5,553 organisms/m^3) to Station M2 (7,000 organsims/m^3); then continued to increase at Station M3 (11,750 organisms/m^3) (**Figure 3-41**). An average of 8,102 organisms/m^3 was calculated for the whole survey area. This is lower compared to the previous result from the JICA Study in February 1998 at a single station fronting the CGS project with a total of 11,726 organisms/m^3 (OCDI/PCI, 1998), but slightly higher when compared to that observed in October 1999 with a total zooplankton of 6,051 organisms/m^3 (Woodward-Clyde, 2000).

In summary, the plankton communities within the study area during the time of sampling were dominated by phytoplankton (66.4 % against 33.6 % zooplankton). The plankton densities during the previous February 1998 collection by the JICA Study are also dominated by phytoplankton (over 99%). The zooplankton is only less than 1 % (OCDI/PCI, 1998). Similarly, the plankton samples collected in the same survey area in October 1999 showed nearly the same findings (dominated by phytoplankton at 99.9 % against 0.1 % zooplankton). Normally, this is to be expected since they represent the primary producers as "grass of the sea", forming the base of the food web upon which all marine life depends. Zooplankton (animal plankton) are consumer organisms that depend upon on phytoplankton, and to some extent on dead organic matter for their source of food and energy (Basson *et al.*, 1981).

Table 3 - 39. Density and Abundance of Zooplankton Sampled at the Three Stations Along the Shores of Agusuhin (24 September 2005)

Zooplankton Taxa	STA. M1 No./m^3	STA. M2 No./m^3	STA. M3 No./m^3	Mean Total Density (No./m^3)	Mean Relative Abundance (%)
Ciliata					
Tintinnopsis	1,111	1,000	1,750	1,287	15.88
Foraminifera	1,111	1,000	1,500	1,204	14.86
Copepoda					
Calanoid Copepods	555	1,000	2,750	1,435	17.71
Copepod Nauplius Larvae	1,111	2,000	2,500	1,870	23.10
Polychaete larvae		500	1,000	500	6.17
Appendicularia	555	1,000	1,000	852	10.51
Fishes					
Fish eggs	555		500	352	4.34
Fish Larvae	555	500	750	602	7.43
Total	**5,553**	**7,000**	**11,750**	**8,102**	**100.00**

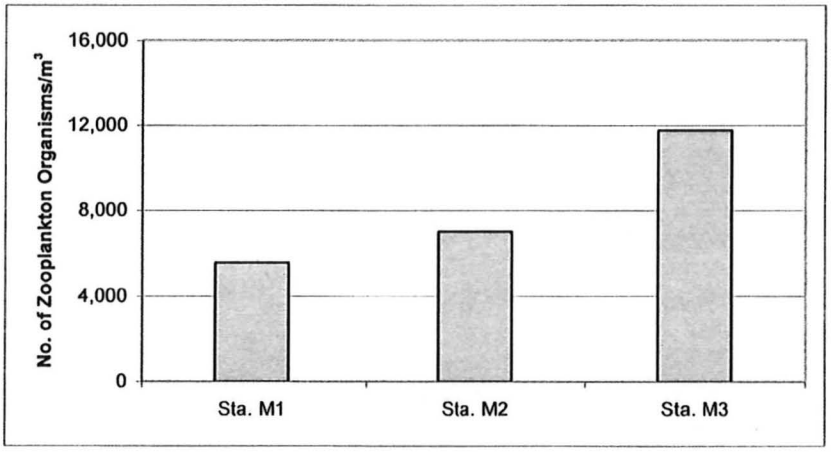

Figure 3 - 41. Density of Zooplankton Sampled at the Three Stations Along the Shores of Agusuhin (24 September 2005)

• Plankton Biomass

The plankton biomass in all sampling sites did not vary (**Figure 3-42**). Both Stations M2 and M3 were higher in plankton biomass (2.75 ml/m^3 each), while Station M1, was slightly lower (2.7 ml/m^3). These displacement volumes (plankton biomasses) were much higher when compared to those samples collected during the summer (dry) season in March 2000 by the Subic Bay Protected Areas Management Plan Project Study at two particular stations located off Panibasco Point and off the mouth of Agusuhin River with displacement volumes of 0.35 and 0.36 ml/m^3, respectively (Woodward-Clyde, 2001).

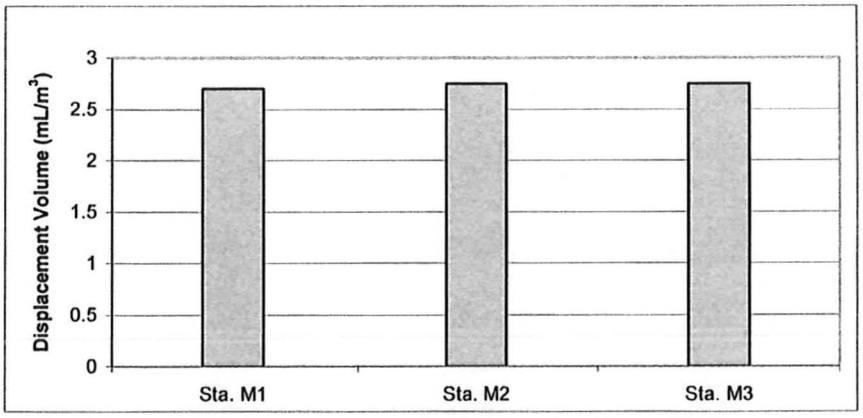

Figure 3 - 42. Plankton Biomass Sampled at the Three Stations Along the Shores of Agusuhin (24 September 2005)

Soft Bottom Benthos

A total number of 359 benthic organisms were obtained from 6 replicate samples samples taken in 3 sampling stations. These organisms were represented by 35 animal taxa. The various animal groups were represented in varying number of taxa. **Table 3-40** presents the total count and percentage composition of the major taxonomic groups sampled from the survey. The polychaetes were the most abundant organisms collected comprising 33 % of the total collection followed by the nematodes comprising 22 % (**Figure 3-42**). In decreasing order the percentage compositions of the other groups were: rhynchocoelans (15%), crustaceans (11%), foraminiferans (9%), and echinoderms (6 %). The other groups constituted an aggregate of 4 %. There were 21 families that represented the polychaetes in the collection. The spionids, which are always present in any kind of benthic marine soft bottom, are most commonly encountered polychaetes constituting 8% followed by the goniadids. There were 5 groups that represented the crustaceans in the collection. The ostracods, gammarids and isopods in that order were the most abundant of the crustaceans collected. There were 2 families that represented the foraminiferan collection. The amphisteginids were the most dominant forams encountered. The echinoids and ophiuroids represented the echinoderm collection. The turbellarian, nematode, rhynchocoelan, mollusk, and cephalochordate were represented only by one taxon each.

During the baseline survey last October 1999 of the soft bottom fauna along the proposed dredging and disposal site for Malampaya CGS project, a total of number of 171 benthic organisms were obtained from 20 samples taken in 11 sampling stations (Woodward-Clyde, 2000). These organisms were represented by 29 animal taxa and the polychaetes were also the most abundant organisms found comprising about 44% of the total collection. Also, the spionids were the most common polychaetes taken.

Table 3 - 40. Total Individual Count and Percentage Composition of Soft Bottom Benthic Organisms Sampled Along the Shores of Agusuhin

TAXA	Count	Percent	Total Count	Total Percent
Foraminifera			31	8.64
Peneroplidae				
Peneroplis sp.	3	0.84		
Amphisteginidae				
Amphistegina sp.	28	7.80		

TAXA	Count	Percent	Total Count	Total Percent
Turbellaria	1	0.28	1	0.28
Rhynchocoela	53	14.76	53	14.76
Nematoda	80	22.28	80	22.28
Polychaeta			116	32.31
Orbiniidae	1	0.28		
Spionidae				
Prionospio sp.	31	8.64		
Magelonidae				
Magelona sp.	3	0.84		
Cirratulidae	3	0.84		
Capitellidae	5	1.39		
Phyllodocidae	4	1.11		
Chrysopetalidae	4	1.11		
Pisionidae	4	1.11		
Hesionidae	5	1.39		
Pilargiidae	1	0.28		
Syllidae	6	1.67		
Nereidae	10	2.79		
Glyceridae				
Glycera sp.	3	0.84		
Goniadidae	21	5.85		
Nephtyidae				
Aglaophamus sp.	3	0.84		
Euphrosinidae	1	0.28		
Onuphidae	3	0.84		
Lumbrineridae				
Lumbrineris sp.	1	0.28		
Dorvilleidae	1	0.28		
Sternaspidae				
Sternaspis sp.	1	0.28		
Oweniidae	5	1.39		
Mollusca			10	2.79
Pelecypoda				
Tellinidae	10	2.79		
Crustacea			41	11.42
Ostracoda	17	4.74		
Tanidacea	1	0.28		
Mysidacea	2	0.56		
Gammaridea	13	3.62		
Isopoda	8	2.23		
Echinodermata			22	6.13
Echinoidea	20	5.57		
Ophiuroidea	2	0.56		
Cephalochordata			5	1.39
Branchiostoma sp.	5	1.39		
TOTAL	**359**	**100.00**	**359**	**100.00**

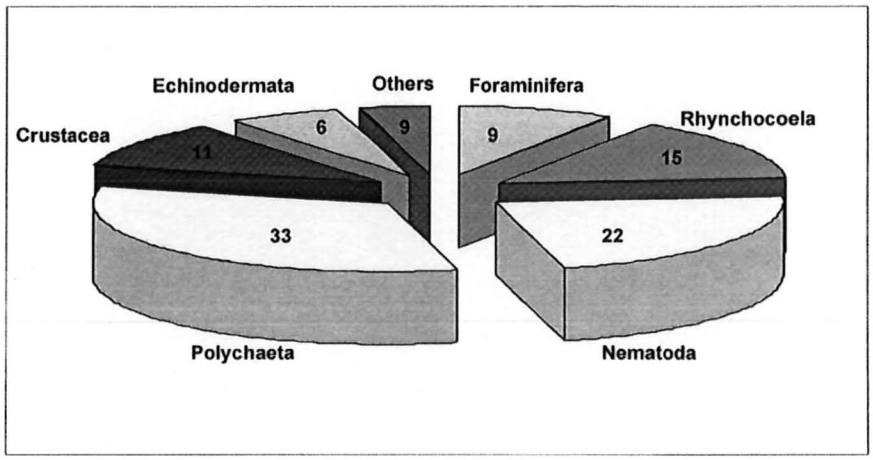

Figure 3 - 43. Mean Percentage Composition of Benthic Fauna Sampled Along the Shores of Agusuhin

The total population density and number of taxa sampled in different sampling localities is shown in **Table 3-41.** The abundance of animals in the soft bottom community varied from 1,156 to 3,622 ind/m^2. The mean density record for all the stations was 2,659 ind/m^2. The highest density of benthic organisms was sampled in the sandy bottom at Station M3 (**Figure 3-44**). The polychaetes, especially the spionid worms and the foraminiferans were the most common organisms found in this station. They were abundant in this type of substrate, which contain organic materials that provide sufficient food supply and other nutrients for the growth, and multiplication of detritus feeders in the community like the polychaetes. The sandy bottom at Station M1 ranked second in density with 3,200 ind/m^2. The nematodes, rhynchocoelans, crustaceans, especially the ostracods, pelecypods and the echinoderms were most abundant in this station. The least density was found in the sandy-muddy substrate at Station M2 with 1,156 ind/m^2. The polychaetes were the dominant organisms collected in this station.

Based on the number of identified taxa along the sampling sites, the survey indicates that Station 1 had the most diverse benthic fauna with 26 taxa out of the 35 benthic taxa found. Stations M3 and M2 have 19 and 17 taxa, respectively. Most of the taxa found on all these sampling stations belong to polychaetes.

An index of diversity of benthic organisms (within major taxonomic group) using Shannon-Weaver Index was computed for the communities found in different stations. The index both measures the variety and number of individuals per taxa. Station M1 had the highest diversity index (H') of 3.0, due to high number of taxa. The diversity indices of Stations 2 and 3 were 2.24 and 2.03, respectively.

Biomass of the benthic organisms at the 3 stations is also shown in **Table 3-41.** The biomass ranged from 4.0 to 6.44 w wt g/m^2. Inter-station comparison shows Station M1 with the highest biomass due to the presence of polychaetes and rhynchocoelans, followed by Station M2 with 6.22 w wt g/m^2 owing to the presence of cephalochordates and polychaetes. Station M3 had the least biomass with 4.0 w wt g/m^2.

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Table 3 - 41. Density (Ind/m^2) and Biomass (W Wt g/m^2) of Soft Bottom Fauna Sampled at the Three Stations Along the Shores of Agusuhin

TAXA	STA. M1	STA. M2	STA. M3
Foraminifera			
Peneroplidae			
Peneroplis sp.	67		
Amphisteginidae			
Amphistegina sp.	622		
Turbellaria	22		
Rhynchocoela	400	67	711
Nematoda	422	22	1333
Polychaeta			
Orbiniidae			22
Spionidae			
Prionospio sp.	556	67	67
Magelonidae			
Magelona sp.	44	22	
Cirratulidae	67		
Capitellidae	44		67
Phyllodocidae	44	44	
Chrysopetalidae	22	67	
Pisionidae		89	
Hesionidae	89	22	
Pilargiidae			22
Spionidae			
Prionospio sp.	556	67	67
Magelonidae			
Magelona sp.	44	22	
Cirratulidae	67		
Capitellidae	44		67
Phyllodocidae	44	44	
Chrysopetalidae	22	67	
Pisionidae		89	
Hesionidae	89	22	
Pilargiidae			**22**
Syllidae	22		111
Nereidae	156	44	22
Glyceridae			
Glycera sp.		22	44
Goniadidae		467	
Nephtyidae			
Aglaophamus sp.	44		22
Euphrosinidae	22		
Onuphidae	44		22
Lumbrineridae			
Lumbrineris sp.	22		
Dorvilleidae		22	
Sternaspidae			
Sternaspis sp.			22
Oweniidae	111		
Mollusca			
Pelecypoda			
Tellinidae		22	200
Crustacea			
Ostracoda	22		356

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TAXA	STA. M1	STA. M2	STA. M3
Tanidacea			22
Mysidacea	44		
Gammaridea	133	67	89
Isopoda	111	22	44
Echinodermata			
Echinoidea	22		422
Ophiuroidea	22	22	
Cephalochordata			
Branchiostoma sp.	22	67	22
Total	**3200**	**1156**	**3622**
No. of Taxa	**26**	**17**	**19**
Species Diversity (H')	**2.59**	**2.24**	**2.03**
Biomass (Wet wt. in grams/sq m)	**6.44**	**6.22**	**4.00**
Depth (meter)	**3**	**6**	**6**
Types of substrate	**Sandy**	**Sandy-muddy**	**Sandy-muddy**

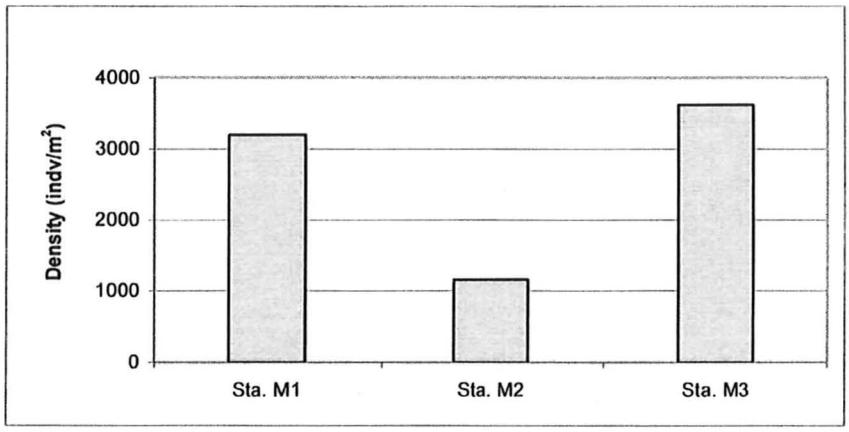

Figure 3 - 44. Density of Soft Bottom Fauna Sampled at Three Stations Along the Shores of Agusuhin

Coral Reef

Previous study (OCDI-PCI, 1998) showed that on the western side of Subic Bay (along Redondo Peninsula) insignificant number of coral patch reefs are found between Nagyantok and Shark Point. Fringing types are found between Shark Point to Sueste Point. From Nagyantok to Macmany Point (3 km coastline), fifteen (15) manta tow observation points were established. The living corals were only encountered in five (5) observation points with an average coral cover of only 5% (poor condition). Between Macmany Point and Shark Point (1.5 km coastline), twenty nine (29) stations were established here and the coral cover was also relatively poor (4%). Six (6) sampling stations were established between Shark Point and Sueste Point (1km coastline) with an average live coral cover of 34% (fair condition) (see **Figure 3-18**). The fringing coral reef area southwest of Grande Island had an excellent condition with an average of 99% coral cover (MCRMFI, 2005) (**Figure 3-45**).

Within the project site, a patch or platform reef about 300 meters long and 185 meters wide is located about 400 m northeast of Sitio Agusuhin Proper (or in front of the former

CGS casting basin). This patch reef was first surveyed in October 1999 to establish baseline con ditions of marine biota in the area for the Malampaya CGS project (Woodward-Clyde, 1999). The CGS was successfully towed out of its casting basin on 28 May 2000 en route to northwest Palawan. The second survey was then conducted in August 2000 to assess the post-dredged condition of the reef system, and compare it with the previous work (Woodward-Clyde, 2000). The two coral reef study transects sampled in a different location in October 1999 and August 2000 at the patch reef possess living coral cover nearly the same at 15% and 19%, respectively, which fall under the poor category.

The percentage cover of live hard coral and other benthic components at the transect location of the patch reef sampled during the present survey as compared with that of the previous surveys on 23 October 1999 and 16 August 2000 is presented in **Table 3-42**. During the present survey, the percentage live coral cover was estimated at 20%. Macroalgal cover was measured at 0.4%. The entire transect location was typically dominated by abiotic component (sandy substrate and coral rubble) at 49%, followed by long dead coral substrate at 25% (**Figure 3-46**) (**Plates 22, 23** and **24**). These conditions of the reef transect was more or less similar to that of the reef transects sampled at the patch reef during the previous surveys in October 1999 and August 2000 (see **Table 3-42**).

The condition of coral reefs is usually expressed in terms of the percentage cover of live coral, which indicates the health of the reef. The transect sites in October 1999, August 2000 and the present survey in September 2005 at the patch reef posses living coral cover estimated at 15%, 19% and 20%, respectively, which fall under the poor category. The poor coral condition observed at the patch reef indicates that there were rampant blast/dynamite and cyanide fishing activities in the area in previous years. In addition, the reef was not spared from the effects of the ash fall deposits during the 1991 Mt. Pinatubo eruption. The sudden deposition of up to 15 cm of Mt. Pinatubo ash changed all areas of the Subic Bay and water shed (Woodward-Clyde, Ecology Center-SBMA, 2001). The corals would have been engulfed by this airfall.

Figure 3 - 45. Location of the Agusuhin Patch Reef.

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Table 3 - 42. Bottom Cover of Reef Components Along the Sampling Transect Station of the Agusuhin Patch Reef (23 September 2005) as Compared with the Previous Surveys (23 October 1999 and 16 August 2000)

Reef Components	Bottom Cover (%)		
	23 OCT. 1999	16 AUG. 2000	23 SEPT. 2005
Hard Corals	14.94	18.50	20.15
Dead Corals	26.06	20.56	25.45
Macroalgae	6.68	4.00	0.35
Other Fauna	0.70	1.04	5.55
Abiotic (Sand/Rubbles)	51.62	55.90	48.50
Total	**100.00**	**100.00**	**100.00**

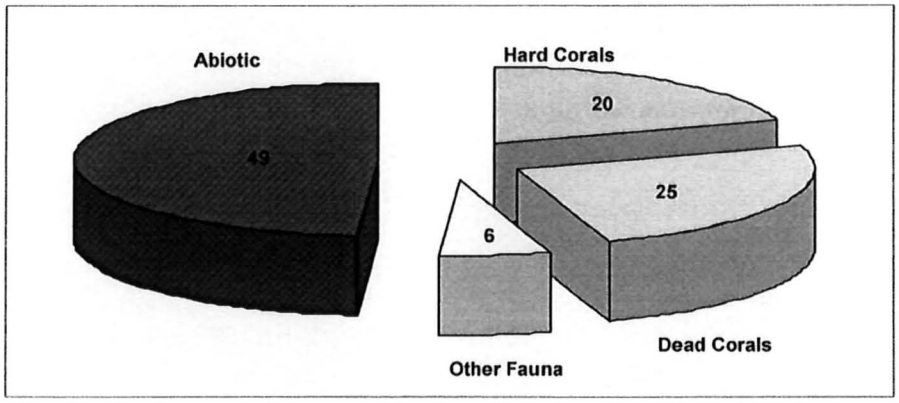

Figure 3 - 46. Percentage Cover of Reef Benthic Components of the Agusuhin Patch Reef (23 September 2005)

Table 3-43 shows a listing of corals found at the transect location to determine the species composition in the surveyed patch reef. The transect indicated a total of 39 coral species, representing 12 families and 22 genera. Massive type of corals such as, *Porites lobata* and *Favia sp.* were the most common in the transect area followed by *Galaxea fascicularis*. Family Favidae was the most abundant coral family represented by 5 genera, followed by Family Acroporidae, which was represented by 3 genera. There were also the Families Poritidae, Agariicidae, Fungiidae, and Merulinidae, which were represented by 2 genera each. Other families such as Pocilloporidae, Pectinidae, Mussidae, Oculinidae, Dendrophyllidae and Milleporidae were represented only by one genus each.

At the species level, Family Favidae was represented by 10 species while Family Fungidae was represented by 9 species. Family Poritidae has 7 species while Family Acroporidae has 3 species. Both Family Agaricidae and Family Merulinidae have 2 species. The rest of the Families such as Pocilloporidae, Oculinidae, Pectinidae, Mussidae, Dendrophylidae and Milleporidae were each represented by single species.

The species diversity (Shannon-Weaver Index) at the patch reef surveyed was generally good and significant with an index value of 3.47. Compared to previous coral survey conducted last February 1998 in Subic Bay by the JICA Study Team (OCDI/PCI, 1998) the species diversity value was higher than the reefs off Nagyantok, Naglatore,

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Shark Point and Sueste Point with diversity index values of 2.84, 3.21, 3.05 and 3.40, respectively at the constant transect depth of 8 meters.

There were about 5 ubiquitous sponges at the patch reef. *Acanthella carteri, Aaptos chromis, Clathria reinwardti, Axinyssa* sp., and *Dysidaea herbacea. Dysidea herbacea* particularly forms a wide colonies carpeting the reef edge (**Plate 25**). It is well known that dysidiidid group was the original source of the compound "averol" which was the template for AZT- the first drug used in AIDS theraphy. The algal component is composed mainly of *Hypnea sp.*, an epiphytic red algae. No soft corals were observed in the transect line indicating that the flushing-effect of currents in the area is not efficient enough. Soft corals prefer clearer waters. They are often found in areas of strong currents, which prevent sedimentation of the colonies surface.

Table 3 - 43. Checklist of Corals at 8-Meter Depth at Transect Line Station

FAMILY/GENUS/SPECIES	PATCH REEF
1. FAMILY POCILLOPORIDAE	X
Pocillopora damicornis	X
2. FAMILY ACROPORITIDAE	X
Montipora nodulosa	X
Acropora sp.	X
Anacropora	X
3. FAMILY PORITIDAE	X
Porites lobata	X
Porites lutea	X
Porites nigrescens	X
Porites sp.1	X
Porites sp.2	X
Goniopora sp.	X
Goniopora undulata	X
4. FAMILY AGARICIDAE	X
Pavona decussata	X
Gardinoseris sp.	X
5. FAMILY FUNGIDAE	X
Fungia actinoformis	X
Fungia danai	X
Fungia echinata	X
Fungia fungites	X
Fungia sp. 1	X
Fungia sp. 2	X
Fungia sp. 3	X
Fungia sp. 4	X
Herpolitha simplex	X
6. FAMILY OCULINIDAE	X
Galaxea fascicularis	X
7. FAMILY PECTINIDAE	X
Pectinia lactuca	X
8. FAMILY MUSIDAE	X
Lobophyllia sp.	X
9. FAMILY MERULINIDAE	X
Hydnopora microconus	X

FAMILY/GENUS/SPECIES	PATCH REEF
Merulina ampliata	X
10. FAMILY FAVIDAE	X
Cypastrea seraillia	X
Favia favus	X
Favia laxa	X
Favia speciosa	X
Favia sp.1	X
Favia sp.2	X
Favia sp.3	X
Favites sp.	X
Goniastrea sp.	X
Platygyra sp.	X
11. FAMILY DENDROPHYLLIDAE	X
Turbinaria sp.	X
12. FAMILY MILLEPORIDAE	X
Millepora tenella	X
TOTAL NO. INDIVIDUAL	**98**
TOTAL NO. OF SPECIES	**39**

Reef Fish

There were 31 reef fish species noted at the patch reef, belonging to 15 families (**Table 3-44**). Majority of the species belongs to the labrids family or wrasses. These were followed by the acanthurids or (surgeonfishes). There was an unnatural limitation of pomacentrids (chromis) in the area.

A total of 192 individuals were counted along the transect line. Considering that the scanned area was 1000 m^2, the extrapolated fish density was low at 0.19/ m^2. Therefore, it takes a total area of 5 m^2 to shelter a single fish. The total estimated biomass was determined at 13,125.10 gms, thus, resulting into an average biomass estimate of 13.13 gm/m^2 (see **Table 3-44**).

Table 3 - 44. The Count and Estimated Weights of Coral Reef Fish at Agusuhin Patch Reef (23 September 2005)

No.	Family	No.	Taxon	No.	Weight
1	Acanthuridae	1	*Acanthurus pyroferus*	6	314.70
	Acanthuridae	2	*Ctenochaetus striatus*	8	1762.56
	Acanthuridae	3	*Zebrasoma scopas*	1	55.89
2	Apogonidae	4	*Apogon kallopterus*	4	93.16
3	Blenniidae	5	*Meiacanthus grammistes*	2	7.84
4	Chaetodontidae	6	*Chaetodon kleinii*	8	564.34
5	Cirrhitidae	7	*Cirrhitichthys falco*	2	3.02
6	Labridae	8	*Cheilinus chlorourus*	2	229.40
	Labridae	9	*Cheilinus trilobatus*	2	33.44
	Labridae	10	*Cheilinus undulatus*	2	65.84
	Labridae	11	*Cirrhilabrus cyanopleura*	8	189.48
	Labridae	12	*Cirrhilabrus temminckii*	8	189.48
	Labridae	13	*Halichoeres hortulanus*	2	250.08
	Labridae	14	*Halichoeres melanurus*	2	54.02

No.	Family	No.	Taxon	No.	Weight
	Labridae	15	*Halichoeres prosopeion*	2	78.06
	Labridae	16	*Halichoeres scapularis*	10	390.34
	Labridae	17	*Oxycheilinus unifasciatus*	2	109.90
	Labridae	18	*Pseudocheilinus octotaenia*	32	257.88
	Labridae	19	*Stethojules bandanensis*	4	51.40
	Labridae	20	*Stethojules trilineata*	2	78.06
7	Monacanthidae	21	*Monacanthus sp.*	4	491.32
8	Mullidae	22	*Parupenus mulitfasciatus*	24	574.12
9	Pinguipedidae	23	*Parapercis cylindrica*	2	84.20
10	Pomacentridae	24	*Plectroglyphidodon lacrymatus*	8	78.82
	Pomacentridae	25	*Chrysiptera rollandi*	4	22.34
11	Scaridae	26	*Chlorurus pyrrhurus*	16	1035.56
12	Serranidae	27	*Diplorion bifasciatus*	2	915.70
13	Siganidae	28	*Siganus argenteus*	17	394.29
14	Tetraodontidae	29	*Arothron hispidus*	2	3807.54
	Tetraodontidae	30	*Canthigastes valentini*	2	10.30
15	Zanclidae	31	*Zanclus cornutus*	2	932.02
15	**TOTAL**	**31**		**192**	**13125.10**
Total Estimated Abundance at (1000m^2)				**192**	
Total Are Surveyed				**1000**	
Average Density				**0.19**	
Total Number Of Families				**15**	
Total Number Of Species				**31**	
Total Estimated Biomass				**13,125.10**	
Average Biomass				**13.13**	
Species Diversity Index				**2.98**	

The rank and proportion of reef fish in terms of count (ni) is presented in **Table 3-45.** There were two species under the Health Indicator Group; namely, the Moorish Idol, *Zanclus cornutus* and the drab butterflyfish *Chaetodon kleinii.* There were about 10 health indicator individuals counted along the transect line. There were more butterflyfishes (80%) than zanclids (20%) observed. Using the health indicator presence, the habitat in the area appears to be clean enough to shelter such sensitive types of fish.

For the Commercially Important Group, there were likewise only two species; namely, the goatfish *Parupeneus multifasciatus* and the rabbitfish, *Siganus argenteus.* The goatfish shares 58.54% of the group while the rabbitfish is at 4.46%. The presence of juvenile rabbitfish in the coral reef was a surprise; however, it was later discovered that there was a small patch of seagrass community nearby where it usually shelters.

The most dominant in terms of count among the major group is the wrasse *Pseudocheilinus octotaenia*, followed by the medium size parrotfish, *Clorourus pyrrhurus*, then another wrasse, *Halichoeres scapularis*, followed by the jeweled chromis, *Plectroglyphododon lacrymatus.* Fifth in rank is the surgeonfish, *Ctenochaetus striatus*, then the wrasses *Cirrhilabrus temmincki* and *C. cyanopleura*, then another surgeonfish, *Acanthurus pyroferus*, followed by another wrasse, *Stethojulis bandanensis.* These in turn were followed by the filefish *Monacanthus* sp. which is a unique and unidentifiable filefish because it has hirsute projections on its

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sides- an uncommon character for a filefish. Lower in rank were the chromis, *Chrysiptera rollandi* and the cardinalfish, *Apogon kallopterus.* The rest had been counted as two's or one's, thus considered as of minor ranks.

The Health Indicator Group shared the least proportion at 5.20%, followed by the Target Group at 21.35% and the majority as expected was the Major Group at 73.44% (**Figure 3-47**).

Table 3 - 45. Count, Rank and Proportion of Coral Reef Fish at Agusuhin Patch Reef (23 September 2005)

Health Indicator

No.	Family	No.	Taxon	Total Count	%
1	Zanclidae	1	*Zanclus cornutus*	2	20.00
2	Chaetodontidae	2	*Chaetodon kleinii*	8	80.00
2		**2**	**Total**	10	100.00
			Proportion		5.21

Commercially Important Species

No.	Family	No.	Taxon	Total Count	%
1	Siganidae	1	*Siganus argenteus*	17	41.46
2	Mullidae	2	*Parupenus mulitfasciatus*	24	58.54
2		**2**	**Total**	41	100.00
			Proportion		21.35

Major Species

No.	Family	No.	Taxon	Total Count	%
1	Acanthuridae	1	*Zebrasoma scopas*	1	0.71
2	Tetraodontidae	2	*Arothron hispidus*	2	1.42
	Tetraodontidae	3	*Canthigastes valentini*	2	1.42
3	Labridae	4	*Cheilinus chlorourus*	2	1.42
	Labridae	5	*Cheilinus trilobatus*	2	1.42
	Labridae	6	*Cheilinus undulatus*	2	1.42
4	Cirrhitidae	7	*Cirrhitichthys falco*	2	1.42
5	Serranidae	8	*Diplorion bifasciatus*	2	1.42
	Labridae	9	*Halichoeres hortulanus*	2	1.42
	Labridae	10	*Halichoeres melanurus*	2	1.42
	Labridae	11	*Halichoeres prosoprion*	2	1.42
6	Blenniidae	12	*Meiacanthus grammistes*	2	1.42
	Labridae	13	*Oxycheilinus unifasciatus*	2	1.42
7	Pinguipedidae	14	*Parapercis cylindrica*	2	1.42
	Labridae	15	*Stethojulis trilineata*	2	1.42
8	Apogonidae	16	*Apogon kallopterus*	4	2.84
9	Pomacentridae	17	*Chrysiptera rollandi*	4	2.84
10	Monacanthidae	18	*Monacanthus sp.*	4	2.84
	Labridae	19	*Stethojulis bandanensis*	4	2.84
	Acanthuridae	20	*Acanthurus pyroferus*	6	4.26
	Labridae	21	*Cirrhilabrus cyanopleura*	8	5.67
	Labridae	22	*Cirrhilabrus temminckii*	8	5.67
	Acanthuridae	23	*Ctenochaetus striatus*	8	5.67
	Pomacentridae	24	*Plectroglyphidodon lacrymatus*	8	5.67
	Labridae	25	*Halichoeres scapularis*	10	7.09
11	Scaridae	26	*Chlorurus pyrrhurus*	16	11.35
	Labridae	27	*Pseudocheilinus octotaenia*	32	22.70

11		**27**	**Total**	141	100.00
			Proportion		73.44

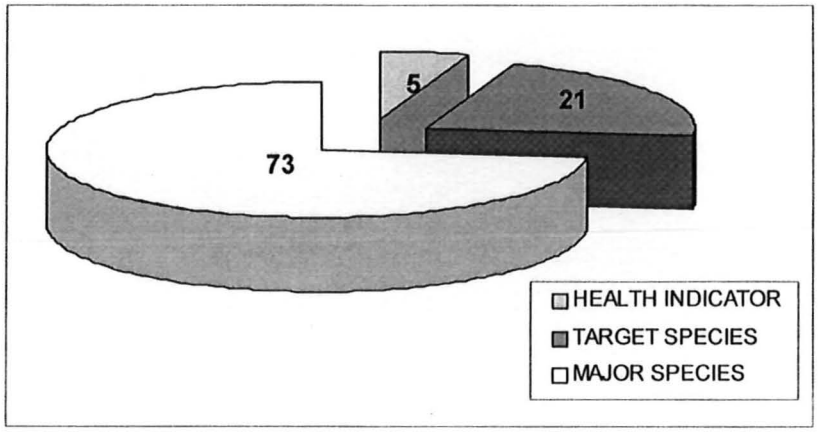

Figure 3 - 47. Count Proportion of Reef Fish at Agusuhin, September 2005

To compliment the rank and proportion in terms of count, the rank and proportion in terms of biomass (implying the robustness, size and age of fish) are presented (**Table 3-46**). For the Health Indicator Group, the Moorish Idol, *Zanclus cornutus* though fewer in count was found heavier and larger, thus dominating the group at 62.29%. The more numerous butterfyfish, *Chaetodon kleinii* has a lower total weight share of 37.71%.

For the Commercially Important Group, the goatfish, *Parupeneus multifasciatus* still was the dominant at 59.28%. Since the rabbitfish, *Siganus argenteus* was still juvenile, it has lower biomass thus sharing 40.72% of the target population.

Among the Major Group, the pufferfish, *Arothron hispidus* being the largest dominates the group in weight at 35.72%, followed by the surgeonfish, *C. striatus*, then the parrotfish, *Chlorourus pyrrhurus*, the soapfish *Diplorion bifasciatus*, the filefish, *Monacanthus* sp., the wrasse, *Halichoeres scapularis* and the surgeonfish, *Acanthurus pyroferus*. These were followed by the wrasses, *Pseudocheilinus octotaenia*, *H. hortulanus*, *Cirrhilabrus tmmincki*, *C. cyanopleura*, and *Oxycheilinus unifasciatus*. The rest were of minor significance in terms of biomass.

In terms of biomass general proportion, the least was the Commercially Important Group at 7.38%, followed by the Health Indicator Group at 11.40% and the dominant was the usual Major Group at 81.22% (**Figure 3-48**). Contrary to the count-proportion, the Health Indicator Group during this season was usually in their adult stage thus it was relatively larger in weight compared with the juvenile Target group.

Table 3 - 46. Biomass, Rank and Proportion of Coral Reef Fish at Agusuhin Patch Reef (23 September 2005)

Health Indicator

No.	Family	No.	Taxon	Biomass	%
1	Chaetodontidae	1	*Chaetodon kleinii*	564.34	37.71
2	Zanclidae	2	*Zanclus cornutus*	932.02	62.29
			Total	**1496.36**	**100.00**
2		**2**	**Proportion**		**11.40**

Commercially Important Species

No.	Family	No.	Taxon	Biomass	%
1	Siganidae	1	*Siganus argenteus*	394.29	40.72
2	Mullidae	2	*Parupenus multifasciatus*	574.12	59.28
			Total	**968.41**	**100.00**
2		**2**	**Proportion**		**7.38**

Major Species

No.	Family	No.	Taxon	Biomass	%
1	Cirrhitidae	1	*Cirrhitichthys falco*	3.02	0.03
2	Blenniidae	2	*Meiacanthus grammistes*	7.84	0.07
3	Tetraodontidae	3	*Canthigaster valentini*	10.30	0.10
4	Pomacentridae	4	*Chrysiptera rollandi*	22.34	0.21
5	Labridae	5	*Cheilinus trilobatus*	33.44	0.31
	Labridae	6	*Stethojulis bandanensis*	51.40	0.48
	Labridae	7	*Halichoeres melanurus*	54.02	0.51
6	Acanthuridae	8	*Zebrasoma scopes*	55.89	0.52
	Labridae	9	*Cheilinus undulates*	65.84	0.62
	Labridae	10	*Halichoeres prosoprion*	78.06	0.73
	Labridae	11	*Stethojulis trilineata*	78.06	0.73
	Pomacentridae	12	*Plectroglyphidodon lacrymatus*	78.82	0.74
7	Pinguipedidae	13	*Parapercis cylindrical*	84.20	0.79
8	Apogonidae	14	*Apogon kallopterus*	93.16	0.87
	Labridae	15	*Oxycheilinus unifasciatus*	109.90	1.03
	Labridae	16	*Cirrhilabrus cyanopleura*	189.48	1.78
	Labridae	17	*Cirrhilabrus temminckii*	189.48	1.78
	Labridae	18	*Cheilinus chlorourus*	229.40	2.15
	Labridae	19	*Halichoeres hortulanus*	250.08	2.35
	Labridae	20	*Pseudocheilinus octotaenia*	257.88	2.42
	Acanthuridae	21	*Acanthurus pyroferus*	314.70	2.95
	Labridae	22	*Halichoeres scapularis*	390.34	3.66
9	Monacanthidae	23	*Monacanthus sp.*	491.32	4.61
10	Serranidae	24	*Diplorion bifasciatus*	915.70	8.59
11	Scaridae	25	*Chlorurus pyrrhurus*	1035.56	9.71
	Acanthuridae	26	*Ctenochaetus striatus*	1762.56	16.53
	Tetraodontidae	27	*Arothron hispidus*	3807.54	35.72
11		**27**	**Total**	**10660.33**	**100.00**
			Proportion		**81.22**

The Species Diversity Index of the reef fish community was 2.98 (see **Table 3-46**). At a scale of "5" this means that the "naturalness" of the reef when using the reef fish as the biological indicator was fair to moderately good. In spite of the wide bare patch at the middle of the submerged patch reef, the reef fish population that shelters on the reef does exist and is thriving.

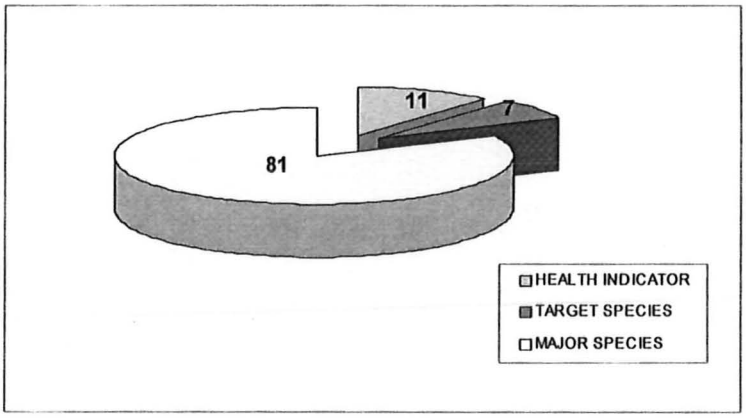

Figure 3 - 48. Biomass Proportion of Reef Fish at Agusuhin, September 2005

Artificial Reefs

Artificial reef (AR) structures deployed in the marine environments may function as recruitment or aggregation sites for both benthic and reef fish communities (Munro and Balgos, 1995). Such structures can be found within the vicinity of the project site, about 1 km on the northeastern side of Agusuhin Point (or approximately 650 m away from the shore or mouth of Agusuhin Creek at Lat. 14°49'32. 9 N, Long. 120°12'59. 5 E) (see **Figure 3-18**). A survey of the these AR structures commissioned by SPEX was carried out in April 2005 (**Figure 3-49**) to assess the current status and condition of the ARs after about 5 years of its relocation in a designated disposal site (about 30-33 meters depth) off the coast of Agusuhin from the casting basin of the so called "Malampaya Concrete Gravity Structure (CGS) Project" (Mr. E. Applied Environmental Sciences, 2005). Summary of major findings from this survey is presented below.

The ARs were made of aggregated concrete slabs with rock boulders and rocks, which varied widely with regard to shape and size. Some of the concrete slabs consisted of steel material ("kabilya"). The concrete slabs at greater depths (100-110 feet) were heavily silted while those of 80-90 feet appeared to be completely covered with marine growths. Hard or stony corals were rarely seen in all the AR sites surveyed.

There were 26 species of associated macroinvertebrates present at the AR sites (**Plates 26** and **27**), belonging to 13 animal groups namely, hydroids, octocorals, sponges, bryozoans, starfishes, featherstars, sea cucumbers, chitons, oysters, nudibranchs, cephalopods, crustaceans and sea squirts. There were a total of 124 individual animals counted. In terms of species number and abundance, the group with high species richness was the octocorals with 6 species. The sponges and oysters having 4 species each followed this group. Using the Pearson Product Moment Correlation, the varied depths of 3 AR dive sites showed a significant negative relationship with the total number of individual macroinvertebrates (-0.95) which indicates that the deeper the AR sites, the less population of hard bottom benthos.

The AR sites surveyed shelters 12 species of coral reef fishes under 9 families. The ARs were still in the process of recruitment and some of its units were not efficient as expected. The shallower the AR site, the better is its fish population dynamics. In terms of fish count and biomass, the target or commercially important group shared the highest. Dominant in the commercially important group in terms of weight were the smoothtailed trevally, dusky rabbitfish, large blue-spotted maskray, threadfin bream,

manybar goatfish, virgate rabbitfish, banana fusilier, and the least was the dwarf spotted rockcod. For the health indicator species, the schooling bannerfish was heavier than the threadfin butterflyfish. Among the major group, the dominants were the bloch's bigeye, black damsel, whitecheek surgeonfish, lined bristletooth, doubletooth soldierfish, spinycheek cardinal fish, fivelined cardinalfish, barred soapfish, tiger cardinalfish, cleaner wrasse, ringtailed cardinalfish and ambon damsel.

Fisher folks of Agusuhin do welcome the establishment of an artificial reef since they do know that these would tend to gather fishes and the effect would be less hunting time for them. Another welcome development for them is the former "casting basin", which at the present status serves as a protected fishing area during rough sea conditions.

Figure 3 - 49. Location of Concrete Deposits Artificial Reefs (Dive Site, 28-29 April 2005)

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Seagrass Bed

Soft bottom/seagrass habitat, consisting primarily of the seagrass species *Enhalus acoroides*, occurs north of CGS (towards Petambu Point, see **Figure 3-18**). This largest species among the seagrasses was found growing nearshore at a depth of 1.5 m. The substratum is sand-silt and the visibility underwater is very low at 0.5 m, considering that the zone is along the breaking point of waves. The length and width of the meadow is narrow at 250 m by 12 m, thus it runs parallel with the shoreline within a strip of 3000 m^2. On the shore is the mouth of Agusuhin Creek that empty into the study area. There are no other seagrass species found in the community thus this is considered not a typical tropic seagrass meadow, which is usually rich in species composition. The delimiting factors such as wave action and the silty type of sediments that are continually deposited directly affect this particular habitat.

The number of individual seagrass species *E. acoroides* determined, starting from the south then northward, was 84 shoots/m^2, then increased to 120 shoots/m^2, then decreased to 48 shoots/m^2, decreased further to 28 shoots/ m^2 and finally increased at 72 shoots/m^2. These average to 70 shoots/m^2 (**Table 3-47**). Assuming that the whole meadow is 3000 m^2, the total estimated abundance was 210,000 shoots in the whole seagrass bed.

Table 3 - 47. Species Composition, Abundance and Biomass of Seagrasses at Five Sampling Quadrats in Agusuhin (23 September 2005)

Sampling Site (Quadrat)	Taxon	Abundance (No. of Shoots)	Biomass (Dry Weight in Grams)
1	*Enhalus acoroides*	84	225.60
2	*Enhalus acoroides*	120	168.72
3	*Enhalus acoroides*	48	94.80
4	*Enhalus acoroides*	28	140.44
5	*Enhalus acoroides*	72	180.84
Total		**352**	**810.40**
Average (No. of Shoots/m^2)		**70.4**	
Average Biomass (Dry Weight in Grams/m^2)			**162.08**
Total Area Surveyed		**3000**	
Estimated Abundance		**211,200**	
Estimated Biomass (Grams)			**486,240**
Pearson r: (abundance vis biomass) 0.53			

This seagrass species may be few in numbers but they are comparatively taller and bulkier than all the other tropical seagrass species. In terms of dry weight biomass the first quadrat sample weights 225.6 gm dry wt./m^2 while the second quadrat though highest in number of individuals only produced 168.72 gm dry wt./m^2. The third was at 94.80 gm dry wt./m^2, then increased to 140.44 gm dry wt./m^2, and finally increased again to 180.84 gm dry wt./m^2 in the last sample. The five samples have a total dry weight of 810.40 gm. The average biomass was 162.08 gm dry wt./m^2. The estimated total biomass of the whole seagrass meadow was 486, 240 gm or 486.24 kg dry weight. Such dry weight biomass value will not suffice to support a significant quantity of faunal population.

Using the Pearson Product Moment Correlation to determine whether there is a positive and high correlation between the number of individuals and their dry weights, **Table 3-47** shows that r = 0.53. This means that there is a positive relationship between abundance and biomass values. However, their correlation is not very high which attests to the observation that some samples may be high in number but lower in weight or low in number though relatively higher in weight. This implies that the growths among sample sites are not uniform. Some sites may have more individuals but these are smaller in size and some may have few counts but their body is longer (about 80cm tall) and bulkier in size.

Fisheries

Figure 3-50 shows the approximate location of fishing grounds and area restricted for municipal fishing in Subic Bay. The fishing grounds are named after the nearest identified place or area. For example, the fishing ground called Cali Beach refers to the waters fronting the resort. Within Subic Bay, the fishing grounds are Castle, Quarry, Snake Island, Mayanga Island, Buoya A, Buoya S, La Serena, Cali Beach and Philseco. On the other hand, the fishing grounds at the mouth and outside the bay area are the coastal areas south of Redondo Peninsula, Morong and San Antonio. Catching of fish is also being done as far as Mindoro, Batangas and offshore into the South China Sea (about 50 miles away from Luzon). The restricted area was designated during the U.S. Navy period for security reason. This restriction is still being enforced by the SBMA up to the present.

General descriptions of the fisheries situation in Agusuhin can be found in Mr. E. Applied Environmental Sciences (2005). These are summarized below.

Around 20-25 motorized boats/bancas fitted with a 16 HP engine (**Plate 28**) are based in Sitio Agusuhin , while around 10 are utilized by spear fishers doing compressor diving. The most commonly used gears in Sitio Agusuhin are: the simple hook and line, the multiple hook and line, bottom set gill net, improvised spear gun and other small fishing implements like jigs and lures. Line fishers operate twice a day and normally catches around 10-15 kilograms of fish each day. Gill net operates at the same frequency (twice a day), one in the late afternoon and one at dawn. Average catch rates nowadays ranges from zero to 3 kilograms per setting.

Another fishery related activity is the gathering of milkfish ("bangos") fry. Fry gatherers commonly operate during the summer months' of May until July. There is also an ongoing aquaculture activity in Sitio Agusushin. Milkfish (*Chanos chanos*) is being cultured extensively in an approximately 3-hectare pond (**Plates 29** and **30**). The same pond was stocked previously with "tilapia" but the operation was unsuccessful because of salinity tolerance problem encountered.

Illegal fishing activities within the immediate vicinity have been lessened, although blast or dynamite fishing have never been heard of for over a year now, cyanide fishing is still being practiced by some fishers, especially those targeting aquarium species. Several fishers practice compressor diving but their activity is coupled with the retrieval of steel ("kabilya") in the AR site.

Gathering of invertebrates, specifically sea cucumber is another related activity since a buyer from Barangay Matain in Subic normally pays 40 pesos per kilogram (wet weight). Cephalopods like octopus and squids are also targeted especially during the cold months of November to February.

Figure 3 - 50. Locations of Fishing Grounds and Area Restricted for Municipal Fishing in Subic bay

Mariculture (Fish Cages)

Fish cage operations inside Subic Bay can be found along the coast of Barangay Cawag Proper (see **Figure 3-18**). Some of these cages are newly installed. Fish cages operating within the bay have different sizes. Most of the fish cages measure about 18 m x 18 m for rectangular and about 10- 12 m diameter for the Norwegian (round) type with a standing stock density of 40,000 fingerlings per cage. Mortality rate ranges from 10 to 15%. Metal or bamboo poles made up the skeleton and the nets are polyethylene with mesh sizes of 17, 14 and 12 depending on the age of the stock.

Milkfish or "bangos" (*Chanos chanos*) is the main fish species being cultured. Days of culture ranges from 6 – 7 months when stock reaches the ideal market weight of 500 – 950 grams per fish. Commercially available artificial (pelletized) feeds whose main ingredients are rice bran, fish meal and soybeans are used and the usual feed conversion ratio is estimated to be 2.5:1 until harvest. Feeding is done at least 5 times a day: 7am, 9am, 11am, 2pm and 4pm.

With the construction of fish cages inside Subic Bay, conflicts among barangay, beach resort owners and fishermen aroused. Some of the complaints include:

1. Local residents alleged that fish cages cause pollution. Unconsumed feeds trapped in the bottom of the net are being released in the open water after 3-4 months during net changing activity and are left to settle in the bottom of the bay. Since the substrate is dirtied, fisher folks claim that this cause some valuable demersal or bottom dwelling fish species to "evade" the area.

2. At present, there is no management plan in place so as to protect the water quality of the bay from the fish cage operation. Fish cages are constructed close to each other and this situation might affect the water quality of water within the area because there was no allowance given for water movement.

At present, the nearest fish cage operation to the project site is located 2 km north of Sitio Agusuhin Proper, near Mahumaling Point at Lat. 14° 50' 31. 3" N and Long. 120° 12' 48.9" E (**Plate 31**).

Declaration of Agusuhin as a Marine Sanctuary and Reservation Area

A marine conservation program is being implemented in the area. Pursuant to Resolution No. 13 (S-1998), Regulatory Ordinance No. 98-02 declaring the areas of Binictican Point to Sampaloc Point, of Subic Municipality, as Subic Marine Sanctuary and Reservation Area; the areas from Sitio Agusuhin, including Nagyantok, Kinabukasan, Naglatore to Binictican Point, all of Barangay Cawag were declared under Sangguniang Bayan Resolution No.77, S-2004 as an extention of the Subic Marine Sanctuary and Reservation Area (**Appendix 8**).

Marine Turtles in Subic Bay

Baseline Information

Three species of marine turtles are reported in Subic Bay: (1) the olive ridley (*Lepidochelys olivacea*), (2) the hawksbill turtle (*Eretmochelys imbricata*) and (3) the green turtle (*Chelonia mydas*). In all life stages, the olive ridley turtle is the most frequently observed and reported among the three species present in Subic Bay.

Beaches along the 65-kilometer coastline of Subic Bay are used for nesting by the olive ridley (*L. olivacea*).

As early as 1993, Subic Bay had already been reported as an olive ridley (*L. olivacea*) nesting site (Palma, 1993). Based on the data from the SBMA Ecology Center, the olive ridley is confirmed to nest in six beaches of Subic Bay. Among these, All Hands Beach had the most number (31%) of reported nests (**Table 3-47a** and **Figure 50a**).

In Sitio Kinabuksan of Barangay Cawag, interviewees claimed than an olive ridley turtle nested in their beach last December 2004. Similarly, interviewees from Sitio Sampaloc also of Barangay Cawag claimed that one of the nests they translocated in front their houses emerged on 04 February 2005. According to Mr. Jeremy Simpson, a marine turtle conservation supported, the 74 olive ridley hatchlings emerged form this nest.

The nesting season for olive ridley in Subic Bay is September to February. An apparent peak season occurs from November to December, accounting to 52.6% of the reported nesting (**Figure 50b**). The olive ridley nesting season in Subic Bay coincides well with the season reported for the same species in Morong, Bataan.

Hawksbill (*E. imbricata*) nests have also been reported in Subic Bay. Last 22 January 2002, 99 hawksbill hatchlings reportedly emerged from a nest in an isolated beach found midway between Sueste Point and Agusuhin. In addition, photographs of hawksbill hatchlings have been provided as evidence for nesting in Pequeña Island. Hawksbill hatchlings have likewise been documented from Sampaloc Beach.

Two tagging records from 1994 and 1998 provide the evidence of presence of green turtles (*Ch. mydas*) in Subic Bay. None of these were nesting. The curved carapace measurements show that one is a juvenile while the other is an adult. The presence of these life stages indicate at least two uses of the demersal and neritic habitats in Subic Bay for this species: (1) as a secondary juvenile developmental habitat, and (2) an adult foraging ground.

As with the hawksbill, data available for this species is still too sparse to proved seasonality and distribution in Subic Bay.

Concluding Remarks

Based on the above baseline data and information presented, marine turtles have not been sighted breeding on the sandy beaches of Sitio Agusuhin.

Table 3 – 47a. Records of Olive Ridley Turtles Nesting in The Port Development Area and Adjacent Areas of Subic Bay (Data Sources: SBMA Ecology Center, PCP Database, www.fasawwu.org/archive/resources/endangered/olive-ridley-turtle.htm)

NESTING SITE	NESTING DATE	HATCHING DATE	REMARKS
Grande Island	23 Dec 92	14 Feb 93	Incubation period: 53 days
	28 Dec 04	16 Feb 05	Clutch size: 115 One (1) unhatched egg; hatchlings unaccounted; Incubation period: 50 days
	31 Dec 04	22 Feb 05	Clutch size: 118 Fifty six (56) unhatched eggs; one (1) dead hatchling in nest Incubation period: 53 days

NESTING SITE	NESTING DATE	HATCHING DATE	REMARKS
All Hands Beach	10 Dec 02	29 Jan 03	Two (2) false nests before complete nest; eggs and hatchlings not counted Incubation period: 50 days
	19 Jan 03	_	Clutch size: 106 Four (4) unhatched eggs
	29 Jan 03	_	Clutch size: 65 Twenty-three (23) unhatched eggs, some eggs eaten by termites
	18 Nov 04	_	False crawl
	27 Oct 05	_	Estimated emergence is 07 Dec 05
	07 Nov 05	_	Estimated emergence is 26 Dec 05
Waterfront			
Seafront Restaurant	07 Oct 02	_	Eggs stolen
	23 Nov 02	_	False crawl in front of Gerry's Grill
Scuba Shack	31 Oct 04		Clutch size: 19 Eggs stolen
Boardwalk	19 Nov 04	24 Jan 05	Clutch size: 103 One (1) unhatched egg; Four (4) dead hatchlings in pipped shell Incubation period: 66 days
Beaches of Barangay Cawag			
Sitio Sampaloc	01 Feb 03	23 Mar 03	Clutch size: 75 Eggs transplanted in Miracle Beach, Camayan; emergence not accounted for Incubation period: 50 days
	03 Feb 04	03 Apr 04	Clutch size: 71 Fourteen (14) unhatched eggs, three (3) dead hatchlings in nest, transplanted in Camayan Beach Incubation period: 60 days
		04 Feb 05	Seventy-four (74) hatchlings emerged from this nest
Sitio Kinabuksan	Dec 04		
Dungaree Beach	23 Nov 04	28 Jan 05	Clutch size: 94 Three (3) unhatched eggs; one (1) live hatchling in nest; one (1) dead hatchling in nest; twelve (12) live hatchlings in pipped shell Incubation period: 66 days
	Unknown (possibly Sep 05)	Unknown	Clutch Size: 112 Seventy-five (75) shells; thirty-seven (37) unhatched eggs; hatchling emergence not observed
Camayan Beach	29 Jan 03		Clutch size: 9 Questionable clutch size

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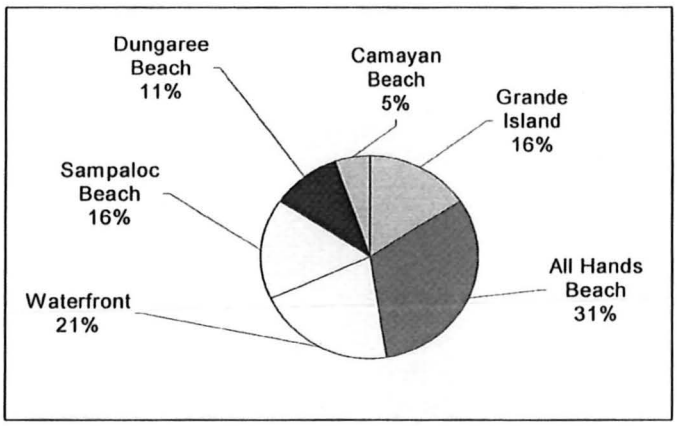

Figure 3-50a. Arranged in Order of Frequency of Reported Nesting and Nesting Attempts, These are the Beaches Where Olive Ridleys (*L. olivacea*) Nest in Subic Bay: (1) All Hands Beach; (2) Waterfront; (3) Grande Island; (4) Sampaloc Beach; (5) Dungaree Beach; and (6) Camayan ea Restricted for Municipal Fishing in Subic bay Beach. (Data Sources: SBMA Ecology Center and Internet Sources)

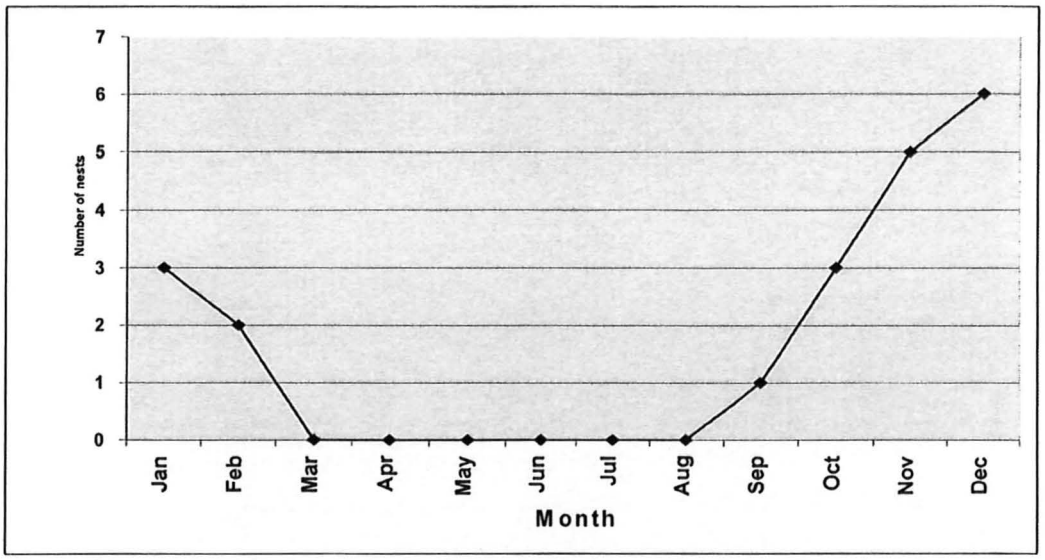

Figure 3-50b. Graph of Marine Turtle Nestings including False Crawls (Data Source: SBMA Ecology Center and Internet Sources)

3.3 SOCIO-CULTURAL, ECONOMIC AND POLITICAL ENVIRONMENT

The latest socio-economic profile available in Subic is included in the Comprehensive Land Use Plan for 2000 – 2010. The municipality is presently updating their data and drafting the latest socio-economic profile in preparation for its bid to become a component city of Zambales. The following paragraphs were lifted from the Comprehensive Land Use Plan of Subic as baseline information for the project.

3.3.1 GEOGRAPHICAL LOCATION

The Municipality of Subic occupies the southernmost portion of the province of Zambales. It is about 139 km north of Manila and geographically situated at 14° 53' latitude and 120° 14' longitude. It is bounded on the north by the Municipality of Castillejos, on the southeast by the City of Olongapo, on the west by the Municipality of San Antonio, and on the east by the Municipality of Floridablanca, Pampanga.

3.3.2 LAND AREA

Subic has a total land area of 25,506.01 ha which is distributed among its 16 barangays. The three largest barangays in terms of land area are Batiawan (11,800.56 ha), Cawag (9,710.74 ha) and Mangan-vaca (926.41 ha). The rural barangays account for a very high percentage (97.26%) of the total land area. Only a small portion (2.74%) of Subic is occupied by the urbanized barangays. The Municipal Hall is situated in barangay Baraca-Camachile (68.63 ha). The Pequena Island is considered part of the barangay Calapacuan (235.32 ha).

Based on the most recent land use accounting prepared in 2000, forestlands still remained the dominant land use (**Table 3-48**). The following table reveals current land use databased on GIS technology. Accordingly, Subic's forest cover makes up roughly about 75 % of Subic's total land area. A significant portion of this valuable land category is denuded. Those that are vegetated are mostly second growth forests. Agricultural lands make up about 7 %, a dramatic drop from 28 % in 1997. The built-up area, which is just about only 5 % percent of the total land area, increased by 16 % (162 ha) from 1997.

Table 3 - 48. Breakdown of General Land Uses, 2000

Land Use	Area (ha)	SHARE (%)
Forest	18,997.92	74.67
Special Project/Uses	3,417.30	13.43
Agriculture	1,825.88	7.18
Built-up	1,199.52	4.71
Parks/Open Spaces	0.0081	-
Rivers/Swamps	3.24	0.01
Total	**25,443.88**	**100.00**

Source: Digital General Land Use Map, UP PLANADES Subic Team

3.3.3 DEMOGRAPHY

The study team coordinated with Subic and SBMA on the latest demographic data. The MPDO said that they are in the process of revising their socio-economic profile in their effort to convert Subic into a component city. Their latest demographic data is 1995.

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Subic is the biggest municipality in the province of Zambales in terms of population with 63,019 persons in 2000. The figure comprises more than 9.88% of the provincial population for the same period. This may be attributed to the town's proximity to the Subic Bay Metropolitan Authority, the center of industrial, commercial and tourism development activities in Region 3. The second most populous town in Zambales is Santa Cruz with 49,269 persons. The provincial capital of Iba came fifth with a population count of 34,678 persons in 2000 (**Table 3-48a**).

Table 3- 48a. The NSO Census for 2000

PROVINCE / MUNICIPALITY/BARANGAY	TOTAL POPULATION	HOUSEHOLD POPULATION	NUMBER OF HOUSEHOLDS
ZAMBALES	627,802	626,481	134,720
BOTOLAN	46,602	46,550	9,629
CABANGAN	18,848	18,842	4,032
CANDELARIA	23,399	23,364	4,321
CASTILLEJOS	33,108	33,038	7,238
IBA (Capital)	34,678	34,487	7,260
MASINLOC	39,724	39,659	7,790
OLONGAPO CITY	194,260	193,752	43,107
PALAUIG	29,983	29,983	5,945
SAN ANTONIO	28,248	28,152	6,483
SAN FELIPE	17,702	17,534	4,094
SAN MARCELINO	25,440	25,401	5,866
SAN NARCISO	23,522	23,499	5,31
SANTA CRUZ	49,269	49,229	9,754
SUBIC	63,019	62,991	13,882

Source: NSO 2000 Census

The municipality of Subic had experienced erratic population growth from 1903 to 1995. In 1960, Subic's population decreased by almost half of its 1948 population with a negative 5.38 % rate. This is attributed to the fact that Olongapo, a barrio of Subic, was converted into a municipality on December 7, 1959 by virtue of Executive Order No. 366 issued by President Carlos P. Garcia. In a span of twelve years, the town's population declined from 25,223 persons to 12,985 persons. The population of Subic recovered in 1975 when the population grew to 28,139 persons or an average annual increase of 5.29 %. In the eighties, however, Subic's population again slowed down with an annual growth rate of 1.52 %. The town's growth rate bounced back in 1990 with a 4.46 % rate and again declined in 1995 with a rate of 4.00 %.

Subic had population density of 2.21 persons per hectare in 2000. Ilwas, Matain, and Wawandue emerged as the barangays with the highest population density for the periods 2000 (**Table 3-49**). In 2000, Ilwas had a population density of 203 persons per hectare. Matain followed this figure with 160 persons per hectare and Wawandue with 83 persons per hectare.

Barangays with the lowest densities were Batiawan and Pamatawan. Batiawan is the largest barangay in terms of land area but it had the least population count in 2000. Barangay Cawag had a population density of 1.1 persons per hectare. The following table shows the details.

Table 3 - 49. Population Density 1990 and 2000

Barangay	Land Area (ha)	1990	Density Persons / ha	2000	Density Persons / ha
Aningway-Sacatihan	777.07	1,728	2	3,185	4.1
Asinan-Poblacion	11.81	700	59	603	51.1
Asinan-Proper	402.90	1,539	4	3,684	9.1
Baraca-Camachile	70. 223	3,082	44	2,828	40.3
Batiawan	11,061.22	430	0	787	0.17
Calapacuan	230.06	8,403	37	10,925	47.5
Calapandayan	117.68	5,293	45	6,080	51.7
Cawag	6,365.64	3,310	1	7,181	1.1
Ilwas	14.81	2,750	186	3,017	203
Mangan- Vaca	928.78	3,051	3	4,665	5.0
Matain	41.98	5,876	140	6,756	160.1
Naugsol	369.51	783	2	1,360	3.7
Pamatawan	7,043.13	2,295	0	2,514	0 .36
San Isidro	184.41	2,420	13	3,890	21.1
Sto. Tomas	82.68	3,258	39	3,974	48.1
Wawandue	18.57	2,011	108	1,542	83.0
Population Density	28,420.47	46,929	2	62,991	2.21

Source: Comprehensive Land Use Plan of Subic 2000-2010 and 2000 NSO Census

There are eight urban and eight rural barangays in Subic. From 1990 to 1995 there was a notable increase in Subic's rural population, from 16,394 persons to 22,632 persons or 6.66 % growth rate. The urban population grew from 30,535 persons to 34,467 persons, or 2.45 % increase.

Urbanization level in 1990 was 65.07 percent. In 1995, the figure declined to 60.36 %. This implies that only about 60 % of the population resided in urban areas for the given period. The increasing rural population may be attributed to the location of a resettlement site in Barangay Cawag as well as increasing settlements outside the poblacion and the peripheries.

3.3.4 HEALTH AND SANITATION

Subic's morbidity indicators have been consistent for the past 3 years. Leading causes of morbidity included sicknesses like pneumonia, diarrhea, TB respiratory, and hypertension (**Table 3-50**). The leading causes of mortality in Subic are shown in **Table 3-51**.

Table 3 - 50. Leading Causes of Morbidity

1997 Causes	No.	1998 Causes	No.	1999 Causes	NO.
Pneumonia	1,165	Pneumonia	1,160	Pneumonia	2,120
Diarrhea	462	Diarrhea	620	Diarrhea	409
TB Respiratory	377	TB Respiratory	329	Hypertension	286
TB Meningitis	262	Malaria	138	TB Respiratory	239
Hypertension	160	Chicken Pox	35	Malaria	35

1997 Causes	No.	1998 Causes	No.	1999 Causes	NO.
Malaria	25	Malignant Neoplasm	19	Chicken Pox	11
Influenza	22	Influenza	18	Diseases of the Heart	5
Measles	16	Bronchitis/Bronchiolitis	5	TB Other Forms	1
Chicken Pox	13	Measles	4		
Dengue Fever	7	Diseases of the Heart	4		

Source: Comprehensive Land Use Plan of Subic 2000-2010

The municipality's crude death rate (CDR) for 1999 was 35.86. This figure indicates that there was an estimated average ratio of 35.86 deaths per 1,000 populations for the given calendar year.

Subic's infant mortality ratio (IMR) for 1999 was zero. IMR is the number of deaths to infants under 1 year of age per 1,000 live-births, or it is the risk of a child dying before reaching his first birthday. Likewise, the maternal mortality rate (MMR) for calendar year 1999 was zero. These are positive indicators of the health profile. The MMR is the number of women who die as a result of child bearing in a given year per 1,000 births in that year. Maternal deaths are usually caused by complications of pregnancy and childbirth.

Table 3 - 51. Leading Causes of Mortality

1997 Causes	No.	1998 Causes	No.	1999 Causes	No.
Natural Cause	44	Natural Cause	46	Old Age Heart Failure	46
Cancer	30	Hypertensive Vascular Disease	21	Hypertensive Vascular Disease	31
Accidents	29	Cancer	19	Cancer	22
Hypertensive Vascular Disease	27	Tuberculosis	17	Tuberculosis	21
Status Asthmatics	12	Accidents	17	Accidents	14
Pneumonia	11	Pneumonias	13	Coronary Artery Disease	11
Tuberculosis	11	Bronchial Asthma	9	Pneumonia	8
Coronary Artery Disease	9	Coronary Artery Disease	8	Status Asthmatic	8
Diabetis Mellitus	7	Diarrheal Disease	8	Congestive Heart Failure	6
Diarrhea	5	Acute Pancreatitis	7	Sepsis	5

Source: Comprehensive Land Use Plan of Subic 2000-2010

A Barangay Health Station (BHS) provides primary health services to the area, which usually include health education, control of locally endemic diseases, immunisation, maternal/child health and family planning, nutrition, treatment of common diseases, and supply of essential drugs. There are nine BHS facilities in Subic. These are located in the following barangays: Calapandayan, Mangan-Vaca, Ilwas, Aningway-Sacatihan, Pamatawan, Cawag Proper, Matain, Sto. Tomas and San Isidro.

There are two Rural Health Units (RHUs) found in barangays Wawandue and Calapacuan. The RHUs usually provide secondary health services. In Subic, the RHUs take care of the medical needs of barangays that do not have BHS facilities. RHU I cover the following areas: Asinan Proper, Asinan Poblacion, Baraca Camachile, and Wawandue. The RHU II takes charge of far-flung barangays of Naugsol and Batiawan.

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There is one doctor and three public health nurses working for the local government of Subic. There is one medical technologist, one sanitary inspector, nine midwives, and three birth attendants. The local government employs one dentist and two dental aides.

3.3.5 EDUCATION

Majority (40.90 % and 33.57 %) of the Municipality's population aged 5 years and above is in the elementary level and secondary level, respectively. The rest are in the post-secondary level (5.41%) or are college undergraduates (4.57 %), while 5.05 % are academic degree holders. 6.21 % of the population aged 5 years and above, however, have not completed any grade.

The 1995 Census does not provide data on literary rate, but it is encouraging to note that only 6.21% of the population aged 5 years and above have not completed any grade. It could be inferred that the percentage of those who can not read nor write is lower than 6.21%, although 0.67% of the population 5 years and over did not state whether they completed any grade or not.

The Municipality has one educational institution that offers tertiary/vocational education, the Ramon Magsaysay Technical University (RMTU). It has 2 four-year course offerings: (1) Management, and (2) Social Science. RMTU has a faculty complement of 16 persons.

The Municipality has a National Public High School and two private high schools, which serve its secondary school-going population. The Department of Education Culture and Sports (DECS) recommends a standard teacher-student ratio of 1:50 for Secondary Schools.

For the School Year 1999-2000, the Municipality Elementary Schools have an average of 1:36 teacher-student ratio, a ratio that more than meets the standard of 1:50 teacher-student for Public Elementary Schools and a ratio of 1:52 for Private Elementary Schools set by the DECS.

3.3.6 HOUSING

In 1990, the NSO's Census of Population and Housing shows that of the 9,520 housing units, 9,155 housing units are occupied while the rest (365) are vacant although at the time, the number of households (HHs) were already 9,499. There are doubled-up households in 193 housing units, which means that there are 193 cases wherein two households are sharing one housing unit. Moreover, there are 35, 18, 4, and 2 cases where three, four, five, and six or more households share one (1) housing unit, respectively. Most of the HHs house 3 to 6 persons. The mean number of occupants per housing unit is 5.101.

Of the 9,499 HHs in 1990, a great majority (7,196 HHs) owns or is paying for the amortization of the housing units. The others are renting (1,508 HHs) their units, are occupying their units for free with the consent of the owner (775 HHs). Twenty HHs occupy their unit for free without the consent of the owner.

For those who own or are amortizing their housing units (7,196 HHs), a little more than half (4,555 HHs) own or are paying for the amortization of their lot. There are 605 HHs who are renting the lot where their houses are built, and 1,647 HHs are occupying the lot for free with consent of the owner, while 389 HHs are occupying their lot for free without the consent of the owner.

3.3.7 ECONOMIC SECTOR

Of the 28,789 household population 15 years old and over, 12,430 (43.18 %) are employed while 2,012 (6.99 %) are unemployed. The other 14,347 (49.84 %) are not in the labor force (NSO Census of Population and Housing, 1990)

In the 1998-2001 Municipal Trade and Industry Development Plan, the number of skilled workers total 26,580 (**Table 3-52**). The distribution of these workers according to skills is presented in the table below:

Table 3 - 52. Skills Inventory (Municipality of Subic, 1998)

Skills	No. of Persons
Automotive mechanic	102
Basic accounting and bookkeeping	76
Basic computer literacy	1,564
Basic driving	6,000
Basic electronics	107
Basic typing and data encoding	11,419
Drafting	53
Dressmaking	1,271
General electricity	205
Heavy equipment operation	46
High-speed sewing	279
Hotel housekeeping	2740
Intermediate computer literacy	854
Refrigeration and aircon mechanic	47
Tailoring	104
Welding	1713
TOTAL	**26,580**

Source: Municipal Trade and Industry Development Plan (1998-2001), prepared by Cynthia F. Valdeconza

3.3.8 AGRICULTURE

Subic has seven agricultural barangays that include Pamatawan, Aningway-Sacatihan, Mangan-Vaca, Cawag, San Isidro, Naugsol, and Calapacuan.

Presently, 2.50 % of the total municipal land or 697.92 ha are devoted to field crops. Of this, more than 572 ha are planted to rice. This figure comprises more than 82 % of the total agricultural land devoted to field crops. Close to 50 percent of rice grow in irrigated areas. More than 30 % of rice production grows in rainfed areas, while the remaining 2.87 % are cultivated in upland areas.

Root crops are grown in 54 ha of land, or 7.79 % of agricultural lands devoted to field crops. Other crops raised in Subic include corn, vegetables, and legumes.

Permanent/commercial crops comprising mostly of fruit trees are grown in 844.63 ha of land, or 3 % of Subic's total land area. Specifically these crops include mangoes, coconut, guyabano, cashew, banana, guava/guapple, and calamansi. These are scattered in Subic's seven agricultural barangays.

There are 15 commercial livestock farms and eight semi-backyard livestock farms identified by the Municipal Agriculture Office. These farms raise cattle, swine, goat, and sheep and are found in Mangan-Vaca, Sacatihan, Pamatawan, and Naugsol.

There are four organized / commercial poultry farms in the municipality that raise ducks, broiler chicken, and layer (quail). Native chicken and pigeons are usually grown in backyard farms.

The municipality has one slaughterhouse and one chicken dressing plant. These are located in Barangay Mangan-Vaca.

There are three hand tractors provided by the local government through the Department of Agriculture (DA). These tractors service the areas in Mangan-Vaca. On the other hand, there are 33 privately owned hand tractors in the municipality.

Five dryers are in operation in the following barangays: Mangan-Vaca, Cawag, Aningway-Sacatihan, and Pamatawan. Again, the local government through the DA provided these facilities. Three other dryers are privately operated. A rice mill (kiskisan) is located in Barangay Mangan-Vaca.

In 1998, it was estimated that Subic Municipality yielded a total fishery resources of 1,746,000 kilograms (kg). Approximately 752,000 kg out of the total production were generated through inland fishing (Source: Provincial Agricultural Office). The rest were caught in the seas using motorized and non-motorized bancas.

According to the PAO, Subic had a deficit of 770,600 kg of fish for the same period. The estimate was based on the town's population, consumption, and total fish production.

Cawag, Ilwas, and Wawandue are coastal barangays. These barangays generate estimated fishery resources of 2-3 metric tons per month. Fishponds are likewise found in Cawag and Ilwas. These ponds commonly cultivate milkfish and prawns.

3.3.9 COMMERCE, TRADE AND INDUSTRY

Commercial and industrial activities play a vital role in the development and progress of a town. Subic has a total number of 15 industries categorized as major industries, mixed/medium industries, and Agro-industrial industries, as well as a number of commercial establishments.

Subic Shipyard and Engineering Inc. (formerly Philippine Shipyard and Engineering Corporation – PHILSECO), an industry engaged in ship repair since 1982, is considered to be the town's major export-oriented industry.

Strip commercial development is evident in the locality with the presence of commercial establishments along the National Road and the major and secondary arterial transportation network in the locality. The public market could be considered the influencing factor in the concentration of commercial activities within its periphery. Other commercial activities concentrate in the southern portion of the Municipality, mainly due to the presence of the SBMA. The service sector could be considered a growing sector with canteens, bars, nightclubs and other service establishments such as motor repair shops, barbershops, and beauty parlors proliferating in the area.

Establishments inside and near the public market are mostly engaged in wholesale and retail activities, establishments along the national highway, on the other hand, are mostly service-oriented, while there are a few establishments that are engaged in banking and finance activities. The five banking institutions that are present in the Municipality are the following:

Bataan Savings Bank, San Marcelino Bank, Zambales Bank, Progress Savings Bank, and Ever Savings Bank.

3.3.10 INFRASTRUCTURE AND UTILITIES

The National Highway, which traverses the Municipality, is the major arterial road linking most of the barangays. It also serves as the national artery that connects the Province of Zambales to the Province of Pampanga and Pangasinan.

Collector and service roads include all municipal and barangay roads in the area. Aside from serving as the main access road to and from the inner areas of Subic, collector and service roads are also used as farm-to-market roads by the farmers of the municipality.

Based on the inventory of roads submitted to the Provincial Planning and Development Office (PPDO) last 1995, Subic has a total road network of 93.854 km (**Table 3- 53**).

Table 3 - 53. Classification of Roads (Km)

Type of Pavement	National	Provincial	Municipal	Barangay	Total	Percent (%)
Concrete	6.419	1.78	1.00	-	**9.199**	**9.80**
Asphalt	5.110	4.12	1.08	-	**10.310**	**10.98**
Gravel	-	9.64	1.00	43.709	**54.349**	**57.91**
Earth/Dirt	-	-	1.05	18.946	**19.996**	**21.31**
Total	**11.529**	**15.54**	**4.13**	**62.655**	**93.854**	**100.00**
Percentage	**12.28**	**16.56**	**4.40**	**66.76**	**100.00**	

Source: Provincial Engineer's Office

There is only one National Road traversing the Subic Municipality. It comprises 12.28 % of the total road network of the town. The total length of the road is 11.529 km wherein 55.68 % is concrete while the remaining length of 5.11 km is asphalt. The ten barangays that are along the National Highway are Santo Tomas, Matain, Calapacuan, Calapandayan, Baraca-Camachile, Ilwas, Mangan Vaca, Asinan Proper, Aningway Sacatihan and Pamatawan.

As of 1995, the total length for the provincial roads is 15.54 km. The Cawag Road, which comprises 9.64 km or 62.03 % of the total provincial road, is gravel. It is then followed by the asphalt road surface with a total length of 4.12 km.

For the Municipal roads, the total length is 4.13 km, of which 1 km is of concrete, 1.08 km is of asphalt, 1 km is of gravel, and 1.05 km is earth-filled.

Barangay roads comprise 66.76 % of the total road network. Still under the unpaved road classification, 43.709 km (69.76 %) is of gravel and 18.946 km or 30.24 % is earth filled.

Surrounded by rivers and channels, Subic has 13 bridges, seven of which are under the administration of the national government. Four are under the municipal administration and two are maintained by the barangays concerned. Majority of the bridges are made of concrete. The Tamayok Bridge in Ilwas is the only one made of timber.

Subic is accessible by private cars, public utility jeepneys, mini-bus and buses routing from Olongapo City to the Northern portion of the province. Trucks and trailers also ply the National Highway while tricycles and pedicabs service the barangay routes.

Victory Liner, Inc. and ZAMODCA are the only bus companies authorized by the LTFRB to operate within the province. They have their terminals located in Olongapo City, San Felipe, Iba and Sta. Cruz.

3.3.11 POWER

Presently, the Zambales Electric Cooperative II (ZAMECO II) serves the electrical power needs of the municipality. Its source of power supply is from the National Power Corporation. With main offices at Castillejos, it has a sub-office at Barangay Ilwas, Subic. Based on the status of electrification of ZAMECO II, of the 16 barangays of the municipality, 15 have been energized.

As of October 1997, there are already 8,806 connections, 92.10 % of which are for domestic use and 6.77 % are for commercial use. There are minimal power interruptions and fluctuations. As of July 2000, the connections have reached 10,037 which is equivalent to 83.36 % of the potential consumers based on the 1995 census.

For the other households not currently serviced by ZAMECO II, kerosene lamps and generators are used as alternative sources of power. Such locations are mostly from the remote sitios of Barangays Cawag and the whole barangay of Batiawan.

3.3.12 WATER SUPPLY

Data on drinking water sources provide information on the proportion of households with access to potable water. In the 1990 census, 3,705 or 39 % of the households have their own faucets and are connected either to the Subic Water District (SWD) or a community water system. Water system with deep well as source is reported under this category as long as it subscribes to a community water system. There are 2,386 or 25.12 % of the households who get their water from the faucet of another household, establishment, or office which is connected to the community water system also known as the SWD. Ten percent or 1,014 of the households get their water from a tubed/piped well which is at least 100 feet (5 pieces of 20 ft pipes) or 30 m deep, for private use of the household or households in the same building or compound. Springs, lakes, and rivers are used by the residents in remote barangays for their water needs.

The upland barangays of Cawag and Batiawan do not rely on the SWD for their domestic water supply. Publicly- and privately owned deep wells are their alternative sources of water supply. Cawag Resettlement residents also get water from springs while Batiawan residents get their water from the nearby river.

3.3.13 COMMUNICATIONS

Telecommunication services that are available in the municipality are telegraph and telephone facilities. The Philippine Telephone Company (PILTEL) provides telephone services within the town with 4,800 lines or 33.89 % of the total households projected as of 2001. It is currently serving 14 barangays of Subic. It has an up-graded system using fiber optics. As of April 2000, it has 2,000 pending applications. It can relay long distance calls to other towns and cities in the country.

Other telecommunication services available in the municipality include the Cellular Mobile telephone service provided by Smart which has its tower at Maligaya, Calapandayan. Other cellular phones operating in the municipality are MOBILINE, and EXTELCOM. Radio communications system which is operated by the municipality through the assistance of the provincial government serves as a link-up between Subic and the rest of the towns in Zambales.

There is only one Telegraph Service Facility in the Municipality of Subic and it is owned and operated by the Bureau of Telecommunications (BUTEL), a government entity. It is located at the ground floor of the Municipal Hall.

Postal Service Facilities include a Post Office, Mail Distribution Center, Mail Boxes, Money Order Machine, Stamping Machine (meter), Postal Stations/ Circuits, and three motorcycles as mail transport vehicles. The postal service of the municipality has six employees servicing the whole town. This includes a postmaster-teller, an acting postmaster, three postmen II and sorter and a dispatcher.

There are two radio broadcasting companies located at Iba: the Far East Broadcasting Co. (DWRF) aired under the AM Band and the "Ang Radio Namin" under FM Band. A Repeater Station under Short wave, SW-ZNN, is located at San Antonio. There are cable stations operating in the province as well: the Sky Cable and Northwest Cable.

Newspaper tabloids are printed and published in the province weekly and semi-monthly. Other newspaper and tabloids printed outside Zambales are circulating daily.

3.3.14 Peace and Order and Fire Safety

A Municipal Police Station (MPS) located at the Municipal Center services the whole municipality. The 28 Philippine National Police(PNP) personnel are complemented by *barangay tanods.* The station has two vehicles that it can use for its operations, three portable hand-held radio, and one base radio receiver.

There is only one jail cell for male offenders with an area of 2 X 3 square meters. Female offenders are detained at the PNP office.

Fire protection services in the municipality are being carried out by 6 fire personnel (as of 1997). The Municipality's fire station is located along the National Road. Its facilities include one fire truck and a few fire hydrants.

3.3.15 Social Services

Day care facilities are found in all Subic barangays. In Cawag, there are six day care centers. There are two day care facilities in the following barangays: Calapandayan, Matain, and Sto. Tomas. A proposal is underway to expand day care services in Batiawan and Calapacuan. Day care services are offered to children 3 – 7 years old.

During periods of calamity, resources are organized to provide relief goods to affected families. The Municipal Disaster Coordinating Council, chaired by the Honorable Mayor, is tasked to oversee the implementation of disaster operations and activities. It allows non-government organizations and people's organizations to volunteer their services in relief and rehabilitation work. During emergency situations, the council is mobilized to provide overall coordination of disaster management.

On-going programs that address the needs of families include: Family Counselling, Marriage Counselling, Family Casework/Counselling, Special Social Services for Solo Parents, Assistance for Abused Children, and Maternal and Child Care Skills Development.

Cawag Resettlement is an 803-ha CIDSS Area, which was originally established to provide shelter and rehabilitation services to victims of the Mt. Pinatubo eruption in 1991. The site can

accommodate a maximum of 600 families. In 1999, there were a total of 283 families in the area, or a total population count of 4,289 persons.

Through the CIDSS, basic services are made available to the residents comprising of both lowlanders and Aetas. Elementary and high school education facilities are provided in the site. A Day Care Center and a Rural Health Unit provide the necessary public services to the community. Other services include counselling services, food for work, cash for work, supplemental feeding, self-employment assistance and referrals for social services.

The Aetas are acknowledged to be one of the earliest settlers in the municipality. Historically, as lowlanders came to Subic, the Aetas were displaced and were forced to flee to the hinterlands. While a number of Aetas have managed to be integrated within the mainstream of development activities in the municipality, many have remained deprived of public services such as health, social welfare and basic education. Aeta families are scattered in some barangays in Subic, such as: Batiawan and Naugsol.

3.3.16 TOURISM SECTOR

Subic has long been recognized a tourist destination area with the presence of its beach resorts and accommodation facilities. There are several good tourist destination areas in the town. Among these are seven prominent beach resorts, one shrine, and one inland resort (Balon Falls). Four of these resorts are accessible by land transportation while the rest are accessible by boat. Moreover, because of the emerging interest of people in Eco-Tourism in general, Subic can develop Patal falls located in Batiawan where visitors can trek or camp. The Municipal government can also explore other areas in the Municipality that can be developed into eco-tourism sites.

3.3.17 POLITICAL SECTOR

The political structure of the municipality of Subic is typical of the political structures in other municipalities. The chief executive is the mayor, duly elected by the voters every three years. The mayor can only serve a total of three consecutive terms.

The municipal council (Sangguniang Bayan) is composed of the vice-mayor as the presiding officer and the councilors as members. The head of the association of barangay chairmen (ABC) and the representative of the Sangguniang Kabataanalso sit as members of the council.

The mayor is empowered by the Local Government Code (LGC) to enforce all laws and ordinances relative to the governance of the municipality; initiate and maximize the generation of resources and revenues and apply the same to the implementation of development plans, programs, objectives and priorities; and ensure the delivery of basic services and the provision of adequate facilities (Section 444, LGC).

The municipal Council shall approve ordinances and pass resolutions necessary for an efficient and effective municipal government and in this connection (vi) Protect the environment and impose appropriate penalties for acts which endanger the environment such as dynamite fishing and other forms of destructive fishing, illegal logging and smuggling of logs, smuggling of natural resources products and of endangered species of flora and fauna, slash and burn farming and such activities which result in pollution, acceleration of euthrophication of rivers and lakes or of ecological imbalance (Section 447 LGC).

The barangay is the basic political unit in the Philippines. It is headed by the barangay chairman (punong barangay) who is duly elected by his constituents. There is also a barangay council

presided by the chairman. The barangay chairman functions as an executive and legislative head at the same time.

In pursuant to the general welfare clause, the barangay chairman is specifically mandated to enforce all laws and ordinances which are applicable to the barangay; maintain public order; enforce all laws and regulations relating to pollution control and protection of the environment; and ensure the delivery of basic services (Section 389 LGC).
An important element of the barangay unit is the existence of the conciliation panel (Pangkat ng Tagapagkasundo) composed of residents of the barangay who are tasked to amicably settle disputes arising from the residents. Cases falling under its jurisdiction are first referred to this panel. Cases not resolve in this level are certified to have passed by the panel for court dispute or settlement. This system has greatly reduced the number of cases being brought to court for litigation.

The barangay has its own revenue making power through the enactment of ordinances. In addition, it receives a share of the national taxes which is called the internal revenue allotment (IRA). The computation of the IRA is based on three factors namely, land area, population and equal sharing. There is also the share on the national wealth, a tax levied by the national government for the utilization of the natural resources in a given area.

Republic Act 7227 creating the Bases Conversion Development Authority (BCDA) was enacted on March 13, 1992. Section 12 of the BCDA Law created the Special Economic and Free Port Zone composed of the City of Olongapo and the Municipality of Subic, Province of Zambales, the lands occupied by the Subic Naval Base and its contiguous extensions as embraced, covered, and defined by the 1974 Military Bases Agreement between the Philippines and the United States of America as amended, and within the territorial jurisdiction of the Municipalities of Morong and Hermosa, Province of Bataan.
The powers and functions of SBMA are discussed in the section under Legal Framework. It also discusses the relationship between the local government and SBMA.

3.3.18 Sitio Agusuhin Historical Background

As part of a training area during the Subic U.S. Naval Base, Sitio Agusuhin was mainly dependent the economy brought about by the Americans for almost 30 years, not foreseeing the eventuality of a pullout, the people failed to establish a sustainable and independent industry or means of livelihood. When the US military forces withdrew in 1992, the people of Agusuhin were caught flatfooted and their livelihood took a deep plunge.

In 1997, forty hectares of shore land in Agusuhin was chosen as the site for the Malampaya Concrete Gravity Structure (CGS) project of the Shell Philippines Exploration (SPEX) B.V. This presented the residents with an opportunity for economic recovery. Employment priority was given to the residents. And more importantly, the Pilipinas Shell Foundation Inc. (PSFI) was set to implement a development program for the advancement of the community.

The CGS project was constructed in a 40-hectare land at Sitio Agusuhin, Redondo Peninsula. This is a coastal village with in the Subic Special Economic Freeport Zone.

At the beginning of the project, Sitio Agusuhin has a population of 919 with 147 households. The primary source of income before the CGS project was fishing and almost 50 % of the population lived below the poverty level. Education and skills level of the people are low due to the inaccessibility of educational institutions.

The residents of the village do not receive regular and appropriate basic health care services. Because of the lack of employment opportunities, some fishermen engaged into illegal activities

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such as dynamite and cyanide fishing contributing to the degradation of marine environment and resources in Subic Bay and nearby areas.

SPEX, through the PSFI, launched the Sitio Agusuhin Development Program (SADP) in conjunction with the Ecology Center of SBMA. This program was developed to ensure the smooth flow of construction and tow-out of the structure while harnessing and enhancing the long-term relationship with the village.
The projects that were implemented were the following; (a) Livelihood and Enterprise Development (b) Organizational Development and Capability Building (c) Basic Social Services and Infrastructure (d) Bat Habitat Restoration Project, and (e) Community Based Forest Management.

In 2001, the Ecology Center conducted a census and tagging operation to determine the number of households in the Redondo Peninsula. The following were the results.

The total population of the area is 3,981 persons coming from 709 households, with an average family size of 3-5 members/HH. The general population has an equally low level of educational attainment. Around 62 % of the population is in the elementary level. This is the major factor contributing to the low-income levels and lack of employment opportunities to the general population. Around 50 % of the population is heavily dependent on natural resources as their source of livelihood. It was also found out that 52 % of the population is dependent on forest resources for fuel. The most common source of water for the communities are the water pumps (76 %). Majority (64 %) does not have permanent places of disposing human waste. Half (50 %) of their houses are made from concrete hollow blocks, lumber and GI roofing. Sizes of their dwellings vary from 16 to 49 square meters.

The population of Sitio Agusuhin was 1,426 persons comprising 35.8% of the total surveyed population. There were 234 households with an average size of 6.09 persons per household. There were 228 houses housing these 234 households. Aside from these houses, there were also three structures devoted for religious use, a barangay hall currently being used as the day care center, the Agusuhin Elementary School and Annex Cawag Resettlement High School, basketball court and a health center.

From June 29-July 15, 2005, the Ecology Center conducted a socio-economic and perception survey in Sitios Agusuhin and Nagyantok. The combined total population is 2,152 persons in 477 households. The average household size is 5 persons per household. There are 272 households in Sitio Agusuhin with 1,306 persons.

Fifty one percent are males while 49 % are females. Forty-four percent of the population belongs to the working age population (18-50). There are 2.2 persons depending on one member of the productive age group.

3.3.19 Social Acceptability

3.3.19.1 Public Participation

The communities in the three impact areas and various stakeholders were provided different venues for participation in the conduct of this study. These include the conduct of unobtrusive informal interviews with key informants, community meetings, focus group discussions and public consultation (2nd level scoping).

A survey instrument (see **Appendix 9**) was administered to obtain the respondent's profile, views on their community, and their perception towards the proposed shipbuilding project.

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Key Informants Interview of the community leaders, the mayor, and SBMA was conducted to gather general issues and concerns towards the project as well as to map out socio-political influences that might affect the Project.

Focus group discussions were also conducted to validate the results of the survey while second level scoping/ public consultations were facilitated to capture the "pulse" of the community on the acceptability of the project as well as to gauge their conditions on the schemes for social preparations.

Residents discussed among themselves the possible environmental and social impacts as a result of the implementation of the proposed project. They also took a very active part in the identification of positive and negatives effects of the project and in the formulation of mitigating measures that would minimize if not totally eradicate the adverse socio-economic and environmental impacts.

Secondary information was collected from SBMA Ecology Center, where they recently conducted a complete survey (June 29 – July 15, 2005) for 477 households along Redondo Peninsula which covered Sitios Agusuhin (272 households) and Nagyantok (205). Some of data generated by this survey were adopted to present a fuller picture of the concerned communities.

3.3.19.2 Socio-Economic / Perception Survey

The survey was conducted on 16-18 September 2005 in the three sitios (village), namely: Agusuhin, Nagyantok, and Nagtulong – coastal communities along Redondo Peninsula in Barangay Cawag Subic, Zambales. The survey instrument patterned after the recommended form of Environmental Management Bureau (EMB) was used. Enumerators were enlisted from the cluster leaders of Agusuhin Neignborhood Association (ANA)

The study area was classified into two types. The direct impact area (DIA) is the whole of Sitio Agusuhin where the proposed project site will be located. The survey undertook 100% interview coverage with the three-hundred fifty-five (355) households living within Sitio Agusuhin. A settlement map of Sitio Agusuhin is shown in **Figure 3-51**

The secondary impact area (SIA) is defined as within a three-kilometer radius from the proposed project site. There are two sitios in the secondary impact area, namely: Sitio Nagyantok and Sitio Nagtulong. Fifty respondents (24%) in Sitio Nagyantok were selected out of the total of 205 households. Twelve respondents (20%) in Sitio Nagtulong were selected out of the total of 60 households. Overall, the total number of respondents for the DIA and SIA is 417 respondents.

The respondents interviewed in the study were heads of the family, ages 18 and above and residents of Sitio Agusuhin, Nagyantok, and Nagtulong.

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Figure 3 - 51. Settlement Map of Sitio Agusuhin.

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3.3.19.3 Results of the Awareness and Perception Survey

Respondents

Three hundred fifty-five (355) respondents or 100% of the total number of households were interviewed in Sitio Agusuhin. This enumeration reflects an almost accurate result in demographic and socio-economic information as well as the general perception of the residents.

Respondents from Sitio Nagyantok and Sitio Nagtulong, on the other hand, represented the 20% - 24% of its total number of households (205 and 60 households). The number of respondents interviewed from the three sitios will reflect precise information about the area and the general trends on the perception of its residents (**Table 3-54**).

Table 3 - 54. Distribution of Respondents by Sitio

Sitio	Number of Respondents	Number of Households	Percent (%) to Total HH Population
Agusuhin	355	355	100
Nagyantok	50	205	24
Nagtulong	12	60	20
TOTAL	**417**	**620**	

Sitios Agusuhin, Nagyantok, and Nagtulong have a combined household population of 665 where Sitio Agusuhin was the largest (53 % of the total households) while Sitio Nagtulong was the smallest with 10 % coverage (**Table 3-55**).

Table 3 - 55. Distribution of Population (bas ed on survey sample) and Number of Households (actual)

Sitio	Population	Number of Households	%
Agusuhin	1,476	355	53
Nagyantok	261	205	37
Nagtulong	67	60	10
Total	**1,804**	**620**	**100**

Source: SEP at Redondo Peninsula (SBMA, 2005)

Sitio Agusuhin, the center of the proposed shipbuilding facility, has significantly increased its household population by 85% from 147 HH, in 1999 Pre-CGS construction survey (PSFI Accomplishment Report, 2001), to 272 HH latest survey conducted by SBMA in June 2005. This increase may be attributed to the development projects in the area where residents took the opportunity for employment and other compensations (**Table 3-56**).

Table 3 - 56. Distribution of Popul ation and Number of Households by Cluster in Sitio Agusuhin, Barangay Cawag, Subic, Zambales

Clusters	Household Population	Number of Households	Number of Families	ANA Members	Non-ANA Residents
Cluster 1	160	40	43	37	6
Cluster 2	91	22	24	22	2

Clusters	Household Population	Number of Households	Number of Families	ANA Members	Non-ANA Residents
Cluster 3	52	13	13	12	1
Cluster 4	106	18	18	14	4
Cluster 5	55	13	14	13	1
Cluster 6	76	17	17	10	7
Cluster 7	55	13	13	11	2
Cluster 8	66	19	19	16	3
Cluster 9	115	24	27	16	11
Cluster 10	122	28	28	23	5
Cluster 11	86	23	24	16	8
Cluster 12	81	21	21	10	11
Cluster 13	125	33	34	23	11
Cluster 14	169	38	43	15	28
Cluster 15	117	33	33	8	25
Total	**1,476**	**355**	**371**	**246**	**125**

This study also showed a 22 % increase in household population, from June to September 2005, due to the knowledge of other sitios/areas in Subic that there will, again, be another project (the shipbuilding) to be developed in the area.

This created an influx of migrants in Agusuhin, building new houses (although some do not really intend to live in the area), expecting for greater valuation of their property just like what happened during the CGS Project of SPEX while others look for employment opportunity in the proposed project. In fact, this study showed that 34 % of the total household population was not members of Agusuhin Neighborhood Association (ANA), an association created during the CGS Construction to determine the original settlers in the area (see **Table 3-56**).

Sitio Nagyantok and Nagtulong, on the other hand, have gradually increased by 18 % and 17`% from its household population of 205 HH and 50 HH, respectively.

Household Size

Among the 417 respondents, the most common household size is composed of 3-4 members (33 %) while others ranges from 5-6 (26 %) (**Table 3- 57**). Compared to the previous generation, where household size ranged from 10-12, this declined in size may be attributed to the effective family planning campaign of the government and the widespread knowledge of the negative effects of poverty to families with large household sizes. Moreover, some of the married members of the family may have separated their homes from their parents which lessened the size of the households, thus, may have also contributed to the increase in the number of households in the Sitio.

Table 3 - 57. Household Size of Respondents by Sitio

HH Size	*Agusuhin*	*Nagyantok*	*Nagtulong*	*Total*	*%*
1-2	38	4	-	42	10
3-4	132	7	-	139	33
5-6	93	11	3	107	26
7-8	40	7	1	48	12

HH Size	*Agusuhin*	*Nagyantok*	*Nagtulong*	*Total*	*%*
9-10	26	3	-	29	7
11-12	3	9	-	12	3
13 & above	23	9	8	40	9
Total	**355**	**50**	**12**	**417**	**100**

Family Relationship

The following table (**Table 3-58**) shows that most of the type of family of the respondents, based on relationship, is non-extended (92%). Meaning, only few relatives were living with the family. One of the reasons may be that there is no limitation in building new house in the area that some do so instead of living with their relatives.

Table 3 - 58. Distribution of Households by Family Relationship by Sitio

Sitio	Non-Extended	%	Extended	%	Frequency
Agusuhin	320	90	35	10	355
Nagyantok	50	100	-	-	50
Nagtulong	12	100	-	-	12
Total	**382**	**92**	**35**	**8**	**417**

Age Distribution

Out of 1,476 total population in Sitio Agusuhin, 61 % belong to the productive age group (15 to 64), the same with Sitio Nagyantok with 54 % of its total population (**Table 3-59**) On the other hand, half of the population of Sitio Nagtulong belongs to the younger age group (1-14).

Generally, a large number of the population of the three sitios is composed of younger to early productive stage, which indicates an actively increasing population for the next five to ten years. Therefore, family planning and reproductive health programs should be strengthened to at this early stage to control the rate of increase in its population.

Table 3 - 59. Distribution of Population by Age Group by Sitio

Age Group	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Under 1	25	2	28	11	9	13	62
1-4	132	8	31	12	7	12	170
5-9	215	15	20	8	10	14	245
10-14	180	12	33	12	8	12	221
15-19	162	11	39	15	5	7	206
20-24	146	10	21	8	9	13	176
25-29	138	9	18	7	3	5	159
30-34	104	7	16	6	3	5	123
35-39	75	5	17	6	1	1.5	93
40-44	75	5	14	5	4	6	93
45-49	63	4	11	4	5	7	79
50-54	48	3	7	3	-	-	55

Age Group	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
55-59	67	5	-	-	1	1.5	68
60-64	22	2	3	1	-	-	25
65-69	4	-	1	0.5	1	1.5	6
70-74	10	1	2	0.5	1	1.5	13
75-79	5	0.5	-	-	-	-	5
80 & over	5	0.5	-	-	-	-	5
Total	**1,476**	**100**	**261**	**100**	**67**	**100**	**1,804**

On the other hand, this population belonging to the productive age group indicates a potential for higher workforce that might contribute to the manpower requirement of the proposed project, however, with much consideration on the skills training and upgrading to qualify the general populace.

Age Dependency Ratio

Age dependency ratio indicates the extent to which those who are too young or too old to earn a living depend for support on those who work. As shown in **Table 3-60** Sitio Agusuhin has a medium level dependency ratio of 64%. Meaning, for every one-hundred (100) productive individuals, there are around 64 dependents. The same is true with Sitio Nagyantok, with 79 % dependency ratio.

Table 3 - 60. Distribution of Population by Age Composition by Sitio

Age Group	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Child & Youth (1-14)	552	37	112	43	34	51	700
Productive Population (15-64)	900	61	146	56	31	46	1,077
Dependent Population (65 and above)	24	2	3	1	2	3	27
Total	**1,476**	**100**	**261**	**100**	**67**	**100**	**1,804**

However, Sitio Nagtulong indicates the highest (116 %) total dependency ratio because of its high number of dependent population (child & youth and old). Thus, it might indicate high number of child labor cases or those working at a younger age in this area.

Sex Distribution / Sex Ratio

The population in the three sitios indicates a very slight predominance of males than females with 112 % ratio (**Table 3-61**). It means that there are 112 males for every 100 females.

Table 3 - 61. Distribution of Population b y Sex by Sitio

Sitio	Male	Female	Frequency
Agusuhin	787	689	1,476

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Sitio	Male	Female	Frequency
Nagyantok	141	120	261
Nagtulong	31	36	67
Total	**959**	**845**	**1,804**
Percentage (%)	**53**	**47**	**100**

Migration Pattern

Survey result shows that only 25 of the respondents are original settlers of the three sitios while the large portion (94 %) is composed of migrants (**Table 3-62**). The perception survey conducted by this study asked about the place of birth of respondents, out of the total number of respondents in Sitios Nagyantok (50 respondents) and Nagtulong (12 respondents), all of them were not born in their present places of residence.

Table 3 - 62. Migration Pattern of Respondents by Sitio

Migration Pattern/ Sitio	Original	%	Migrants	%	Frequency
Agusuhin	25	7	330	93	355
Nagyantok	-	-	50	100	50
Nagtulong	-	-	12	100	12
Total	**25**	**6**	**392**	**94**	**417**

In Sitio Agusuhin, 93% are migrants (**Table 3-63**) while almost all of the residents in Sitio Nagyantok and Nagtulong are migrants.

Table 3 - 63. Migration Pattern of Respondents in Sitio Agusuhin by Cluster

Clusters	Original Settlers	Migrants	Frequency
Cluster 1	7	33	40
Cluster 2	2	20	22
Cluster 3	-	13	13
Cluster 4	-	18	18
Cluster 5	-	13	13
Cluster 6	-	17	17
Cluster 7	3	10	13
Cluster 8	3	16	19
Cluster 9	2	22	24
Cluster 10	-	28	28
Cluster 11	1	22	23
Cluster 12	-	21	21
Cluster 13	-	33	33
Cluster 14	2	36	38
Cluster 15	5	28	33
Total	**25**	**330**	**355**
Percentage (%)	**7**	**93**	**100**

In addition, most (40 %) of the respondents have lived in the area for about 30 to 40 years, the time when the US Naval Base was operating in Subic Bay area and used the Redondo Peninsula as their training ground (**Table 3-64**).

Migration has become more prevalent in these areas even after the withdrawal of the US Naval Base as it was converted as an Economic Freeport Zone managed by the SBMA. Light to heavy industries were established within SBMA property area, which include Agusuhin, and part of Nagyantok and Nagtulong.

Table 3 - 64. Years of Stay of Respondents by Sitio

Years	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Less than 1	-	-	-	-	-	-	-
1-2	2	-	-	-	-	-	2
3-4	13	4	-	-	-	-	13
5-6	36	10	-	-	-	-	36
7-8	17	5	10	20	-	-	27
9-10	11	3	4	8	-	-	15
11-12	7	2	1	2	-	-	8
13-14	20	6	2	4	-	-	22
15-16	18	5	9	18	-	-	27
17-18	27	8	2	4	-	-	29
19-20	25	7	8	16	-	-	33
21-30	77	22	10	20	4	33	91
31-40	76	21	1	2	8	67	85
41 & above	26	7	3	6	-	-	29
Total	**355**	**100**	**50**	**100**	**12**	**100**	**417**

The results of the survey however on the number of years stay of the respondents are not accurate. There was an increase of 83 households from July 15 to third week of September 2005. It is surmised that the sudden increase of migrants is in anticipation of the compensation that the old residents may receive from the proponent and/or SBMA.

Because of these developments, the residents were encourages to establish their homes in these Sitios. **Table 3-65** showed that most of the migrants came from within the vicinity of Barangay Cawag (30 %) and within Subic Municipality (27 %). This is because they were more accessible to the area that they can easily put-up their home upon knowing that a certain project will be developed in the area.

The same is true with sitios Nagyantok and Nagtulong, though they were really not the center of the development projects, but their proximity somehow provides them with access. It shows that 32 % and 17 % came from within Barangay Cawag while 28 % and 58 % from within the Subic Municipality, respectively.

Table 3 -65. Place of Origin of Migrant Respondents by Sitio

Place	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Same Barangay	98	30	16	32	2	17	116
Same Municipality	90	27	14	28	7	58	111

Place	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Other Municipality/ Same Province	85	26	10	20	1	8	96
Other Province	57	17	10	20	2	17	69
Foreign Country	-	-	-	-	-	-	-
Total	**330**	**100**	**50**	**100**	**12**	**100**	**392**

Being adjacent to the area of development in SBMA means several opportunities primarily on employment, businesses, compensations, etc. It therefore attracted the residents to settle in these sitios such as large portion of the respondents reasoned on employment (34%), while others bought property rights (land) from other settlers in the area (25%), even the fact that they knew that it is legally a property of SBMA (**Table 3-66**).

Table 3 -66. Reasons for Migration of Migrant Respondents by Sitio

Reasons	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
Employment	85	26	45	90	2	17	132
Property	90	27	-	-	10	83	100
Relatives	98	30	-	-	-	-	98
Marriage	29	9	-	-	-	-	29
Others	5	1	-	-	-	-	5
No Answer	23	7	5	10	-	-	28
Total	**330**	**100**	**50**	**100**	**12**	**100**	**392**

Marital Status of the Population

Table 3-67 shows that majority of the residents are single (58 %) while 36 % are married. It can be inferred that these sitios will continuously increase in the population because its large population is married and has a potential for reproduction. However, a much larger population of single group will soon to be the married population in the near future. Therefore a family planning program and reproductive health should be considered in these sitios.

Table 3 -67. Marital Status of the Population by Sitio

Status	*Agusuhin*	*%*	*Nagyantok*	*%*	*Nagtulong*	*%*	Frequency
Single	246	57	183	70	23	34	1,052
Married	563	38	69	26	21	31	653
Widow / Widower	54	4	9	4	23	35	86
Separated	13	1	-	-	-	-	13
Total	**1,476**	**100**	**261**	**100**	**67**	**100**	**1,804**

Educational Attainment

Majority of the educational attainment of the residents of the three sitios (**Tabel 3-68**) reached Elementary Graduate (23 %) while High School Graduate reached 16 % and High School Undergraduate also at 16 %.

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Table 3 -68. Educational Attainment of the Population by Sitio

Educational Level	Agusuhin	%	Nagyantok	%	Nagtulong	%	Frequency
College Graduate	49	3	14	5	3	5	66
College Undergraduate	183	12	35	13	14	21	232
High School Graduate	215	15	70	27	4	6	289
High School Undergraduate	271	18	9	3	6	9	286
Elementary Graduate	331	22	67	26	18	27	416
Elementary Undergraduate	193	13	8	3	4	6	205
Vocational	78	5	1	1	1	1	80
None	156	12	57	22	17	25	230
Total	**1,476**	**100**	**261**	**100**	**67**	**100**	**1,804**

This result implies that there is a lower educational attainment in these areas because of its remoteness from the nearest high school at Subic town proper. It was just recently that a high school building constructed by PSFI that the residents of now attend formal high school level.

The Sitio Agusuhin Elementary School is composed of 6 rooms with 177 students, meaning, there is around 30 students in a room. It also has 1 teacher for every grade level and was accommodated in its 2-room Teacher's Quarters constructed by PSFI. A school playground facility was also provided by PSFI for the students.

The Sitio Agusuhin High School is composed of 4 complete rooms and 3 additional rooms (still under construction). It has 7 teachers with around 200 students from Agusuhin and nearby sitios attending classes. A 2-room Teacher's Quarters were also constructed by PSFI.

A Day Care Center, which was initiated by PSFI in November 2000, was continued by the DSWD and a Day Care Worker presently teaches 36 pre-school age children.

Common Causes of Morbidity from 2004 to Present

Common causes of diseases/ morbidity vary from the different cases, which can be traced from the different external factors present in the sitios especially the environment. The prevalence of coughs and colds being the top cause of morbidity can be rooted from the existing temperature in the area, since it is along the coastline (**Table 3-69**). Allergic rhinitis and Sore Eyes may possibly due to changes in weather and/or the pollens of various fruit-bearing trees in the area such as mango, guyabano, guava, jackfruit, etc. (Socio-Economic Survey of Redondo Peninsula, SBMA, 2005). Conjunctivitis, moreover, is oftentimes viral which may also be brought to contact to others. Diarrhea/ Amoebiasis may be attributed to unhygienic food handling or the untreated/contaminated drinking water from the pitcher pumps, deep wells, and spring water due to unsanitary methods of waste disposal. Other cases such as malaria and

dengue fever became alarming to residents, but the government and Shell responded immediately that isolated these diseases.

Table 3 -69. Causes of Morbidity from 2004 to Present by Sitio

Causes	Agusuhin	Nagyantok	Nagtulong	Frequency
Conjunctivitis	19	-	1	20
Allergic Rhinitis	40	-	-	40
Otitis media / externa	5	-	-	5
Skin rashes / allergy	9	1	-	10
Nasal Disorder	10	-	-	10
Tonsillo / Pharyngitis	7	2	-	9
Acute Respiratory Infection	998	98	45	1,141
Pneumonia	5	-	-	5
Bronchial Asthma	3	1	-	4
Chronic Bronchitis/ Emphysema	1	2	-	3
Tuberculosis	3	-	-	3
Cardio-Vascular Diseases	1	-	-	1
Hypertension	5	-	-	5
Stroke/ Cerebro-vascular Accident	18	-	-	18
Numbness/ Tingling sensation	3	-	-	3
Seizure/ Convulsion	5	1	-	6
Accidents	-	2	-	2
Joint/ Muscle Pains	7	-	6	13
Anemia/ Pallor	11	1	-	12
Oral Lesion/ Discoloration	7	-	-	7
Gingivitis/ Carious Teeth	3	-	-	3
Skin Disease	5	2	-	7
Diarrhea/ Amebiasis	22	1	-	23
Typhoid Fever	9	-	1	10
Ascariasis/ Parasitism	10	-	-	10
Gastritis/ Ulcer	-	-	-	-
Hepatitis (A,B,C virus)	-	-	-	-
Hepatitis (Alcoholic)	-	-	-	-
Cirrhosis (Liver)	-	-	-	-
Kidney Disease	9	-	-	9
UTI	9	-	-	9
Influenza (Flu)	12	-	-	12
Malaria	8	-	-	8
Dengue Fever	15	-	-	15
Measles	6	-	-	6
Chicken Pox	11	1	-	12

Causes	Agusuhin	Nagyantok	Nagtulong	Frequency
Others	5	1	-	6
Total	**1,281**	**113**	**53**	**1,447**

Leading causes of mortality include stroke/cerebro-vascular accident and dengue fever, which are alarming since there are already 18 & 15 cases, respectively. Preventive programs should be done to avoid an epidemic in the future.

Causes of Morbidity by Occurrence to Age Group in 3 Sitios

When the respondents were asked of the causes of morbidity identified and experienced by their household members, Acute Respiratory Infection was the most frequently mentioned sickness with 150 cases (**Table 3-70**). These cases occur mostly on ages 30-34 and mostly in line with fishing activities. Diarrhea (52 cases) and Flu (50 cases) were mentioned next, which are prevalent to ages 1-4. Other cases include lung diseases, UTI, malaria, allergy, stroke, oral lesions, and toothache, which are mostly isolated. Most of the respondents have not identified any of the diseases experienced by their household members.

Table 3 -70. Ten Leading Causes of Morbidity of the Population from 2004 to Present by Age Group

Diseases/ Morbidity / Age Group	Ten Leading Causes of Morbidity / Diseases from 2004 to Present									
	Acute Resp	Diarrhea	Flu	Lung Disease	UTI	Malaria	Allergy	Stroke	Oral Lesion	Tooth ache
Under 1	1									
1-4	16	15	15	8	1	1	2			
5-9	8	5	6	1	1		1			
10-14	8	5	3	3	1				1	
15-19	18	5	3	1	2					
20-24	6	5	2	3	4	5				
25-29	8	3	3	4	1					
30-34	50	4	4	1	9	1	3			1
35-39	6	4	5	2	1					
40-44	4	2	4	4	2					
45-49	3	1	2		1					
50-54	2	1	1		1			1		
55-59	18	1	1		1			2		
60-64	2	1	1		1		1	1		
65-69								1		
70-74										
75-79										
80 & over										
Total	**150**	**52**	**50**	**27**	**26**	**7**	**7**	**5**	**1**	**1**

Health Resources and Services

A Health Center was constructed by Shell in Sitio Agusuhin in year 2000 and trained 9 health workers and 1 microscopist to attend to the health needs of the residents and provide assistance during medical missions, vector control projects, and nutrition

programs (PSFI CGS Comparative Report, 1998-2001). But beginning January 2001, the clinic operation was stopped because the Subic-LGU's commitment to continue services did not materialize. The barangay health workers and microscopist provide services on voluntary capacity.

Medical/Health Units Commonly Seek

Because of the mentioned situation, most of the respondents (161) go to the Municipality of Subic to seek medical assistance and avail free medicines (**Tabel 3-71**). Other respondents (154) commonly go to the Barangay Cawag Health Center also for check-ups and free medicines but its services are not regularly provided to the residents.

Only few availed medical consultation to Hospitals in Subic (34 respondents) or private clinics (48 respondents) such as Monte Falcon due to high expenses that some resort to own-treatment using over-the-counter medicines and to *quack doctors*.

Table 3 -71. Medical / Health Units Commonly Seek by Respondents by Sitio

Medical / Health Units	Agusuhin	Nagyantok	Nagtulong	Frequency
Barangay Health Unit	126	26	2	154
Municipal Health Unit	112	23	26	161
Private Clinic	26	9	13	48
Hospital	13	11	10	34
Others	9	6	5	20
No Answer	69	-	-	69
Total	**355**	**75**	**56**	**486**

Personnel Providing Health/ Medical Services

Medical personnel providing services to the residents are commonly doctors, weather in government or private hospitals/ clinics, or during medical missions conducted in their area. The health workers, are the extension of the Municipal Health Office to the community, were also mentioned by the respondents providing health care services (**Table 3-72**).

Table 3 -72. Personnel Commonly Provide Health / Medical Services to Respondents by Sitio

Personnel	Agusuhin	Nagyantok	Nagtulong	Frequency
Doctor	95	101	30	226
Nurse	22	35	19	76
Midwife	6	-	-	6
Health Worker	63	37	23	123
Others	4	6	-	10
No Answer	165	-	-	165
Total	**355**	**179**	**72**	**606**

Medicines Regularly Taken by the Respondents

A variety of medicines are commonly taken by the respondents include paracetamol (325 respondents), an over-the-counter medicine for fever or flu, which are considered safe and no side effects. Antibiotic (99 respondents), on the other hand, was also taken usually by the respondents to cure upper respiratory infection and other related diseases, which is also prevalent in the area. However, if taken without a doctor's prescription at an improper amount or dosage might worsen the disease (**Table 3-73**).

Table 3 -73. Medicines Regularly Taken by the Population by Sitio

Kinds	Agusuhin	Nagyantok	Nagtulong	Frequency
Paracetamol	118	168	39	325
Analgesic	29	13	35	67
Pain Reliever	36	29	11	76
Antibiotic	66	17	16	99
Carbocistein	7	7	3	17
None	99	-	-	-
Total	**355**	**234**	**94**	**584**

Health Units/Stores Where Medicines are Commonly Given / Bought

Medicines are commonly availed by the respondents to different health units, either for free or bought. Most of them avail free medicines at the Subic Municipal Health Unit (243 respondents) or the Barangay Cawag Health Center (100 respondents) while others buy medicines at the Pharmacy Stores in Subic (154 respondents) or at a variety store within their Sitio (100 respondents) **Table 3-74**.

Table 3 -74. Health Units/Stores Where Medicines are Commonly Given to or Bought by Respondents by Sitio

Health Units / Stores	Agusuhin	Nagyantok	Nagtulong	Frequency
Pharmacy	50	71	33	154
Variety Store	66	23	11	100
Barangay Health Unit	45	63	21	129
Municipal Health Unit	112	110	21	243
Hospital	5	7	-	12
Others	-	-	-	-
No answer	77	-	-	77
Total	**355**	**274**	**86**	**715**

Medical / Health Care Services Provided by Agencies

Medicines are hardly accessible to residents of Sitio Agusuhin, Nagyantok, and Nagtulong that most of them have to travel a long way (by sea) to the Subic Town Proper to buy or avail free medicines. Medicines at variety stores in their area are limited and quite expensive.

These are the reasons why different government and private agencies provide medical missions (**Table 3-75**) to respond to the health needs of the residents of these Sitios.

Table 3 -75. Medical/ Health Care Projects Provided by Government and Private Agencies by Sitio

Agencies	Projects	Agusuhin	Nagyantok	Nagtulong	Frequency
Government:					
Mitos Magsaysay	Medical Mission	150	-	10	160
Mayor Khonghun	Medical/ Dental	30	1	-	31
Dr. Montefalcon	Medical Mission	10	-	-	10
Dr. Afable	Medical Mission	29	16	-	45
Dr. Vitug	Medical Mission	10	1	-	11
Dr. Dolly	Medical Mission	-	2	-	2
Private:					
Rey Langit Found.	Medical Mission	155	-	2	157
Korean Team	Medical Mission	22	-	-	22
No answer			30	-	30
Total		**406**	**50**	**12**	**468**

Most of the residents mentioned Governor Mitos Magsaysay (160 respondents) and Rey Langit Foundation (157 respondents) who provided them with Medical Missions, while others include Mayor Jeffrey Khonghun (31) and a certain Dr. Afable (45), which also provided Medical or Dental Missions.

Method of Garbage Disposal

The residents of the three sitios use different methods of waste/ garbage disposal. Most of them burn their garbage (290 respondents) together with composting/burying (**Table 3-76**). Waste management is critical in the area, which might pollute the sea (as a livelihood resources for large number of fishermen in the area) and its river streams (where some residents utilized this as source of domestic water) if disposed improperly. Burning of garbage is already prohibited by the government, which can cause health hazards and air pollution.

Table 3 -76. Method of Garbage Disposal of Respondents by Sitio

Methods	Agusuhin	Nagyantok	Nagtulong	Frequency
Burning	248	39	3	290
Composting / Burying	229	42	9	280
Collection	17	-	-	17
Dumping	8	-	-	8
Total	**502**	**81**	**12**	**595**

Type of Toilet Facilities

Most of the residents from Agusuhin, Nagyantok, and Nagtulong already own a decent toilet facility which is water-sealed (46 %) or flush type (7 %). Others share to a

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communal or public toilet (11 %). However, 36 % of the residents are still using other methods such as the antipolo type or thru open pit which might contaminate the ground water or the river streams where they get their domestic water (**Table 3-77**).

Table 3 -77. Type of Toilet Facilities of Owned by Households by Sitio

Type	Agusuhin	Nagyantok	Nagtulong	Frequency
Water Sealed	163	24	4	191
Flush	28	1	1	30
Antipolo Type	96	5	4	105
Public Toilet	40	1	3	44
Others	28	19	-	47
Total	**355**	**50**	**12**	**417**

Social Organizations

Several socio-civic organizations were established in Sitio Agusuhin and mostly initiated by Shell as part of their Social Development Program with concerns on livelihood, health, social, and environmental (**Table 3-78**).

The umbrella organization in Sitio Agusuhin, called the Agusuhin Neighborhood Association or ANA is composed of 246 families subdivided into 15 clusters. A Cluster Leader is assigned for each cluster group to facilitate social projects in their respective area. This association attended various seminars sponsored by PSFI such as Team Building, VMG, Leadership, etc. It has also legally registered its association to the Securities and Exchange Commission (SEC).

ANA is also structured into different sub-groups based on the needs and concerns of the members. These sub-groups include the SMMA, ACRA, Micro-Lending, and Consumer Cooperative.

The Samahan ng Magsasaka at Mangingisda or SMMA, a group of farmers & fishermen, is composed of 42 members from different clusters in Agusuhin. Based on the report of PSFI (year 2001), the group was provided with fund to develop a 3.5-hectare aquaculture pond where they reared more than 220,000 bangus fry. Each member received PhP 5,000 as their share for the revenue generated from the project. After the project, the group no longer reared another round of bangus culture, but they utilize the pond on their own using net fences.

Agusuhin Community Reforestation Association or ACRA is a community organization served as beneficiaries and stewards of the Community-Based Forest Management Project of Shell, SBMA, and ACDCI implemented in year 2000. A 100-ha land, planted with mangoes, eucalyptus, and other cash crops, was subdivided into 40 parcels (2.5 ha each) and distributed to ACRA members. Real benefits from the trees will be realized after 5 to 7 years.

Table 3 - 78. Local Organizations in Sitio Agusuhin vs. Programs/ Projects

Organizations	Members	Projects
Samahan ng Magsasaka at Mangingisda	42	Aqua Culture
Agusuhin Neighborhood	147	Livelihood, Health, Social Projects

Association		
Agusuhin Community Reforestation Association	40	Reforestation
Agusuhin Community Coop	15	Consumer store, Micro-Lending

Source: Pilipinas Shell Foundation, Inc., 2001

Agusuhin Community Cooperative or ACC, is composed of 15 members, organized and funded by Shell to put-up a consumer store to cater to the needs of the CGS workers. Though there is no exact figure on the amount of fund granted to ACC, but PSFI report (2001) showed that it has generated an approximately PhP 295,000 income after 1 year of operation. Each member received PhP 7,000 as dividends while the remaining income was allocated for other businesses. These members were also provided with loans averaging to PhP 10,000 each to start livelihood projects such as poultry, variety store, and backyard fishpond. At least 52 % of these are still on-going and remains profitable.

Sitio Agusuhin Community Development Program

Table 3-79 shows some of the vital projects implemented by Pilipinas Shell Foundation, Inc. from 1998 to 2002 as part of the Sitio Agusuhin Community Assistance Program. This Program is in compliance with the Malampaya CGS Alliance's ECC.

Table 3 -79. Community Development Projects Implemented by Shell in Sitio Agusuhin

Project	Year Implemented	Beneficiaries
Employment	1998	167 Individuals
Micro-Lending	1998	58 Individuals
Community-Based Forest Management Project	1999	40 Farmers
Consumer Cooperative Store	1999	15 Members
Aqua-Culture Dev't. Project	2000	40 Fishermen
Organizational Management Training	1999	5 community associations, 1 cooperative
Scholarship	1999	90 OSY
Sanayan sa Kakayahang Pangangalakal	1999	58 Individuals
High School Building	2000	168 Students
Elementary School Building	2000	177 Student
Elementary School Playground	2000	177 Students
Teacher's Quarters	2000	10 Teachers
Community Center	2000	162 households
Health Clinic	2000	162 households
Medical Missions	1999-2000	162 households
Nutrition Program	2000	962 children
Flood Control Project	2002	162 households
Vector Control (Defogging)	2001	162 households
Health Worker's Training	2000	9 CHW
Day Care Center	November 2000	36 pre-school children

Source: Comparative Socio-Economic Profile prior to phases of CGS construction (November 2001) Pilipinas Shell Foundation, Inc., PSFI@20 brochure (2002)

Community Problems and Needs

On the recent survey conducted by SBMA Ecology Center last June 2005 on 477 households in Agusuhin and Nagyantok, it shows that no electrical/ power connection (24%) is their main problem while other problems include permanent job (19%), lack of medicines and doctors for their health concerns (**Table 3-80**).

Table 3 -80. Community Problems and Needs in Sitio Agusuhin and Nagyantok

Problems	Agusuhin	Nagyantok	Nagtulong	Frequency
Electricity	136	135	-	271
Road (mode of transpo)	87	64	-	151
Potable Water	75	52	-	127
Permanent Job	146	61	-	207
Medicines / Doctor	95	101	-	196
Livelihood Projects	9	0	-	9
New Projects	1	0	-	1
Others (education, neighbors, typhoon, sanitation)	26	70	-	96
N/A	32	17	-	49
Total	**607**	**500**	**-**	**1,107**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

Monthly Household Income of Respondents

Out of 477 households surveyed by SBMA (June 2005), majority of the monthly income of the respondents in Sitio Agusuhin and Nagyantok ranges from PhP 5,000 to 9,999 (30%) while 24% received a monthly income of PhP 1,000 to 4,999 (**Table 3-81**).

Table 3 -81. Monthly Household Income of Respondents in Sitio Agusuhin and Nagyantok

Monthly Income (PhP)	Agusuhin	Nagyantok	Nagtulong	Frequency
Less than 1,000	2	0	-	2
1,000 – 4,999	75	42	-	117
5,000 – 9,999	76	65	-	141
10,000 – 14,999	35	38	-	73
15,000 – 20,000	24	20	-	44
More than 20,000	11	20	-	31
No Answer	49	20	-	69
Total	**272**	**205**	**-**	**477**

Results show that majority of its residents are receiving a minimum salary or wage where most of them are engaged into blue collar jobs (i.e. construction worker, laborer, carpenter, services, etc.) which they learned during the construction of the CGS in their area. Those engaged in the fishing activities receive minimal income due to the seasonality of fish catch along Subic Bay waters.

Occupation of the Population / Main Sources of Income

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Table 3-82 shows that 14 % of the population is engaged in blue collar jobs while 13 % is engaged in fishing activities (both in municipal and brackish water). Twelve percent of the population (12 %) landed to white-collar jobs in SBMA, Subic, and other area. Majority of the working population belongs to the productive age group while most of the younger population is either studying or not working.

Businesses owned by some residents (6 %) include fishpond, variety stores, boat rentals, bakery, charcoal manufacturing, etc.

Table 3 -82 Main Sources of Income of the Population by Sitio

Occupation	Agusuhin	Nagyantok	Nagtulong	Frequency
None	411	60	23	494
Student	351	60	14	425
Farming	75	13	1	89
Fishing	153	63	13	229
Blue Collar Job (construction worker, laborer, carpenter, services, etc.)	214	22	8	244
White Collar Job (professionals, teachers, employees, etc.)	189	15	5	209
Own Business	83	28	3	114
Total	**1,476**	**261**	**67**	**1,804**

Occupied Housing Units by Type of Building

Of the 417 household population surveyed, 153 or 37 % are occupying single detached type of housing unit. Only 14 % of the respondents have two-storey housing unit while 14 % of the inhabitants dwell in a multi-residential building, such as apartment type (**Table 3-83**). The large number of single detached housing indicates that the sitios are not dense and there are still areas for the construction of houses.

Table 3 -83. Occupied Housing Units by Type of Building by Sitio

Type	Agusuhin	Nagyantok	Nagtulong	Frequency
Single	118	32	3	153
Duplex	70	4	3	77
Apartment	55	3	2	60
Two-Storey	48	6	3	57
Others	64	5	1	70
Total	**355**	**50**	**12**	**417**

Occupied Housing Units by Construction Materials

There are different construction materials used for building houses in the sitios (**Table 3-84**). From the survey conducted, 26 % of the respondents used cogon/bamboo for the outer wall and roof materials. These materials are readily available in the community, cheaper and easier to transport compared to concrete/brick/ stone. Some used wood (27 %) for their outer wall and galvanized iron (5 %) for the roof materials. A small

fraction (5 %) used makeshift or improvised materials such as the plastic matting boards left by SPEX after the CGS construction.

Table 3 -84. Occupied Housing Units by Type of Construction Materials on Roofing and Walls by Sitio

Materials	Agusuhin	Nagyantok	Nagtulong	Frequency
Cogon / Bamboo	92	14	3	109
Wood	95	12	44	111
Concrete	60	10	-	70
Wood and Concrete	70	11	1	82
Galvanized Iron	18	2	-	20
Makeshift/ Improvised	18	1	-	19
Others	2	-	4	6
Total	**355**	**50**	**12**	**417**

Occupied Housing Units by Floor Area

On the survey conducted by SBMA (June 2005) on the sizes of dwelling units by floor area, it showed that 34 % of the respondents occupied 21 to 50 square meters while 0.2% occupied spacious units (1,001 square meters and above) (**Table 3-85**).

Table 3 - 85. Occupied Housing Units by Floor Area in Sitio Agusuhin and Nagyantok

Floor Area (sq m)	Agusuhin	Nagyantok	Nagtulong	Frequency
Less than 10-20	49	28	-	77
21-50	87	73	-	160
51-80	38	33	-	71
21-100	9	10	-	19
101-150	20	12	-	32
151-200	11	8	-	19
201-300	17	8	-	25
301-400	8	5	-	13
401-500	6	5	-	11
501-600	5	2	-	7
601-700	3	1	-	4
701-1,000	3	0	-	3
1,001-above	3	0	-	3
Under construction	4	0	-	4
No Answer	9	20	-	29
Total	**272**	**205**	**-**	**477**

Tenure Status of the Housing Units

Of the 417 respondents, majority (52 %) own both the housing unit and lot where their housing unit is erected. Although these are legally SBMA property area, some purchased the "rights" on the property from previous settlers while others treat the

property as their own. Forty-two percent of the respondents own only the housing unit and recognized that the land is a property of SBMA. Some owners (3 %) built their houses in the area but did not occupy the units. Instead, they hired caretakers to maintain the unit (**Table 3-86**).

Table 3 - 86. Owner-Household in Occupied Housing Unit by Tenure Status of Lot by Sitio

Tenure of Status	Agusuhin	Nagyantok	Nagtulong	Frequency
Owned (house & lot)	205	2	8	215
Owned (house only)	128	43	4	175
Rented	13	1	-	14
Being Occupied for Free with Consent of Owner	9	4	-	13
Being Occupied for Free without Consent of Owner	-	-	-	-
Total	**355**	**50**	**12**	**417**

Main Sources of Drinking Water

Sources of drinking water are critical for survival of the residents living in a coastal community like Sitio Agusuhin, Nagyantok, and Nagtulong.

Table 3-87 shows that of the total of 417 households, respondents used difference sources for drinking water. There were 265 respondents who usually accessed their water from pitcher pumps while 122 source their water from springs.

Result shows that potable water supply is one of the problems in the sitios that most of its water sources are untreated and may be prone to contamination if wastes are disposed improperly.

Table 3 -87. Main Source of Drinking Water by Type of Ownership by Sitio

Source	Agusuhin	Nagyantok	Nagtulong	Frequency
Waterworks System	8	-	-	8
Dug Well	25	23	1	49
Pitcher Pump	215	48	2	265
Private Pump	34	-	1	35
Spring Water	103	16	3	122
River	20	-	-	20
Rainwater	16	-	4	20
Others	4	12	-	16
Total	**425**	**99**	**11**	**535**

The pitcher pumps, as main source of drinking water in the sitios, are usually owned by majority of the residents (69 %) (**Table 3-88**). However, the owners share the pumps to their neighbors in the Sitio. Common depth of the pipes/ tubes for the pump is less than 20 feet (**Table 3-89**). PSFI also constructed about 2-3 communal pitcher pumps for the Sitio Agusuhin.

Table 3 -88. Ownership of the Source of Drinking Water

Ownership	Agusuhin	Nagyantok	Nagtulong	Frequency
Owned	253	26	9	288
Not Owned	102	24	3	129
Total	**355**	**50**	**12**	**417**

Table 3 -89. Common Depth of Pitcher Pump or Deep/ Dug Wells by Sitio

Depth (ft.)	Frequency
Less than 20	85
21-30	39
No answer	164
Total	**288**

Domestic Usage of Water

Respondents used the water sources in various ways (**Table 3-90**). Majority used these for cleaning, cooking and for drinking. It can be inferred that the residents are generally dependent on groundwater and spring water as their vital source of water for daily needs. Therefore, these water sources and its reservoirs should be protected to avoid contaminants that may cause a spread of waterborne diseases. This can be done through proper waste management and monitoring of septic tanks of the toilet facilities for each household.

Table 3 -90. Domestic Usage of Water by Sitio

Usage	Agusuhin	Nagyantok	Nagtulong	Frequency
Drinking	293	48	12	353
Cleaning, Bathing, Laundry, etc.	302	50	12	364
Cooking	297	49	12	358
Others	27	1	2	30
Total	**919**	**148**	**38**	**1,105**

Fuel Used for Lighting

Because of the lack of electrical power lines in the three sitios, the respondents use different kinds of fuel for lighting purposes. Majority used kerosene/gas (191 respondents) to light lamps in their houses or during fishing activities (**Table 3-91**). Others used generators as a source of electricity (118 respondents) while some used candles (98 respondents). However, any of these fuels can be dangerous that might create house fires resulting to loss of properties. Thus, the community should also be trained on fire prevention, safety, and disaster management.

Table 3 -91. Fuel Used for Lighting by Sitio

Fuel for Lighting	Agusuhin	Nagyantok	Nagtulong	Frequency
Candle	87	6	5	98

Fuel for Lighting	Agusuhin	Nagyantok	Nagtulong	Frequency
Electricity / Generator	100	13	5	118
Kerosene / Gas	166	20	5	191
Others	38	11	4	53
Total	**391**	**50**	**19**	**460**

Fuel Used for Cooking

Table 3-92 shows that respondents use different kind of fuel for cooking purposes. Majority used firewood/ charcoal (201 respondent), which is readily available and cheap source of fuel in the community. Others used LPG (109 respondents) purchased at the town proper of Subic.

Table 3 -92. Fuel Used for Cooking By Sitio

Fuel Used for Cooking	Agusuhin	Nagyantok	Nagtulong	Frequency
Firewood/ Charcoal	176	20	5	201
LPG	89	15	5	109
Electric Stove	60	6	3	69
Kerosene	40	6	4	50
Others	27	3	4	34
Total	**392**	**50**	**21**	**463**

Land Properties

On a survey conducted by SBMA on 477 households last June 2005, it showed that 9 % of the respondents owned 2 to 3 parcels of land aside from the land where their housing unit was erected (**Table 3-93**). These land parcels were located at the adjacent Mt. Redondo, Mt. Maybe and within the vacant lots inside their sitios (**Table 3-94**).

Table 3 -93. Parcels of Land Owned by the Respondents in Sitios Agusuhin and Nagyantok

Land Parcel	Agusuhin	Nagyantok	Nagtulong	Frequency
1	234	196	-	430
2	17	8	-	25
3 or more	16	1	-	17
NA	5	6	-	11
Total	**272**	**205**	**-**	**477**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

Tabl e 3 -94. Location of the Land Parcels of Land Owned by the Respondents in Sitio Agusuhin and Nagyantok

Land Parcel	Agusuhin	Nagyantok	Nagtulong	Frequency
Near the River	14	6	-	20
Mt. Redondo (east, west,& north)	31	18	-	49

Land Parcel	Agusuhin	Nagyantok	Nagtulong	Frequency
Bukid (near HS)	13	0	-	13
Inside the Sitio	245	188	-	433
Total	**303**	**212**	**-**	**515**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

These other land parcels owned by some respondents are commonly allocated for farming (rice & vegetables), orchard, grazing area, reforestation, fishpond, and beaches/ resort (**Table 3-95**).

Table 3 - 95. Common Use of Land in Sitio Agusuhin and Nagyantok

Use	Agusuhin	Nagyantok	Nagtulong	Frequency
Farm (rice, vegetable, orchard, grazing area)	88	26	-	114
Reforestation	40	0	-	40
Fishpond	4	0	-	4
Residential	167	111	-	279
Beach	4	75	-	79
Total	**303**	**212**	**-**	**515**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

Trees Planted and Animals Raised

Sitio Agusuhin and Nagyantok are rich in agro-forest trees and fruit-bearing cash crops (**Table 3-96**). On the survey conducted by SBMA (June 2005) on 477 respondents, it showed that 23 % have planted mangoes, 10 % cashew, and 18 % other fruit-bearing and forest trees such as guyabano, guava, jackfruit, eucalyptus and mahogany.

Table 3 -96. Inventory of Trees Planted by the Respondents in Sitio Agusuhin and Nagyantok

Kind of Trees	Agusuhin	Nagyantok	Nagtulong	Frequency
Mango	5864	1374	-	7238
Cashew	1411	1197	-	2608
Santol	15	180	-	355
Duhat	114	127	-	241
Eucalyptus	8350	858	-	9208
Mahogany	186	57	-	243
Jackfruit	336	232	-	568
Banana	1547	450	-	1997
Guava	229	133	-	362
Coconut	501	208	-	709
Pine Tree	531	77	-	608
Talisay	41	0	-	41
Ipil-Ipil	1240	0	-	1240
Avocado	8	0	-	8
Narra	5	0	-	5

Kind of Trees	Agusuhin	Nagyantok	Nagtulong	Frequency
Sampalok	15	0	-	15
Atis	15	0	-	15
Kalamansi	41	0	-	41
Bamboo	47	0	-	47
Others	1400	645	-	2045
Total	**22056**	**5538**	**-**	**27594**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

Approximately 7,238 mangoes, 9,208 eucalyptuses, 2,608 cashew and 2,045 other fruit bearing trees have been planted in their backyard and other reforestation area.

Livestock animals are also being raised by the respondents, as per SBMA Survey (June 2005) (**Table 3-97**). It showed that approximately 2,303 chickens and 242 goats are raised while others include swine, cattle and carabaos.

Table 3 -97. Inventory of Animals Raised by the Respondents in Sitio Agusuhin and Nagyantok

Kind of Animal	Agusuhin	Nagyantok	Nagtulong	Frequency
Cattle	24	0	-	24
Goat	238	6	-	242
Swine	30	33	-	63
Carabao	18	0	-	18
Chicken	1524	779	-	2303
Others	257	162	-	419
Total	**2089**	**980**	**-**	**3069**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

3.3.19.4 Stakeholders' Perception Towards the Project

Perception on Development Projects

In the survey conducted by SBMA last June 2005, 108 respondents viewed development projects as a very good source of employment (108 respondents) (**Table 3-98**). The effects of the Shell project have not waned and the primary expectation of the residents is priority in employment. They deeply expect that they will be part of the development process through employment.

Table 3 -98. Perception on Development Projects in Sitio Agusuhin and Nagyantok

Perception	Agusuhin	Nagyantok	Nagtulong	Frequency
Employment	108	69	-	177
Displacement	90	69	-	159
Chaos	12	0	-	12
Compensation / Development of the area	35	14	-	49
N/A	61	80	-	141
Total	**306**	**232**	**-**	**538**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

The residents also expect that the development of projects in their areas will result in their displacement (90 respondents). They are fully aware that the lands they are presently occupying belong to SBMA. Concomitantly, they are also fully expectant that if they are displaced, they will receive compensation (35 respondents) for the structures and development that they have invested in the area.

Recommendation to Solve Community Problems and Needs

The residents (133 respondents) are expecting the government to help them solve their community problems and needs (**Table 3-99**). This is indicative of the traditional thinking still prevalent in rural areas because it would mean either the mayor or governor or both. Patronage politics is still very much alive in these areas.

There is also a realization that new projects (70 respondents) in their communities and employment (42 respondents) will solve their community problems and needs. This is indicative of the economic nature of their problems and needs. This also means that given the opportunities, they will take a more active role to improve their conditions.

Table 3 -99. Recommendation to Solve Community Problems & Needs in Agusuhin & Nagyantok

Recommendation	Agusuhin	Nagyantok	Nagtulong	Frequency
New Projects to help the Community	70	27	-	97
Provide Employment	42	10	-	52
Government to Act	81	52	-	133
Provide Livelihood Projects	11	1	-	12
N/A	72	92	-	164
Others (individual efforts)	1	23	-	24
Total	**277**	**205**	**-**	**482**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

Twelve respondents cited provisions for livelihood projects to solve their community problems and needs. There were apprehensions in the communities that some residents may not avail of employment because of their failure to pass the medical examinations or they lack the qualifications for the jobs. Other respondents are outright entrepreneurs who would rather prefer businesses than employment.

Recommendation for Incoming Development Projects in their Community

If ever that there are incoming projects, 83 respondents expect that there will be provisions for relocation (**Table 3-100**). This expectation was reinforced during the FGDs when some opined that they are just earning their livelihood peacefully and if ever there are projects that will result in their eviction, relocation should be put in place.

Table 3 -100. Recommendation for Incoming Development Projects in Agusuhin & Nagyantok

Recommendation	Agusuhin	Nagyantok	Nagtulong	Frequency
Work Priority	33	4	-	37
Relocation	55	28	-	83

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Recommendation	Agusuhin	Nagyantok	Nagtulong	Frequency
Community Consultation	19	6	-	25
Livelihood Project (micro-lending, income-generating activities, etc.)	23	16	-	39
N/A	131	153	-	284
Total	**261**	**207**	**-**	**468**

Source: Socio-Economic Profile of Redondo Peninsula (SBMA, 2005)

The second recommendation is for livelihood projects. Based on the FGDs, livelihood projects are replacements for their livelihoods that were disrupted by the project. A farmer who is deprived of land will have a hard time surviving and livelihood projects are alternative sources of income.

Thirty-seven respondents cited employment priority in the incoming projects while community consultation was the recommendation of 25 respondents.

Community Perception to Environmental Changes

The respondents were asked about changes on the environment in their communities (**Table 3-101**). The respondents felt that there were increases in the population/migration (74 respondents), air/noise pollution (52 respondents) and forest cover (51 respondents). It should be noted that these are interconnected. With the influx of migrants, the additional population will produce their corresponding air/noise pollution. The nearby reforestation project of the community may have contributed to the observation that the forest cover had increased.

Table 3 -101. General Observations to the Changes in the Communities' Environment by Sitio

Changes	Agusuhin		Nagyantok		Nagtulong		Frequency	
	M	L	M	L	M	L	M	L
Factories/ Power Plants/ Industries	1	32	0	3	5	2	6	37
Land Converted into subdivision	4	13	0	3	12	6	16	22
Farm Harvest	24	33	19	0	1	17	44	50
Flooding in low lands	15	14	17	15	12	2	44	31
Forest Cover	17	23	15	12	19	2	51	37
Population / Migration	33	2	37	2	4	1	74	5
Water Pollution	4	20	1	5	7	1	12	26
Air / Noise Pollution	6	20	30	2	16	3	52	25
Traffic Congestion	0	18	0	2	1	0	1	20
Others	22	26	100	26	15	15	137	67
No Answer		28		-		-		28
Total	**126**	**201**	**219**	**70**	**92**	**49**	**437**	**320**

The most observed negative changes in their environment are; decrease in farm harvests (50 respondents), forest cover (37 respondents), and factories/plants (37 respondents. The observation that there was a decrease of forest cover may mean areas outside of the reforestation project, a traditional source of firewood. The

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decrease in factories may mean the completion and termination of the SPEX project in the community.

Environmental Changes that Adversely Affected their Community

The respondents were asked out of the perceived negative changes cited in the previous question, what environmental change has the highest impact on your family and/or community. Two hundred respondents cited air/noise pollution as the environmental change that had the highest impact on their family/community. The details are shown in the following table (**Table 3-102**).

Table 3 -102. High Impact Environmental Changes by Sitio

High Impact Envt'l. Changes	Agusuhin	Nagyantok	Nagtulong	Frequency
Factories/ Power Plants/ Industries	-	-	-	-
Land Converted into subdivision	-	-	-	-
Farm Harvest	-	-	-	-
Flooding in low lands	100	10	8	118
Forest Cover	-	5	-	5
Population / Migration	55	-	4	59
Water Pollution	-	35	-	35
Air / Noise Pollution	200	-	-	200
Traffic Congestion	-	-	-	-
Others	-	-	-	-
Total	**355**	**50**	**12**	**417**

One hundred eighteen respondents cited flooding in low lands as having the most impact to their family/community. Fifty-nine respondents felt that the increase in population had the most impact while 35 respondents cited water pollution as having the most impact on their family/community.

Community Awareness on the Project

Two hundred twenty respondents are aware of the proposed project while 197 respondents are not aware of the project (**Table 3-103**). The results of this question is quite disturbing considering that percentage wise, the awareness in the host, Sitio Agusuhin, is lower than the neighboring sitios of Nagyantok and Nagtulong.

Table 3 -103. Awareness on the Project by Sitio

Awareness	Agusuhin	Nagyantok	Nagtulong	Frequency
Aware	177	35	8	220
Not Aware	178	15	4	197
Total	**355**	**50**	**12**	**417**

Before the survey period, there were many activities and meetings held by the proponent, SBMA and the local government in Sitio Agusuhin about the project. There

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were also many pre-construction activities such as soil boring and testing with about 100 test holes. And yet, 178 respondents were not aware of the proposed project.

Mode of Communication

The number one source of information about the project came from barangay officials with 86 responses (**Table 3-104**). This is predictable because being isolated from the rest of Subic by the lack of roads; the barangay officials play an important role in information dissemination. This was followed by family member accounting for 48 responses. The other details are shown in the following table.

Table 3 -104. Mode of Communication on the Awareness of the Project by Sitio

Mode of Communication	Agusuhin	Nagyantok	Nagtulong	Frequency
Radio	30	8	-	38
TV	15	-	-	15
Parish Priest	-	5	-	5
Family Member	34	11	3	48
Neighbor	7	-	-	7
Barangay/ Municipal Official	71	11	4	86
Project Employees	13	-	-	13
Others	7	-	1	8
Total	**177**	**35**	**8**	**220**

Effects of the Project to the Community

The respondents perceived positive and negative effects (multiple responses) in the proposed project. The primary positive effect of the proposed project is employment accounting for 81 responses. Second is industrialization with 37 responses. This response is partially connected with employment because of the increase in economic activities. Industrialization will result in electric power, the primary problem in the community in the June 2005 survey. It was also perceived that the project would contribute to the income of the barangay, which in turn may result in the delivery of basic services (**Table 3-105**).

Table 3 -105. Positive & Negative Effects of the Project to the Community by Sitio

Effects	Agusuhin	Nagyantok	Nagtulong	Frequency
Positive	**362**	**50**	**12**	**424**
None	-	-	-	-
Employment for local residents	34	39	8	81
Barangay Income/ Revenue	32	1	-	33
Industrialization	35	2	-	37
Community Dev't. Projects / Assistance	29	2	-	31
Community Solidarity	30	3	-	33
Others	190	-	-	19
No Answer / Comment	12	3	4	190

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Negative	**1,104**	**200**	**32**	**1,336**
None	79	-	9	88
Decrease in Farm Harvest	140	18	6	164
Flooding	105	20	3	128
Decrease in ground water resources	92	13	2	107
Health hazards	176	28	4	208
Peace and order hazard	161	31	1	193
Water Pollution	145	30	1	176
Air Pollution	190	27	3	220
Noise Pollution	6	32	3	41
Traffic Congestion	5	1	-	6
Other	5	-	-	5
Total	**1,459**	**250**	**44**	**1,753**

On the negative effects of the proposed project, the primary concern of the residents is air pollution accounting for 220 responses. This may be corrected by additional information to the community because the proposed project will only assemble finished raw materials and is not into manufacturing. Because of this misperception that manufacturing is involved, the second negative effect of the project is the project will be a health hazard. It was also perceived that the arrival of migrant workers would adversely affect the peace and order condition in their communities.

Water pollution was cited as a negative effect of the project. One of the components of the project is a water treatment plant. Wastewater will be treated before it is discharged in the waterways. The residents expect that there will be a decrease in farm harvests. This perception may be attributed to two things. A productive area in the community will be used for the project. Hence, there will be a decrease in the area planted. Second, if it will be based on their perception of water pollution, their crops will be adversely affected and will yield lesser produce.

Opinion About the Project

The respondents were asked about the effects of the proposed project to their communities. Majority of respondents rated the project as highly beneficial to the community accounting for 167 responses (**Table 3-106**). One hundred sixty eight respondents rated the project as lowly beneficial to their communities. In Sitio Agusuhin there were more respondents who felt that the project is highly beneficial that lowly beneficial. This is opposite in the case of Sitio Nagyantok wherein majority saw the project as lowly beneficial than highly beneficial. There is a possibility that the nearer a household to the project, the higher the expectation of deriving benefits from the project.

Table 3 -106. Opinion About the Project by Sitio

Opinion	Agusuhin	Nagyantok	Nagtulong	Frequency
Highly beneficial to the community	154	7	6	167
Lowly beneficial to the community	124	40	4	168
Not beneficial to the community	53	2	1	56

Opinion	Agusuhin	Nagyantok	Nagtulong	Frequency
Detrimental to the community	24	1	1	26
Total	**355**	**50**	**12**	**417**

Fifty-six respondents felt that their communities will not derive any benefits from the project. This figure represents 13.4% of the total respondents. Twenty-six respondents or 6.2% of the total respondents felt that the project would be detrimental to their communities.

Acceptability of the Project

More than two-thirds of respondents (67.15%) are in favor of the project while only 11 respondents (2.6%) are against the project (**Table 3-107**). A significant number of respondents (19.67%) are not sure if they will accept or reject the project. In addition, 44 respondents had no comments about the project.

Table 3 -107. Acceptability of the Project by Sitio

Acceptability	Agusuhin	Nagyantok	Nagtulong	Frequency
Accept	245	29	6	280
Reject	7	4	-	11
Not Sure	74	8	-	82
No Comment	29	9	6	44
Total	**355**	**50**	**12**	**417**

The primary reason for acceptance is economic. The residents see the project as the salvation to their miserable economic conditions. Out of the top four answers, three may be categorized in the economic aspect namely employment, additional source of income and livelihood (**Table 3-108**). The fourth answer is connected to the delivery of basic services and infrastructure.

The primary reasons for rejection are lack of information about the project and there is no agreement yet on what will SBMA offer for resettlement and/or compensation. The lack of detailed information has resulted on their lack of understanding on how the proposed project will positively or negatively affect their lives. They cannot clearly decide whether to accept or reject the project. Hence, they took the position that they will reject the project in the meantime that they are waiting for additional information and/or agreement with SBMA.

The respondents who are not sure whether to accept or reject the project cited the lack of information as their reason for such a response. It can also be advanced that the 44 respondents who did not give any comments also lack sufficient information to rationally express their opinions about the project.

Table 3 -108. Common Reasons for Favoring/ Not Favoring the Project by Sitio

Favorable	Not Favorable	Not Sure
Employment	The Project is not clear	No knowledge about the Project
Additional Source of Income	No agreement yet with the community	
Development of the Community		

Favorable	Not Favorable	Not Sure
Livelihood		

It is clear that the proponent should improve and augment the information dissemination to the directly and indirectly affected residents. The proponent should produce information materials, conduct meetings and group discussions to address this issue.

Project Employment

The respondents were asked: if given the chance, will they or their family members be interested in working in the project. One hundred ninety-nine respondents answered in the affirmative, 147 respondents in the negative and 71 respondents were not sure. The details are shown below (**Table 3-109**).

Table 3 -109. Community Participation to the Project in Terms of Employment by Sitio.

Project Employment	Agusuhin	Nagyantok	Nagtulong	Frequency
Yes	176	20	3	199
No	127	15	5	147
Not sure	52	15	4	71
Total	**355**	**50**	**12**	**417**

For the 199 respondents who are willing to work in the project, the primary reasons are it will be a source of income and help their families (**Table 3-110**). It should be noted that during the SPEX project, employment in the community reached 70%. When the project was finished, the residents went back to their fishing and farming. This means that given the change, the residents are willing to engage in employment.

Table 3 -110. Common Reasons for Participation to the Project's Workforce by Sitio

Yes	No	Not Sure
Employment	Not qualified in for employment	False promises like before
Source of Income		Not sure of the Project
Will help the family		Depends upon the agreement
		The Project is not clear

Majority of the respondents who do not want to work in the project cited their lack of qualifications or of their family members as the reason. For the community to be a partner in progress, SBMA or the proponent should provide either skills training or retraining to equip the residents with special skills for the incoming project.
Seventy-one respondents expressed reluctance in working in the project. The lack of sufficient information is again cited as one of their reasons for their reluctance. False promise as before was cited as one of their reasons. It is safe to speculate that during the SPEX project, some residents who were expecting to be employed were not employed.

As of the date of the survey, the residents are still waiting for SBMA to present the alternatives for resettlement because based on the agreement of the proponent and SBMA; SBMA will be responsible to settle this issue. Hence, the decision to work in the

project may be impliedly based on the favorable resolution of the resettlement issue by SBMA.

Community's Acceptance upon Mitigation of the Project's Negative Effects

The respondents who did not approve or accept the project were asked if upon mitigation of the negative effects of the project, will they now approve the project (**Table 3-111**). The 11 respondents who rejected the project still reject the project even if proper mitigating measures are put in place to address the negative effects of the project.

Table 3 -111. Community's Acceptability upon Mitigation of the Project's Negative Effects by Sitio.

Acceptance upon Mitigation	Agusuhin	Nagyantok	Nagtulong	Frequency
Yes	246	43	11	300
No	7	4	-	11
Not sure	75	3	1	79
No Comment	27	-	-	27
Total	**355**	**50**	**12**	**417**

Out of the 82 respondents who are not sure, three respondents changed their minds and said that they will approve the project upon adoption of mitigating measures to address the negative effects of the project. Out of the 44 respondents who did not comment of the acceptability of the project, 17 respondents said that they would approve the project once abatement measures will be adopted to address the negative effects of the project.

Willingness of the Community to Relocate

Out of the 417 respondents of the survey, 173 respondents are willing to relocate their houses. In Sitio Agusuhin, 149 households (42 %) out of the total of 355 households are willing to be relocated (**Table 3-112**). Reasons for their willingness to be relocated are: they will have permanent living area, good relocation site, development of the barangay, will help the poor, near the proposed project, and if there is a good agreement about the terms and conditions of relocation with SBMA.

Table 3 -112. Willingness of the Community to Relocate by Sitio

Willingness to Relocate	Agusuhin	Nagyantok	Nagtulong	Frequency
Yes	149	19	5	173
No	30	4	-	34
Not sure	101	12	-	113
No Comment	75	15	7	97
Total	**355**	**50**	**12**	**417**

Overall, thirty-four households are not willing to be relocated. In Sitio Agusuhin, 30 respondents (8.5 %) are not willing to be relocated. The reasons for their answers are;

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they do not know the conditions in the relocation site, they have their own properties and they will just return to their provinces (**Table 3-113**).

Table 3 -113. Common Reasons for Willingness/ Unwillingness to Relocate by Sitio

Yes	No	Not Sure
Permanent Relocation/ house	Do not want to be relocated	No idea
Good Relocation Site	Do not know the conditions	Do not know where will be the relocation site
Development of the Barangay	Have own properties to other place	
Near the employment site		
Will help the poor	Will return to the province	No specific relocation site
Good agreement		Employment
		Depends upon the site for relocation

There are 113 respondents who are not sure if they want to be relocated or not. Out of this total 101 respondents (28.5 %) are from Sitio Agusuhin. Reasons given by the respondents are; they have no idea about the relocation site, depends on the relocation site, and they are not sure if they will be employed in the project.

Ninety-seven respondents did not give any opinion about their willingness to relocation. Out of this total, 75 respondents (21 %) are from Sitio Agusuhin. It can be suggested that these respondents have adopted a wait and see attitude about their willingness to be relocated. If the conditions for relocation approximate their expectations, then they are predisposed to agree on relocation.

Proposed Relocation Site

Two hundred ten respondents (50.35 %) are in favor that the relocation site is within SBMA property (**Table 3-114**). However, there are legal impediments of private persons owning SBMA land as discussed under the sub-section of legal framework in this social section.

Table 3- 114. Proposed Relocation Site by Sitio

Proposed Relocation Site	Agusuhin	Nagyantok	Nagtulong	Frequency
Within SBMA Property Area	172	30	8	210
Within Barangay Cawag	29	1	2	32
Other Barangay within Subic	99	-	-	99
Other Municipality	35	-	-	35
No answer	20	19	-	20
Total	**355**	**50**	**12**	**417**

Thirty-two respondents are willing to be relocated in other areas within Barangay Cawag (**Figure 3-52**). Ninety-nine respondents are willing to be relocated in other barangays with Subic while thirty-five respondents are willing to be relocated in other municipalities within Zambales. Twenty respondents did not provide any answers,

Conditions for Relocation

The respondents were asked about their conditions for relocation. The respondents may give multiple responses (**Table 3-115**). Two hundred forty three respondents wanted that they should be compensated for their houses and/or lots. It should be noted that the ownership of the land is vested on SBMA.

Table 3 -115. Conditions of the Community on the Relocation Issue by Sitio

Conditions	Agusuhin	**Nagyantok**	**Nagtulong**
Buy-Out House and/or Lot	207	35	1
Compensation for Crops & other properties in the area	46	-	-
Disturbance Fee	82	5	5
Provide Relocation Site	120	1	1
Provision of House & Lot	3	2	1
Provide long-term employment	1	-	-
Provide Livelihood	6	-	1
Others	21	-	-
No Answer	72	-	3
Total	**558**	**43**	**12**

One hundred twenty-two respondents wanted a relocation site. Eighty-two respondents wanted to be paid disturbance fee while 46 respondents wanted compensation for the trees, crops and other improvements that they have undertaken in the area.

It should be noted that the four major conditions for relocation were also brought out and captured in the focus groups discussions.

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Figure 3-52. Proposed Relocation Site

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3.3.19.5 Highlights of the Focus Group Discussions

Focus Group Discussions (FGDs) were undertaken in the three community organizations of the directly affected community of Sitio Agusuhin, namely:

- Agusuhin Neighborhood Association (ANA);
- Samahang Magsasaka at Mangingisda ng Agusuhin (SMMA); and
- Agusuhin Community Reforestation Association (ACRA).

Officers and members of the groups were invited in the informal small group discussion focusing on the major issues and concerns including problems in their barangays and their perception on the present and future socio-economic and the environmental impacts of the project to their communities. **Plates 32, 33 and 34** are photographs taken during the conduct of the FGDs. Attendance sheets of FGD participants are attached as **Appendix 10**.

Agusuhin Neighborhood Association (ANA)

The major socio-economic findings of the perception survey were presented to the ANA leaders for further verification. They confirmed the following results of the perception survey:

1. The average household size is 4-5 persons, which is slightly lower than the data gathered by SBMA, which is from 5-6 persons.
2. Most of the residents in Sitio Agusuhin are migrants debunking the claim that most of the residents were born in the Sitio.
3. The educational attainment of residents ranges from elementary graduate to high school graduate.
4. The local organizations in the area include ANA, SMMA, ACRA, Micro-lending, & ACC.
5. The two primary sources of income are from employment of blue-collar jobs and fishing.
6. Some of the residents of Sitio Agusuhin have other properties in the area use for farming or grazing.

It was explained that the proponent and SBMA entered into an agreement for the lease of a 300-hectare property located in Sitio Agusuhin for the construction and operation of a ship building facility. Based on the agreement, SBMA will be responsible for the issue of resettlement. However, because of financial constraints, Hanjin will advance the financial resources for resettlement against any future payments due to SBMA. Hence, SBMA will be deciding on the final resettlement and compensation packages for the project affected persons.

This explanation was very necessary because the participants were asking about the details of the resettlement and compensation, which were beyond the competence of the consultants. Hence, to provide direction for SBMA in the formulation of these packages, the FGD focused on the characteristics and other collateral issues, which are discussed in the following paragraphs.

The participants were encouraged to identify the characteristics of an ideal relocation site in the absence of any concrete relocation site for the project-affected persons

(PAPs). The first characteristic is its nearness or accessibility to the proposed project. The reason is for them to benefit from the project in terms of access to employment and livelihood opportunities. Lack of accessibility would mean longer trips and higher transportation cost to and from the proposed project.

It was suggested that the relocation site might be located within SBMA for better access. It was pointed out by a participant that the cost of the land in Sitio Nagtulong (sitio adjacent to Agusuhin) is already 80 pesos per square meter based on the Municipal Assessor's Office. If the relocation site were within SBMA, the relocation lots would be for free because SBMA will not buy land located outside of SBMA from persons who would certainly ask for the payment.

It was pointed out that to have permanency, the relocation site should be titled so that it can be transferred to the relocated households. SBMA land is classified as inalienable land and beyond the commerce of man. Hence, even if SBMA agrees, which is very remote considering its legal complications, the relocated households would still not have absolute title over the relocated lots and may in the future be subject again of involuntary resettlement.

The second characteristic is its proximity or access to their sources of livelihood such as fishing, farming and in some cases, gathering of stones from the river. Their fishing grounds are outside the jurisdiction of SBMA and their problem is who to reach the fishing grounds from the relocation site. Hence, the relocation site should be near the sea to enable the owners of boats and fisherfolk to dock. In addition, it should be well protected against storms and typhoons.

The Department of Public Works and Highways (DPWH) is planning to construct a coastal road connecting finally Sitio Agusuhin to the rest of Subic. Presently, the only access to the sitio from Subic or Olongapo City is by sea. The proposed road will increase their accessibility to their farms from the relocation site and will enable them to bring in farm inputs and bring out farm products.

In relation to farming, some of the farmers were apprehensive that they will lose their farmlands because of the project. It was explained that SBMA owns the land and any compensation that will be formulated will be based on legal jurisprudence. In addition, a livelihood program will be recommended by the study in a planning workshop to identify the livelihood projects suitable for the PAPs. Farmers who will lose their farmlands will be the beneficiaries of this livelihood program.

There was a query about farmlands not covered by the project, meaning outside of the project site. SBMA will formulate the resettlement and compensation packages and it is solely the decision of SBMA to include or exclude in the packages, areas outside of the project site.

The third characteristic is for the provision for home lots and low amortization. The president of ANA shared the information that the mayor tasked her to look and identify a suitable relocation site of approximately 50 hectares and the slope should not be more that 18 %. They have already identified a suitable area but a certain Benito Chua already owns the land.

The representative of Hanjin-SBMA (Sonny) told some of them that the beneficiaries would amortize the relocation lots. Some of the participants said that they have no capacity to pay and that the lots should be given free.

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The decision again to have the lots amortized or given free depends on SBMA. SBMA may formulate qualification criteria for beneficiaries of relocation. It was pointed out that in the decision making process of SBMA, the allocation of certain amounts of money would require board approval.

The fourth characteristic is the provision for basic services. The participants narrated their efforts to have their own schools, day care center, assembly center and religious structures. In addition, the relocation site should have water, electricity, roads, health and educational facilities.

It was pointed out that the relocation site would require the provision of basic services. If all of these will be available at the time when actual relocation is implemented will largely depend again on SBMA.

The participants were also asked on the breakdown of compensation that they are expecting as a result of the involuntary resettlement because of the project. The following were raised and discussed in the meeting;

Houses and other Structures – The participants wanted that their houses and other structures that they built would be compensated. The basis for valuation is that if the same structure will be built today, how much would it cost to build.

It was posited that households who have resided in the sitio longer should receive larger compensation in terms of higher valuation of their structures. However, some pointed out that it would also be unfair if a long time resident living in a hut would receive more that a resident living in the area for a shorter period but his house is made of concrete.

Permanent Improvements – The participants said that they should also be compensated for the trees and crops that they have planted. They have checked the valuation of the tree in the Municipal Assessor's office and the valuation was for 1999. The office had yet to update their rates. Hence, a fruit bearing mango tree is valued at only PhP 7,740, which they feel is to low considering the value of the harvests they make in one year. Some participants postulated that the value of the tree should be based on the income that they generate from the tree.

They also want compensation from the improvements that they made on the land such as fishponds, irrigation and gardens. They invested labor and money to improve their areas and it is only fair that they are compensated for their money and efforts.

Land Tenancy – This is a form of compensation based on the length of stay in the community. The president of ANA related that in her talk with Ecology Center, it would be recommending that residents who have stayed in the community for more than 10 years would be included in this scheme.

Disturbance Fee – It is a form of compensation for the loss of income because of the disturbance brought about by the resettlement of the affected households. Some participants wanted to equate this compensation to the length of stay I the community.

It was pointed out that there are two ways that SBMA would be addressing the compensation issue. First, their budget would have no limit, hence, all their demands may be accommodated. The second way, which is more probable, would be that SBMA would have a fixed budget. Even if they have many demands, the budget approved by the board would be constant. It was pointed out that the influx of new

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migrants would adversely affect their compensation packages because there will be an increase in the number of households who would divide the same pie. According to some participants, the representative of Hanjin-SBMA allegedly said that the compensation would be paid by the LGU.

The following paragraphs contain the other issues and concerns of the residents raised in the discussion.

Employment – The participants perceived the project as a very good source of employment considering that they are the primary affected residents. It was pointed out that during the CGS project, many of the residents were trained as welders. These residents can be utilized for the project because of the special skills that they possess. A short re-training is all they need to be hired by the proponent.

It was suggested that the proponent and PAPs should enter into memorandum of understanding giving the PAPs first priority in employment. It was emphasized that permanent slots should be given to them and not on a contractual or temporary basis. It was suggested that they could only be terminated by just causes as provided by law.

Skills Training – Many of the affected residents may not have the proper shills to qualify for the jobs open in the ship building facility. Hence, it is vital to have skills training so that they can participate in the benefits that can be derived from the project.

It was pointed out that Mayor Khonghun of Subic would build a training school for vocational and technical courses that would fit to the requirements of the proposed project. They see the newly high school graduates as the priority in skills training. The type or kind of skills training will depend on the actual requirements of the proponent. Food preparation and/or food catering was mentioned because of the opportunity of ANA of selling cook food for the construction workers and later to the employees when the facility is operational.

Livelihood – It is viewed as an alternative of employment. Residents who would not qualify for employment may benefit from the project through livelihood projects. This will also approximately replace the opportunities of farmers and fishermen who are not able to do their activities anymore because of the project. Possible livelihood projects mentioned were rag making, micro-lending, and consumer store and food concession inside the ship building facility.

Samahang Magsasaka at Mangingisda ng Agusuhin (SMMA)

The members of SMMA welcomed the proposed project because of its potential to provide employment and livelihood opportunities. However, the sources of their livelihood such as farms and fishponds will be destroyed to give way to the project. Hence, it is very important that there will be full compensation for the farms and fishponds.

Part of the consultation process of the EIA is to learn the views of affected households on the issue of compensation. Based on the Municipal Assessor's Office, the different fruit trees have different values depending if the tree is fruit bearing or not, hence it is not a problem of residents. It was suggested that the valuation of tree should be the same whether fruit bearing or not. It was pointed out that a century old mango has higher value that a three year old mango sapling. It was also pointed out that in the survey conducted by Ecology Center, there is a complete inventory of trees.

The main concern of the members is compensation on the fishponds. The members have developed the fishpond with the funds provided by PSFI. The operation of the fishpond was given to an operator and the project suffered losses. The association borrowed funds from Quedancor amounting to PhP 1.8 million. This amount was spent for fingerlings and feeds. If SBMA needs the area, it has to reimburse the full amount.

It was explained that based on fair compensation, the whole amount cannot be paid. When SMMA invested money to raise bangus, it took the risk on whether it will profit or lose in the business venture. The fishpond inputs such as fingerlings, and feeds are assumed risks of SMMA and in case of loss, it will not be compensated. In the same vein, if SMMA will profit from the venture, it will not share the profits to the proponent or SBMA.

Compensation will be given for improvements on the land and or the fishponds such as gates and dikes, which were paid by SMMA. Experts, who will personally visit the fishponds, will evaluate the improvements. SBMA will be the decision-maker in the issue of compensation. The purpose of this FGD is to know your opinions and suggestions on the issues that will arise, once the proposed project will push through.

Some members pointed out that the valuation of the assessor's office is not sufficient for the members who lost their livelihood. It was explained that the valuation of the assessor's office represents the value of the tree. The price does not include the loss of earnings from the tree. Livelihood programs to be initiated by the proponent and/or SBMA will address this issue. It was suggested that as a replacement for the fishponds that will be lost to the project, fish cages would be a good alternative.

A rice farmer said that he is harvesting 40 cavans of palay a cropping three times a year. Compensation should be based on the area and improvements of the rice land. Another participant suggested that compensation of the rice land should be based on the expected yield per year times the number of years the project will operate. For clarification, it was asked if the suggestion holds true whether the land is titled or not. He claimed that the government and not SBMA own the land.

Compensation should not only be based on things that you could see but should also consider the length of time a household stayed in Agusuhin. He is not against the project but SBMA should not be a miser.

If Hanjin is the project proponent, then, why is it that SBMA will be responsible for compensation and resettlement issues? Hanjin should deal with the residents directly. It was explained that as owner of the land, SBMA assumes responsibility for land issues to encourage investors to locate in the zone. However, because of financial constraints, Hanjin will advance the money to settle the land issues and the total amount that it advanced will be deducted against future payables of Hanjin to SBMA. In effect, it is the money of SBMA that will be used to settle these land issues. Hanjin only advanced the money to SBMA.

It was pointed out that SBMA in settling the land issue will have to face the legitimate and alleged claims of the affected households. The more probable method is for the board to fix a budget. If there are new migrants that are entering and constructing structures in the sitio, the old migrants (lehitimo) may be adversely affected because there will be now more households who will be dividing the fixed budget. It was pointed out that SBMA has the results of the various surveys done in the sitio. In 1999 there were 147 households. This increased to 272 in June-July 2005 census. When the perception survey was conducted on the third week of September 2005, the

households grew to 355 households. "Lehitimo" is defined as a family "na matagal nang nakatira dito, nagka anak, nagka apo."

To guide the discussions on what are subject to compensation, the facilitator explained that in the FGD with ANA, the following are expected to be compensated; house and structures, permanent improvement, land tenancy and disturbance allowance. The members concurred with these observations of ANA.

It was explained that being a naval reservation during the US Navy, the land cannot be titled. When the Americans left, a law (RA7227) was enacted giving all the lands formerly occupied in Subic to SBMA. The law reserved the land to SBMA and it cannot still be titled. Relocation is not tenable inside SBMA because it is reserved by law for other uses. If the residents would not agree to an equitable compensation package, SBMA have many options. Many things may happen, among them are; SBMA will force the issue, Hanjin will totally withdraw or SBMA may sue the residents.

A participant asked what are the benefits of a legitimate household. It was explained that the term "legitimate" has not yet be defined for the specific case in Agusuhin. It was suggested that households that were Agusuhin at the time of the perception survey should be treated as legitimate.

It was pointed out that it will be in conflict with the principle that length of stay should be one of the basis of determining compensation. It was also pointed out that there are various surveys, which showed the names of households in a given period. It was explained that there is a concept in law of a builder in bad faith. A person who having known that there will be a project in Sitio Agusuhin, deliberately build a house in anticipation for compensation of his newly built house is a builder in bad faith.

There are 42 members of SMMA out of more that 100 fishermen. Some participants suggested fish cages as viable replacements for the fishponds that will be occupied by the project. Others suggested deep sea fishing boats because of the scarcity of commercial quantity of fishes in the bay.

For residents who are over age or for medical reasons, not qualified to work in the project, livelihood projects are viable alternatives. Identified projects are canteen operations, janitorial services, and houses for workers.

It was mentioned that there is again a survey measuring their houses. It was explained that this is a baseline data gathering authorized by SBMA to determine the measurements of their houses and be a basis for any recommendation regarding compensation. How will SBMA know how much will be the budget if they do not know the dimensions of the houses that will be compensated.

Agusuhin Community Reforestation Association (ACRA)

Part of the reforestation area will be occupied by the proposed project. They do not know if parts of the reforestation project outside of the 100-ha project site will also be affected. If this is the case, ACRA will totally lose the whole project. They pointed out that there is an agreement with SBMA for a 25 years CBFM agreement. Section 2 of the lease agreement provides for the following:

In the event of the cancellation of this agreement, the CBFM holder shall be entitled to fair compensation for all permanent improvements thereon, based on their reasonable fair market value as assessed by a third party acceptable to both SBMA and the holder

on the date of cancellation, minus charges or any other monetary obligations accruing the government. The holder may also harvest or remove such improvements, the value of which shall be deducted from final compensation.

It is very clear in the CBFM agreement that a CBFM holder will receive reasonable compensation for portions of the CBFM area that will be affected by the project. It will not also prevent SBMA in canceling the whole CBFM area from its coverage. However, the CBFM holder shall receive reasonable compensation for the trees and other permanent improvements.

It is also useful and fair to apply the concept of builder, sower and planter in good faith because after the residents were informed about the project, new structure may be seen from the docking area of the sitio. It is very probable that these structures were built in anticipation of the compensation to be awarded to structure owners.

The members of ACRA are asking for compensation of the following, considering that their occupation in the area is covered by a legal agreement.

Payment for trees and crops – The value of the trees and crops within their individual area. This is a form of indemnity based on the fair market value of the trees and crops that they planted hoping that in the near future they are able to convert these trees and crops to cash.

Years of stay in the area – It is a form of indemnity based on their efforts to protect the area against illegal logging and other illegal extraction of forest products, kaingin, forest and grassland fires and other responsibilities as provided in their agreement with SBMA.
Infrastructure – The value of the nipa huts that they built to monitor the area against illegal activities and irrigation system that they channeled and developed for the project.

The members of ACRA are all residents of Sitio Agusuhin who will be displaced by the project. They wanted that their relocation site would be the parts of the reforestation area that is outside of the 300-hectare project site. They are suggesting re-subdividing the unaffected area to the members of ACRA as their relocation site and reforestation areas.

PSFI spent a total of PhP 8.5 million for the reforestation project. Other local organizations have already benefited from the grants given by PSFI but their members will only benefit upon maturity of the trees, the earliest is five years. Hence, it is only proper that the amount spent for reforestation by PSFI should be returned to ACRA because unlike other organizations, they have yet to benefit from their project.

The members look forward to being employed in the project because of their unique positions of holders of a legal document signed by SBMA. Most of its members were trained during the CGS construction such as steel man, fabricators (rebar technician), and divers. They would be willing to undertake the same jobs as before. If their skills are not sufficient, the group proposed to upgrade their skills to fit to the qualification and requirement of the shipbuilding project.

3.3.19.6 Concluding Remarks on the Issue of Endorsements of Stakeholders

With the new directives from the DENR, endorsements of stakeholders in favor of the project are not pre-conditions for the approval of an ECC. These endorsements merely reinforce the viability of a proposed project. The project should be assessed and evaluated based on its merits and should not depend on the endorsements of the stakeholders. In the past, some of these endorsements have been used to extract favors from the proponent of the project.

It is obvious that the municipality of Subic will endorse the project because they have accepted their role to provide and implement the relocation of the affected residents within their jurisdiction.

The proponent should work out for the barangay resolution endorsing the project from Barangay Cawag. However, there were reports from the field visits conducted by the team that certain barangay officials are allegedly involved in the scam to invite new settlers to build their houses and plant trees in the hope that they will be part of the compensation and relocation packages. It is not remote that the barangay endorsement will be affected by who will be included in the compensation and relocation packages. Hence, in the absence of any compelling reason to oppose the project, the barangay endorsement may be waived because of the local conditions that have contaminated the endorsement process.

There are indications that there are internal conflicts within some community organizations in Sitio Agusuhin as highlighted by the formation of break away factions. Endorsements are expected to be provided by the main factions of the community organizations once the resettlement issues are adequately addressed by SBMA.

3.3.20 ARCHAEOLOGY

Baseline information on the shipwreck located in front of the former Malampaya CGS casting basin are available from inspections or studies (inspection on 24-26 November 1999 and re-inspection on 19 July 2000) conducted by the Underwater Archaeology Team of the Philippine National Museum (UAT-PNM) for the Malampaya CGS Project of SPEX (see **Appendix 11**).

The shipwreck is located about 100 meters off the mouth of the former CGS casting basin at a depth o 20 to 21 meters. It has been identified as Land Sea Transport (LST) 1625, a steel vessel which sunk in August of 1946. The shipwreck matched the record of the shipwreck's location, which is North 14° 49' 16" and East 120° 12' 51". During the dredging of the channel used for the tow out of the CGS, this shipwreck was successfully avoided. The two dives conducted prior to the construction and after the tow out of the CGS as reported by the UAT-PNM indicated that the LST 1624 remained in stable condition.

On 4 November 2005, a KKCS survey team conducted an underwater inspection of the said shipwreck to determine its present status and condition. The shipwreck was observed at 14° 49' 16.5" North Latitude and 120° 12' 51" East Longitude at a depth of 21 meters which also matched the UAT-PNM survey. Similar to the previous findings, the LST still remains to be in a stable condition.

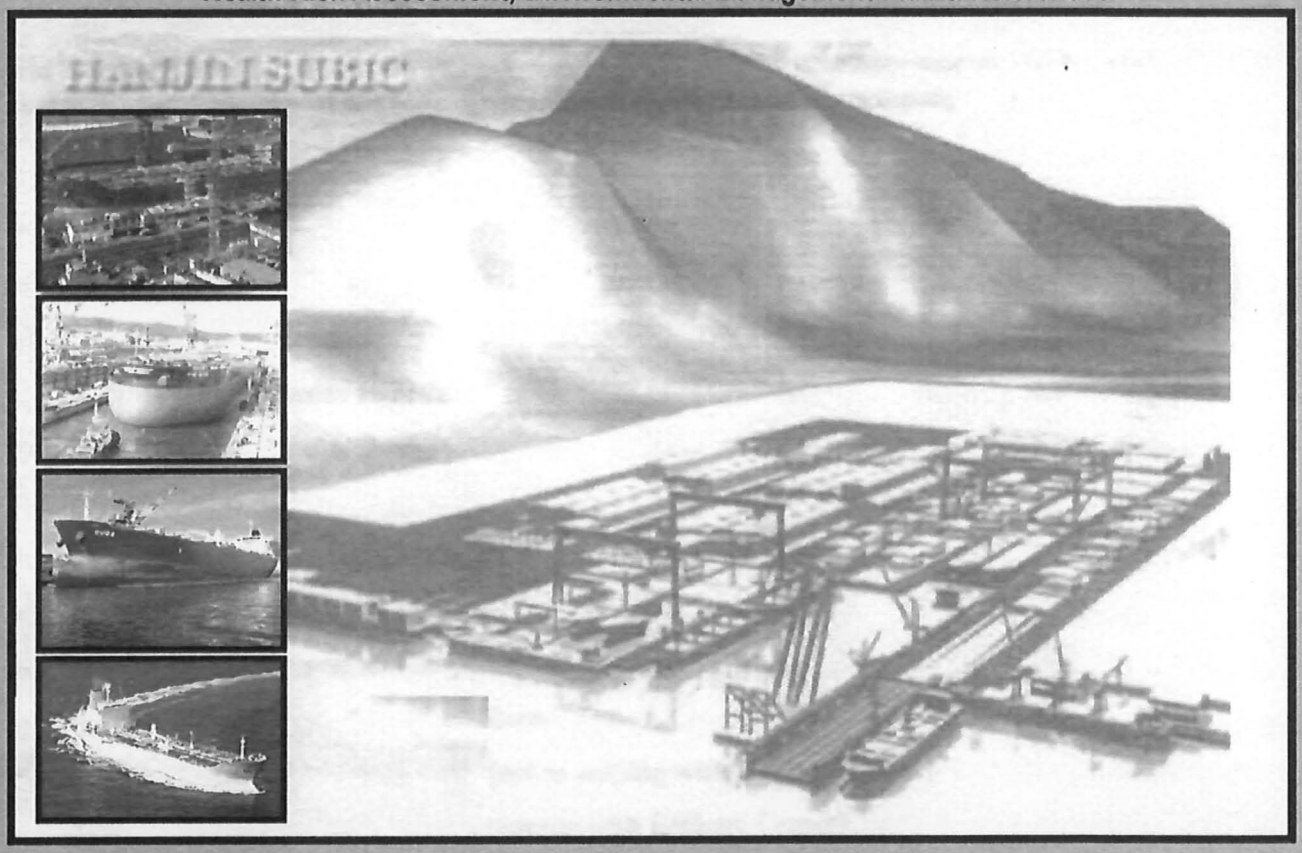
FINAL REPORT
(Revised)

ENVIRONMENTAL IMPACT STATEMENT OF THE PROPOSED HANJIN SUBIC PROJECT- SHIPBUILDING FACILITY

SITIO AGUSUHIN, REDONDO PENINSULA BRGY. CAWAG, SUBIC, ZAMBALES

VOLUME 2

Project Impact and Mitigating Measures, Environmental and Health Risk Assessment, Environmental Management Plan & References



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APPENDIX 1 SBMA FIRE SAFETY GUIDELINES

This section, which is divided into three main parts, assesses potential environmental impacts with or without the proposed shipbuilding facility project. The first part describes the future environmental conditions without the proposed project. The second part presents the potential environmental impacts associated with the proposed project. It classifies the impacts and how the project and the surrounding areas were delineated into potential impact zones. The second part also predicts and evaluates the environmental impacts of the project on the environment at different phases from the pre-construction, construction, operation and abandonment phase. It also discusses how these potential impacts are planned to be mitigated in order to eliminate, if not, reduce the adverse effects. The last part of this section presents the residual and unavoidable impacts of the project to the environment.

4.1 FUTURE ENVIRONMENTAL CONDITIONS WITHOUT THE PROJECT

4.1.1 PHYSICAL ENVIRONMENT

Without the Project, various physical processes that occur in the area would continue at present levels, possibly with increasing anthropogenic activities (e.g. population increase, expansion of farms) putting pressure on the existing environment.

4.1.1.1 Topography, Geology and Natural Hazards

Without the Project, the existing topography and geology of the area will remain the same. As the construction activities attendant with the proposed project such as excavation, dredging, land grading and reclamation will not materialize, the existing landform will not be altered. Natural hazards in the area are expected to generally remain at present baseline levels barring the sudden occurrence of large-scale natural processes that may upset current landscape denudation rates.

4.1.1.2 Pedology and Land Use

Without the Project, there will be no striping of the soil, thus, disturbance of the soil profile will not take place.

Land use patterns will remain essentially the same. With increasing population, more lands will be used as subsistence farms. Generation of solid and domestic wastes would continue, which without proper solid waste management practices could adversely affect the environment. Practices, such as slash-and-burn farming, will further enhance soil erosion, mass wasting and siltation of the natural drainage system.

Emigration to urban areas is very likely to occur. People would seek better employment opportunities in other areas since the Project site would not have the opportunities they aspire. These may result to minimal development and upliftment of the affected barangays.

4.1.1.3 Hydrology and Water Resources

The flow of the natural drainage systems and its seasonal variation will persist. Runoff will either increase or decrease depending on the vegetation cover in the project area. Eroded sediments from bare areas will find its way to the streams.

Groundwater extraction through springs and shallow coastal wells will continue. The demand will increase depending on population but will not be significant as emigration

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to urban centers will continue. The threat of shallow groundwater contamination due to construction of unlined septic tanks and generation of domestic wastes will continue.

Total suspended solids are likewise expected to increase due to enhanced erosion during storm events.

4.1.1.4 Air and Noise Quality

The air quality in the area may remain the same without the Project. At present, there are no possible locators that are interested to invest in the area. Background noise levels in the area will remain the same.

4.1.2 BIOLOGICAL ENVIRONMENT

4.1.2.1 Terrestrial Ecology

Without the implementation of the proposed shipbuilding facility project, the terrestrial ecology for the primary and secondary impact area will not be affected. The biodiversity may improve or it may not, depending on the intervention (e.g. development projects) of SBMA in the proposed site. As reported earlier, the site for the shipbuilding facility project is already disturbed, hence without the project scenario may not change the biodiversity indices of the area.

Terrestrial Flora

No stripping of vegetation cover would take place without the Project. Thus, no loss of vegetation-covered habitat types will occur. On the other hand, the few remaining secondary forests will continue to be threatened with increasing demand for forest products and land clearing by slush and burn method (kaingin) to accommodate subsistence farming.

Terrestrial Fauna

Wildlife species are dependent on their habitats for food and shelter. At the proposed project site, the wildlife population is very poor. Most observed species are transitory from one forested area to another. The only important habitats for wildlife, and these should be preserved, are the riparian vegetation and sparse secondary forests in the uplands.

4.1.2.2 Aquatic Ecology

Without the proposed project, the condition of the marine environment and coastal habitats and resources including fisheries in the project area and vicinities will remain the same in the immediate future and will continue to be influenced by the existing environment processes and condition currently prevailing in the area. However, the local coral communities and fisheries life may continue to suffer from continued destructive and illegal fishing activities (i.e., blast and cyanide fishing), over-exploitation of reef fishes (e.g., aquarium fishes) and invertebrates (e.g., sea cucumbers).

The population of the residents in the area will continue to increase attributed mostly to immigration. This increase in population will result in increase in exploitation and utilization of the coastal and marine resources. Therefore, a negative side effect (i.e., destructive fishing activities, over-exploitation and eventually depletion) on the available limited coastal marine resources is expected.

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4.1.3 SOCIO-ECONOMIC ENVIRONMENT

Without the project, the Subic Bay Metropolitan Authority (SBMA) will not earn any income from Sitio Agusuhin because the area will remain unproductive. The expected revenues amounting to millions a year will not materialize. There were reports that the Federal Express is one of the big locators in SBMA". It is a permanent loss of income of SBMA from Federal Express if it will move out of SBMA. However, SBMA may find other sources of income from companies that may locate in the zone in the future.

The households in the area will continue to reside in the area without any benefits to SBMA because they do not pay any taxes or permits.

The municipality of Subic will not earn any directly or indirectly additional income from project if it will not materialize. Direct income will come from its share in the 5% of the gross income generated from the project. Indirect income will come from the additional commercial activities in the area, which will be subject to local taxes. Subic will continue to experience financial constraints to provide basic services to its constituents.

The project is expected to generate thousands of jobs in the construction and operational phases. Without the project, the residents of the area and adjacent municipalities will continue to seek employment and livelihood opportunities elsewhere to earn income for their families. Residents of Agusuhin will continue to earn their living either by farming or fishing because of the lack of better sources of income.

Without the project, the proposed road connecting the sitio to the rest of Subic will not happen or will be constructed much later because the primary purpose of the road is to provide access for the project. Hence, the sitio and the surrounding areas will remain isolated from the rest of Subic. Products and services will continue to be supplied by sea, their main mode of transportation with the rest of Subic.

The proposed electrification of the area will not happen or will happen much later because the proposed transmission line is primarily to supply electric power to the project. The residents will continue to depend on non-electrical sources for light and generators or batteries to power their electrical appliances.

The households in Sitio Agusuhin will not be displaced because of the project. They will continue to live in the area either by mere toleration by SBMA and for other households, by forcible entry. Without the project, the households will continue to live in the area without any security of tenure, waiting for other projects or development to finally resolve their status as temporary dwellers in the area.

The expected generation of air and noise pollution will not occur. The area will experience the same environmental conditions that are presently prevailing in the area. The reforestation area and the fish ponds will continue to exist and provide alternative sources of income to many of the residents.

4.2 FUTURE ENVIRONMENTAL CONDITIONS WITH THE PROJECT

4.2.1 SUMMARY OF IMPACT AND MITIGATING MEASURES

The Potential Impact Zones (PIZ) are shown in **Figure 4-1**. The PIZ is delineated based on the project's impact on the physical, biological and socio-economic environment. The impact areas

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are as follows:

The Primary Impact Area (PIA) is the entire 300-hectare Shipbuilding Facility. This area will be the direct receiver of waste discharges, disturbance of habitat, generation of dusts, dislocation of community, etc.

The Secondary Impact Area (SIA) refers to areas in the vicinity of the proposed development. This will include Sitios Nagyantok and Nagtulong of Barangay Cawag. Included in this zone is the 2 kilometer radius north and south of the project boundary where issues on air quality (dust) and water quality (suspended solids) could be felt during earthmoving, excavation, dredging and reclamation activities.

Table 4-1 presents the summary of impacts and mitigating measures for the proposed project. Included in the table is the evaluation of the magnitude of each impact. A guide in reviewing the summary of impacts and mitigating measures in **Table 4-1** are guided by the following:

Scope:

- W = widespread effect
- LO = localized effect

Classification:

- (+) = positive impact
- (-) = negative impact

Occurrence:

- F = frequent
- S = seldom/occasional

Status:

- R = reversible
- IR = irreversible

Duration:

- ST = short term
- LT = long term

Magnitude:

- SI = significant
- MO = moderate
- IN = insignificant

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Table 4 - 1. Matrix of Potential Impacts and Mitigating/Enhancement Measures

Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
Pre-Construction/Construction Phase							
Physical Environment							
Topography (alteration)	LO	(-)	F	IR	LT	SI	Unavoidable; excavated materials to be used as fill materials
Geology (excavation)	LO	(-)	S	IR	LT	MO	Unavoidable; excavated materials to be used as fill materials
Soil (erosion/siltation)	LO	(-)	S	IR	ST	MO	Retaining walls; sabo dam; siltation pond; silt curtains; armour rocks; use of geomembrane around reclamation boundary; proper stock piling of removed soils; benching; site grading in a progressive manner; revegetation
Hydrology (stream alteration)	LO	(-)	S	IR	LT	SI	Adequate drainage; bank protection
Hydrogeology (groundwater over abstraction – sea water intrusion)	LO	(-)	F	IR	LT	SI	Consider surface water; watershed management program
Water Quality (land clearing and excavation)	LO	(-)	S	R	ST	MO	Drainage canals with silt traps; settlement of suspended solids in natural depressions
Water Quality (oil and grease)	LO	(-)	S	R	ST	MO	Containment canal around motor pool Oil – water separator
Water Quality (reclamation and dredging)	W	(-)	S	IR	ST	MO	Silt curtains; scheduling of reclamation and dredging activities
Solid and Domestic Wastes	LO	(-)	F	R	ST	MO	Solid Waste Management Program following the Ecological Solid Waste Management Act of 2003 (RA 9003)
Air Pollution (emissions from equipment)	LO	(-)	S	R	ST	IN	Air quality monitoring Regular maintenance of equipment
Dust generation	LO	(-)	F	R	ST	MO	Wet suppression of dry surfaces
Noise generation	LO	(-)	S	R	ST	MO	Buffers; excessive noise construction activities confined during daytime when practicable

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Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
Biological Environment							
Flora (removal of vegetation)	LO	(-)	S	IR	ST	MO	Landscaping of grounds; watershed management
Fauna (displacement)	LO	(-)	S	IR	ST	MO	Replanting of indigenous plants in vacant spaces and along waterways
Aquatic Ecology (smothering of fish eggs, diminishing of food sources, reduction of availability of light, destruction of habitat)	LO	(-)	S	IR	ST	MO	Installation of sheet piles, silt curtains; selection of reclamation site
Socioeconomic Environment							
Change in actual land use	LO	(+)	F	IR	LT	MO	Prompt payment of lease and other permits and licenses to assist SBMA
Affects portion of reforestation area	LO	(-)	F	IR	LT	MO	Compensation for improvements
Within marine sanctuary	LO	(-)	F	IR	LT	MO	Consultations and secure proper documents
Displacement of households	LO	(-)	F	IR	LT	SE	Prepare and implement a resettlement action plan
Generation of employment and livelihood opportunities	W	(+)	F	IR	ST	SE	Priority of qualified local residents Establish a community relations office
Increase in commercial activities in the area	LO	(+)	F	R	ST	MO	Prioritize local suppliers in buying company requirements
Additional income and Benefits to LGUs	LO	(+)	F	IR	ST	MO	Prioritize local suppliers in buying company requirements
Air and noise pollution to workers	LO	(-)	S	R	ST	MO	Installation of a water sprinkling system Face masks for construction workers Proper maintenance of equipment
Operation Phase							
Physical Environment							
Water Resources (depletion/salt water intrusion)	LO	(-)	F	IR	LT	SI	Water management and conservation; watershed management; reforestation; mini dam; not over mining groundwater resources; more detailed groundwater assessment (through construction of test

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Potential Impacts	Scope	Classification	Occurrence	Status	Duration	Magnitude	Mitigating/Enhancement Measure
							wells and aquifer test) to establish groundwater safe yields
Water Quality	LO	(-)	S	R	ST	MO	Water quality monitoring; wastewater treatment plant; use of organic chemicals
Air Pollution	LO	(-)	S	R	ST	IN	Air quality monitoring; regular maintenance of equipment
Noise generation	LO	(-)	S	R	ST	MO	Buffers, fences
Solid and domestic wastes	LO	(-)	F	R	LT	MO	Solid Waste Management Program following the Ecological Solid Waste Management Act of the DENR.
Biological Environment							
Flora (erosion due to deforested areas)	LO	(-)	S	IR	ST	MO	Re-landscaping of grounds; watershed management
Fauna (return of wildlife)	LO	(+)	F	IR	LT	MO	No enhancement measures
Aquatic Ecology (increase diversity of aquatic organism)	LO	(+)	F	IR	LT	MO	No enhancement measures
Socioeconomic Environment							
Influx of informal dwellers	W	(-)	S	R	LT	MO	SBMA will implement land use plan SBMA/Subic prevent influx of informal dwellers
Generation of employment and livelihood opportunities	W	(+)	F	IR	ST	SE	Priority of qualified local residents Farm out supply requirements as livelihood projects Buy local supplies Livelihood program
Additional revenues for the LGU	LO	(+)	F	IR	LT	SE	Prompt payment of taxes
Air and noise pollution to workers and nearby communities	LO	(-)	S	R	ST	MO	Installation of anti-pollution devises Monitor health conditions of communities Plant trees and shrubs around perimeter Personal Protective Equipment (PPE) to workers exposed to air and noise pollution

Figure 4 - 1. Potential Impact Zones

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4.2.2 IMPACT ASSESSMENT AND MITIGATION

The environmental conditions of the project site could be adversely affected by project activities, if environmental management measures are not properly put in place. Impacts, both positive and negative resulting from the development of the proposed project are identified for the socio-economic environment. The recommended mitigating/enhancement measures are presented in *Italics* for each significant negative impact identified.

Each identified impact is categorized according to its development phase: i) pre-construction; ii) construction phase; and iii) operation phase. The abandonment phase is not considered since the possibility is quite remote. Once operational, the ship building facility cannot be abandoned since the proponent will undertake a very large amount of investment.

4.2.2.1 Pre-Construction Phase

The following pre-construction activities are predicted to impact the environment:

- Supply of Power, Water and Communication Lines
- Construction of Temporary Access Road
- Relocation of Settlers

The construction of power house, water sources and communication lines would create minimal or insignificant impact on the environment.

Physical Environment

Soils

In constructing temporary access road, soil will be disturbed which can be susceptible to erosion especially during the wet season. Soil disturbance should be done as much as possible during sunny weather and minimize the disturbance by disturbing only what is necessary, excessive digging should be avoided.

Socio-Cultural Environment

Population/Settlement/Migration

Legal Framework

Involuntary resettlement often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost. People are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost.

Based on World Bank policy on involuntary resettlement (Bank Policy 4.12), the resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are;

1. Informed about their options and rights pertaining to resettlement;

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2. Consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives; and
3. Provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project.
4. Provided assistance (such as moving allowances) during relocation; and
5. Provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site.

Where necessary to achieve the objectives of the policy, the resettlement plan or resettlement policy framework also include measures to ensure that displaced persons are:

1. Offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living;
2. Provided with development assistance in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities; and
3. In new resettlement sites or host communities, infrastructure and public services are provided as necessary to improve, restore, or maintain accessibility and levels of service for the displaced persons and host communities. Alternative or similar resources are provided to compensate for the loss of access to community resources (such as fishing areas, grazing areas, fuel, or fodder).

The World Bank policy on involuntary resettlement is only mandatory for projects applying for bank financing. This was shown only to highlight the extent and comprehensiveness of the resettlement plan if the bank finances the project. However, it will not preclude the proponent or SBMA in adopting certain policies that will add to the legal benefits that will be discussed in the following paragraphs.

The first issue is whether SBMA has jurisdiction over Sitio Agusuhin, the site of the proposed project?

Republic Act 7227 creating the Bases Conversion Development Authority was enacted on March 13, 1992. Section 12 of the BCDA Law created the Special Economic and Free Port Zone composed of the City of Olongapo and the Municipality of Subic, Province of Zambales, the lands occupied by the Subic Naval Base and its contiguous extensions as embraced, covered, and defined by the 1974 Military Bases Agreement between the Philippines and the United States of America as amended, and within the territorial jurisdiction of the Municipalities of Morong and Hermosa, Province of Bataan.

One of its mandates is (Section 4 paragraph g. BCDA Law) "to plan, program and undertake the readjustment, relocation, or resettlement of population within the Clark and Subic military reservations and their extensions as may be deemed necessary and beneficial by the Conversion Authority, in coordination with the appropriate government agencies and local government units."

Section 12 paragraph i of the BCDA Law provides that "the local government units comprising the Subic Special Economic Zone shall retain their basic autonomy and identity. The cities shall be governed by their respective charters and the municipalities shall operate and function in accordance with Republic Act No. 7160, otherwise known as the Local Government Code of 1991."

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Section 14 of the BCDA law provides "the relationship with the Conversion Authority and the Local Government Units. - (a) The provisions of existing laws, rules and regulations to the contrary notwithstanding, the Subic Authority shall exercise administrative powers, rule-making and disbursement of funds over the Subic Special Economic Zone in conformity with the oversight function of the Conversion Authority. (b) In case of conflict between the Subic Authority and the local government units concerned on matters affecting the Subic Special Economic Zone other than defense and security, the decision of the Subic Authority shall prevail."

Section 21 provides that the implementation of the projects for the conversion into alternative productive uses of the military reservations are urgent and necessary and shall not be restrained or enjoined except by an order issued by the Supreme Court of the Philippines.

Hence, it is established that BCDA through SBMA has jurisdiction over certain portions of the Redondo Peninsula, specifically Sitio Agusuhin, which were formerly under the Subic US Naval Base under the 1974 Military bases Agreement. The site of the proposed project was part of the practice target area of the planes of the US Navy.

There were perceptions in the community that Sitio Agusuhin became part only of SBMA by virtue of the BCDA Law. They claimed that the area during the Americans was part of the municipality of Subic and the base was only renting that portion for the target practice. The nationalists would certainly raise a furor if it were true that the US military was using areas not covered by the Military Bases Agreement as target practice.

The second issue is under what law(s) would apply in the involuntary resettlement of the residents in Sitio Agusuhin as a result of the proposed project?

The Urban Development and Housing Act (RA 7279) enumerates the rights and responsibilities of squatters and landowners. However, the said law will not apply in this case because Section 4 states that "the Program shall cover all lands in urban and urbanizable areas, including existing areas for priority development sites, and in other areas that may be identified by the local government units as suitable for socialized housing.

Furthermore, Section 5 of the UDHA Law provides for the exemptions from the coverage of the law. Paragraph C states that among the lands exempted from coverage are " those used, reserved or otherwise set aside for government offices, facilities and other installations, whether owned by the National Government, its agencies and instrumentalities, including government-owned or-controlled corporations, or by the local government units."

Even if for the sake of argument that Sitio Agusuhin may be treated as an urbanizable area, section 5 clearly exempts SBMA from its coverage. It is therefore submitted that the UDHA Law does not apply in this case.

The Comprehensive Agrarian Reform Law of 1988 covers "all public and private agricultural lands as provided in Proclamation No. 131 and Executive Order No. 229, including other lands of the public domain suitable for agriculture." The lands under SBMA were specifically reserved for the purposes enumerated in the BCDA Law. These lands are therefore not alienable and disposable lands of the public domain. Hence, it is submitted that the territorial jurisdiction of SBMA does not fall under the

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coverage of the Comprehensive Agrarian Reform Law.

The Book on Property of the Civil Code of the Philippines discusses the rights and obligations of the landowner and a builder sower and planter. As used in the Civil Code, the difference between sowing and planting is that in sowing each deposit of seed gives rise merely to a single crop or harvest. In planting, more or less permanent trucks or trees are produces, which in turn produce fruits themselves. In planting therefore, without replanting, crops will continue to grow each season.

It is therefore submitted that in the absence of any special law applicable to the residents of Sitio Agusuhin, the pertinent provisions of the Civil Code of the Philippines will apply.

The third issue is how to classify the residents of Sitio Agusuhin.

There are many residents who settled in the area during the time when the American Base was still operating. The number of residents increased staring 1997 when the Philippines Exploration B. V. (SPEX) started to construct the concrete gravity structure. The presence of employment and livelihood opportunities attracted migrants to settle in the area.

The residents cannot be classified as tenants because in a tenancy relationship, the owner or possessor enters into a written or verbal agreement with a person who uses the land and/or supplies the labor. In return, the owner or possessor receives rent or a share in the harvest.

The residents of Sitio Agusuhin may be classified or included as "encroachers" as defined by World Bank. These are persons without legal titles to the land and structures occupied / used by them. The term "squatters" is typically used for those occupying structures for residential/ commercial purposes, while "encroachers" are those occupying land for agriculture. Their stay in the community is not legal but by mere tolerance of SBMA.

The following paragraphs present a brief history of the settlement and discussions of the pertinent articles from the Civil Code of the Philippines, which are applicable to a builder, planter or sower in good faith or bad faith.

In 1999, before the start of the SPEX project, Pilipinas Shell Foundation Inc. undertook a census in Sitio Agusuhin and the results showed that there were **147** households. After the project was completed, another census was done in 2001 and it showed that there were **234** households. The plan to build a shipyard was confirmed by the residents sometime in May 2005. On June 29-July 15, 2005 another census was taken and the households totaled **272**. On the third week of September or barely 2 months after, the total households went up dramatically to **355** households.

Presently, there is a continuous flow of new settlers who desire to partake the benefits that the residents may receive as compensation because of the Hanjin Shipbuilding Project. This may be observed in Bulungan Port in Subic. Construction supplies and planting materials are being transported from the Poblacion to Sitio Agusuhin.

During the project implementation SPEX through the Pilipinas Shell Foundation Inc. (PSFI), formulated the Sitio Agusuhin Development Program (SADP). It organized four peoples' organizations and one of these, the Agusuhin Community Reforestation Association (ACRA) was later given a community based forestry management

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agreement (CBFMA) by SBMA. The staff of Ecology Center visits the area to monitor and enforce the terms and conditions of CBFMA.

SBMA has knowledge of the encroachers in Sitio Agusuhin and did not oppose the presence of these encroachers. The second paragraph of Article 453 SBMA provides that there is bad faith on the part of the landowner whenever the act was done with his knowledge and without opposition on his part. It may be deduced that because of the continued stay of the encroachers in Sitio Agusuhin and in some cases in collaboration with SBMA in certain activities, SBMA's action may have acted in bad faith when it failed to oppose the continued stay of households in Agusuhin before 2001.

In fact, SBMA, the municipality of Subic and the Agusuhin Neighborhood Association entered into a memorandum of agreement in June 13, 2000, tacitly recognizing the households living in Sitio Agusuhin at that time. Hence, by the principle of estoppel, SBMA cannot claim later that it had no knowledge nor did it oppose the continued stay of the members of ANA. This is also the case in the reforestation project. By entering into a CBFMA with ACRA, SBMA acknowledged the presence of its members and tolerated their stay in Sitio Agusuhin. Hence, it cannot hold the contrary position that it had no knowledge nor did it oppose the continued stay of the members of ACRA.

But these statements need further clarification. The census and tagging project in 2001 was conducted by Agri-Communities Development Center (ACDCI) as part of the Subic II development loan package funded by the World Bank. This project was conducted for SBMA management to have an accurate and comprehensive understanding of the ecological and social issues involved, particularly on the issue of encroachment and "illegal" settlements.

One of the objectives of the project is to increase the awareness of the residents with regards to SBMA's roles, rights, general plans, and resettlement policies including its opposition to the entry of new migrants within its territorial jurisdiction. A series of consultations and FGDs was conducted by ACDCI in behalf of SBMA, to inform the residents of Sitio Agusuhin about their status in the occupied land.

Hence, as early as 2001, SBMA has already opposed the entry of additional migrants in Sitio Agusuhin. In addition, the residents were fully informed that they should control the entry of migrants in the area. In 2002, prior to the signing of the MOA with SBMA, the Agusuhin Neighborhood Association, Inc. imposed a policy that residents who should sell their "rights" would automatically be removed from the list of ANA members. The majority of ANA members approved this policy.

Unfortunately the policy was not fully enforced by the association, thereby allowing more settlers to buy rights and encouraged more migrants to settle in the area. The problem on encroachment in Agusuhin was aggravated by the actuation of the Barangay Council of Cawag. The Council acted as witnesses in the transfer of rights documents. It also gave certifications that such lands were transferred to such persons. In effect, these actions and documents purportedly gave a semblance of legality to these transactions.

SBMA has knowledge and failed to oppose the 234 households based on the census in 2001. But this is certainly not true on the additional 121 households (difference of the 2001 census and September 2005 census) or to the households that will come after the September census. SBMA has already issued an order in 2001 and again in September 2005 to oppose the influx of settlers into the community. By this very action, SBMA has acted in good faith in so far as to the 121 households and to the

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households that may settle in the affected communities in the future.

Hence, for the 234 households, SBMA acted in bad faith while SBMA acted in good faith for the 121 households and households that may settle in the future. Good faith is defined as an honest intention to avoid taking undue advantage of another (Cui v. Henson, 51 Phil. 612).

All households in Sitio Agusuhin acted in bad faith because they knew that they have no legal title over the land but they still built, sowed or planted on the land. It is clear that President Roosevelt declared the area in 1903 as a naval reservation through an Executive Order. Before that, the Spaniards by a royal decree set aside the area for their naval facility. Hence, even if their forefathers were already there during the Americans or Spaniards, their forefathers acted in bad faith.

The above discussions on the issue whether SBMA, the Local Government, or the occupants and their fore fathers act in bad faith or in good faith are not only helpful but vital because of the following reasons:

- A builder, sower and planter in good faith or bad faith are legal concepts that establish the rights and obligations of different types of residents in Sitio Agusuhin.
- It provides a legal framework for SBMA in its dealing with the different types of residents.
- It gives the proponent an estimate on the scope of resettlement involved.
- It differentiates the "bona fide" residents from those that establish structures for personal gain from the proposed project.

Likewise, the discussion is not meant to resolve the problem (of involuntary settlement), the Resettlement Action Plan should address this. The discussion would aid the stakeholders (i.e, SBMA, HHIC-Phil Inc., residents and LGUs concerned) in understanding the present situation of the settlers in the area based on the legal and historical presentation of the subject matter, a vital input for the formulation of the RAP. This is well pointed out in the responses of the preparer.

What are the legal rights and obligations of the 234 households?

Based on Article 446, there is a disputable assumption that structures, plants and trees were made by SBMA unless contrary proofs are presented. However, the residents may present contrary proofs to defeat this disputable presumption.

Article 453 provides that if the 234 households and SBMA are all in bad faith, the rights of both parties shall be the same as though both acted in good faith. It should be noted that good faith is always presumed, and upon him who alleges bad faith on the part of the possessor rests the burden of proof (Art. 527 Civil Code). The burden of proof is on SBMA to show that all households in Agusuhin acted in bad faith.

If SBMA is successful in showing that all households in Agusuhin acted in bad faith in so far as to the 234 households, SBMA has two options based on Article 448. SBMA may appropriate, as his own, all the works, sowing or planting after payment of indemnity for necessary expenses and useful expenses.

Necessary expenses (Gastos Necesarios) are defined as those without which the thing would physically deteriorate or be lost; hence those made for the preservation of the thing (4 Manresa 270-271).

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Useful expenses (Gastos Utiles) are defined as those that add value to the property (Aringo v. Arenas 14 Phil. 263) or increase the object's productivity (Valenzuela v. Lopez, 51 Phil. 279) or useful for the satisfaction of spiritual or religious yearnings (Anacleto Gongon v. Tiangco (C.A.) 36 (O.G. 822) or give rise to all kinds of fruits (Rivera v. Roman Catholic Archbishop of Manila, 40 Phil. 717). It should be noted that households have the right of retention before they are paid for necessary and useful expenses.

Our courts have decided that the following are useful expenses. Expenses incurred in an irrigation system (Aringo v. Arenas 14 Phil. 263), erection of a chapel (Anacleto Gongon v. Tiangco (C.A.) 36 (O.G. 822), making artificial fishponds (Rivera v Roman Catholic Church, 40 Phil. 717), clearing up land formerly thickly covered with trees and shrubbery (Toquero v Valdez, 35 OG 1799).

Article 548 provides that expenses for pure luxury or mere pleasure shall not be refunded to the possessor in good faith; but he may remove the ornaments with which he has embellished the principal thing if it suffers no injury thereby, and if his successor in the possession does not prefer to refund the amount expended.

Pure luxury or mere pleasures are those which add value to the thing only for a certain determinate persons in view of their particular whims. They are neither essential to the preservation nor useful to everybody in general (4 Manresa 274-275).

The second alternative of SBMA under Article 448 is to oblige the households to pay the price of the land and the one who sowed, the proper rent. However, in this case, it is not a viable alternative because the land is not classified as alienable and disposable land. Hence, even if some of the residents are desirous to buy the land, the land is classified as alienable land and beyond the commerce of man. Second, the option to sell the land is given to the owner because he has an older title and not to the residents of Sitio Agusuhin to buy the land. Third, the proposed project will require the use of the land in Sitio Agusuhin and therefore selling the land to the residents is not an option.

What are the legal rights and obligations of the 121 households and households that may settle in the future?

It this case, SBMA acted in good faith because upon his knowledge of the intrusion of households into his territorial jurisdiction, he issued an order in 2001 and again in 2005 to the forest rangers and other SBMA personnel opposing the migration.

Being in good faith, SBMA may demand the demolition of the work, or that the planting or sowing be removed, in order to replace things in their former conditions at the expense of the person who built, planted or sowed (Art. 450 CC). These households lose what is built, planted or sown without right to indemnity (Art. 449 CC). SBMA is entitled to damages from the households (Art. 451 CC). However, these households are entitled to reimbursement for the necessary expenses of preservation of the land (Art. 452 CC).

It is clear based on the above discussions the rights and obligations of the parties that will be involved in involuntary resettlement.

What will be the basis of valuation for indemnity?

Indemnity is defined as "that what is given to a person to prevent his suffering damage".

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(Bouvier's Law Dictionary, Third Edition) Hence, for a person not to suffer damage as a result of being deprived of his property, he should receive just compensation. Just compensation is defined as the full and fair equivalent of the property taken from its owner. The measure is not the taker's gain, but the owner's loss. The word "just" is used to intensify the meaning of the word "compensation" and to convey thereby the idea that the equivalent to be rendered for the property to be taken shall be real, substantial, full and ample *(Association of Small Landowners in the Philippines, Inc. v. Secretary of Agrarian Reform, 175 SCRA 343, July 14, 1989).*

Market value is "that sum of money which a person desirous but not compelled to buy, and an owner willing but not compelled to sell, would agree on as a price to be given and received therefor." *(National Power Corporation v. Chiong, supra, per Quisumbing, J.; Eslaban Jr. v. Vda. de Onorio, supra).*

Section 5 of RA 8974 provides that in determining just compensation, the court may consider, among other well-established factors, the following relevant standards: xxx (b) The developmental costs for improving the land; xxx (e) The reasonable disturbance compensation for the removal and/or demolition of certain improvement on the land and for the value of improvements thereon;

Replacement Cost -- Structures will be compensated at their replacement cost. For houses and other structures, it is the market value of the materials to build a replacement structure with an area and quality similar to or better than those of the affected structure. The cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes are also included in the replacement cost. In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account, nor is the value of benefits to be derived from the project deducted from the valuation of an affected asset.

Assessed Value – Compensation for trees and crops shall be based on the assessed value based on the provincial assessor, municipal assessor, Department of Agriculture and Department of Environment and Natural Resources, whichever is the highest.

It should be noted the pre 2001 census settlers have the right of retention over the structure, trees and standing crops until fully paid. The post 2001 census settlers lose their structures, trees and standing crops without the right to indemnity.

Income Restoration -- Restoration of the incomes of all affected persons is one of the key objectives of this resettlement policy. After resettlement, all of the affected persons should have incomes, which are at least equivalent to their pre-project income levels.

What are the resettlement options of SBMA?

Based on the discussions, there are two types of encroachers in Sitio Agusuhin, the 234 households that settled in the area before 2001 census (pre-2001 census settlers) and those that settled or will settle after the 2001 census (post 2001 census settlers).

Pre-2001 Census Settlers -- As explained earlier, these are the 234 households who have settled in Sitio Agusuhin before the 2001 census conducted in behalf of SBMA. Under the Civil Code of the Philippines, they are entitled to the following;

Indemnities:

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1. Necessary expenses for the preservation of the land
2. Useful Expenses for the preservation of the land
3. Structures
4. Trees and crops

Based on Article 446, which was discussed earlier, there is a disputable assumption that structures, plants and trees were made by SBMA unless contrary proofs are presented. However, the residents claiming such structures, plants and trees may present contrary proofs to defeat this disputable presumption.

Disturbance Allowance - The concept of disturbance allowance is based on the principle of compensating the lost income because of the eviction of a household up to the time that they are relocated or has found a suitable place to settle. While the law does not require it, equity and fairness dictate that a household should be compensated for the lost income that it should have earned if not for the project, which intervened and interrupted its normal and daily routine.

There are two components in computing the disturbance allowance. There will be a fixed amount applicable for all pre 2001 census settlers while a graduated premium will be given based on their length of stay in Agusuhin. Hence, the longer a pre 2001 census household resided in Agusuhin, the larger is his premium.

Relocation – Based on the FGDs conducted for the project, the following are the characteristics that an acceptable relocation site must possess:

1. Near or accessible to the proposed Hanjin project
2. Near or accessible to the sea (for their bancas)
3. Potable water;
4. Power and electricity and an adequate power distribution system;
5. Sewerage facilities and an efficient and adequate solid waste disposal system; and
6. Access to primary roads and transportation facilities.
7. Provisions of basic services and facilities on health and education

Qualifications for Relocation – The qualifications that a household must possess and who is listed in the census conducted in 2001 census are lifted from the Urban Development and Housing Act (RA 7279).

1. Must be a Filipino citizen;
2. Must be an underprivileged and homeless citizen,
3. Must not own any real property whether in the urban or rural areas; and
4. Must not be a professional squatter or a member of squatting syndicates.

"Underprivileged and homeless citizens" refers to individuals or families residing in Agusuhin whose income or combined household income falls within the poverty threshold as defined by the National Economic and Development Authority and who do not own other housing facilities aside from that located in Agusuhin.

"Professional squatters" refers to individuals or groups who occupy lands without the

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express consent of the landowner and who have sufficient income for legitimate housing. The term shall also apply to persons who have previously been awarded homelots or housing units by the Government but who sold, leased or transferred the same to settle illegally in the same place or in another area.

"Squatting syndicates" refers to groups of persons engaged in the business of squatter housing for profit or gain;
Post 2001 Census Settlers - These households entered forcibly or through stealth and build houses knowing fully well that the land belongs to SBMA who have a policy against encroachers. The recent migrants settled in the area knowing fully well of the project and will try to be a part of the beneficiaries of resettlement that will take place in the near future. There were reports in the community that certain unscrupulous persons are collecting money ranging from 5,000 to 10,000 per household to build their houses. There was also an alleged agreement that in cases that these newly constructed houses will be give compensation, 50% of the proceeds will be paid to these unscrupulous persons. These households are patently in bad faith because there is a dishonest intention to take advantage of SBMA and/or the project proponent.

SBMA may demand the demolition of the work, or that the planting or sowing be removed, in order to replace things in their former conditions at the expense of these post June households who built, planted or sowed (Art. 450 CC). These households lose what is built, planted or sown without right to indemnity (Art. 449 CC). SBMA is entitled to damages from the households (Art. 451 CC). However, these households are entitled to reimbursement for the necessary expenses of preservation of the land (Art. 452 CC).

Impact

The project proponent needs an area of around 300 hectares to locate their project in Sitio Agusuhin. The 2001 census in behalf of SBMA revealed that there were 234 households in the sitio. However, in the survey conducted by this study on the third week of September 2005, the households grew to 355 households.

Based on the agreement between the proponent and SBMA, the latter would be responsible for the issue on resettlement. However, this study would recommend the following;

For the pre 2001 census settlers, they are entitled for indemnity for the necessary expense, useful expenses, structures, trees and standing crops. In addition, they are also entitled to disturbance allowance and relocation (see discussions under legal framework).

For the post 2001 census settlers, they are just entitled for necessary expenses for the preservation of the land (Art.452 CC). These households lose what is built, planted or sown without right to indemnity (Art. 449 CC). SBMA may demand the demolition of the work, or that the planting or sowing be removed, in order to replace things in their former conditions at the expense of these post June households who built, planted or sowed (Art. 450 CC). SBMA may sue for damages from the households (Art. 451 CC).

Proposed Mitigating Measure

The proponent/SBMA will be guided by the following principles in determining the compensation and monetary awards.

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Impact

Replacement Cost - Structures will be compensated at their replacement cost. For houses and other structures, it is the market value of the materials to build a replacement structure with an area and quality similar to or better than those of the affected structure. The cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes are also included in the replacement cost. In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account, nor is the value of benefits to be derived from the project deducted from the valuation of an affected asset.

Proposed Mitigating Measure

Assessed Value – Compensation for trees and crops shall be based on the assessed value based on the provincial assessor, municipal assessor, Department of Agriculture and Department of Environment and Natural Resources, whichever is the highest.

Impact

Presence or Increase in the Number of New Entrants/Settlers in the Affected Communities- During the collection of data in Sitio Agusuhin, it was observed that new structures are being built in the area in anticipation of the payment of compensation of the proponent or SBMA. There were unconfirmed reports that some groups are collecting fees from persons who wish to put up new structures.

The proponent was assured by SBMA that the issue of resettlement will be handled by SBMA. SBMA should monitor and control the influx of new migrants to the sitio by mobilizing its security force to prevent additional migrants. If this is not sufficient because of local political dynamics, SBMA should coordinate with the Philippine National Police (PNP) and get additional manpower to implement a moratorium of migrants.

In addition to monitoring and controlling the influx of new migrants, an early formulation and implementation of the RAP will curtail the influx of additional settlers since the criteria, mechanisms, procedures, and other parameters for compensation and relocation would have been identified in the RAP.

Resettlement Issues

There is a proposed lease agreement between SBMA and HHIC- Phil Inc. for the use of the land in Sitio Agusuhin covering a 300-hectare area. Under the proposed lease agreement, SBMA will undertake the resettlement of all affected residents in the area and promises to hand over the project site to HHIC- Phil Inc. free from any human habitation on or before March 31, 2006. The signing of the lease agreement is scheduled on the last week of February. It is expected that the Presidents of the Republics of the Philippines and Korea will attend the signing ceremonies to highlight the importance of this project to the two countries. Presently, SBMA has been negotiation with the affected households in Sitio Agusuhin on relocation and compensation issues.

HHIC- Phil Inc. will be provide financial support for the relocation and compensation for the affected residents in the proposed site. The financial resources needed to settle these issues will be coursed through SBMA. The financial resources are private

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in nature because they came from a private entity. SBMA as the legal institution to undertake resettlement will negotiate and implement resettlement.

This arrangement is being undertaken to facilitate the negotiation with the affected residents because as private money, the transactions will not be under the scrutiny of the Commission on Audit. This will directly benefit the affected residents because they will receive compensation over and above the government approved prices for structures, trees and crops. In addition, it is not remote that the demands of some of the affected residents will dramatically go up and become unreasonable if they knew that HHIC- Phil Inc. is bankrolling the project.

For those residents who are desirous of being resettled, the resettlement will be located outside of SBMA territory. The likely location of the site will be within the municipality of Subic and the local government unit in cooperation with SBMA will provide for the site and the required basic services.

Again, the project proponent HHIC- Phil Inc., will provide the financial support for the resettlement site, basic services and replacement for the community structures such as the schools, day care centers and religious centers. The LGU of Subic will be greatly involved because they will be the receiving LGU for the relocatees.

It is expected that some misunderstandings will arise in the formulation and/or implementation of the relocation action plan (RAP). In order to facilitate the smooth implementation of the RAP, a massive information campaign should be undertaken by SBMA on the basis of computation of compensation, the proposed relocation site and all the mechanics of resettlement. This will ensure that the affected residents are fully aware of the plan that will greatly affect their lives.

Presently, there is an on-going negotiation with the residents of Sitio Agusuhin. It is obvious that there is a relocation action plan being formulated and/or implemented. Based on reports from the field, there is an on-going information and education campaign regarding the RAP. This should be printed in the vernacular and distributed to the sitios. In addition, a general community meeting should be called to explain and answer issues and concerns of the affected residents before actual relocation and payment are undertaken.

SBMA should also create a grievance mechanism to address the concerns and issues of the affected residents on resettlement issues. This is a social safety valve mechanism to facilitate the resolution of issues and concerns connected with the resettlement. An ad-hoc committee should be established composed of representatives of HHIC- Phil Inc., SBMA, LGU of Subic and Sitio Agusuhin. The representative of Sitio Agusuhin may come from the Agusuhin Neighborhood Association, the biggest community organization in the sitio.

In is very important that the Ecology Center will not be involved in these resettlement issues because of the possibility of conflict of interest. Ecology Center is mandated to process the ECC application of the proponent. If the center will also be involved in the resettlement issues, then it would be approving the relocation action plan that the center itself has prepared and implemented. It would be very prudent for the formulation and implementation of the relocation action plan to be undertaken by a different entity or department of SBMA to preclude any suspicions of any irregularities.

It is also prudent and necessary to have a multipartite monitoring team to monitor and evaluate the implementation of the relocation action plan to safeguard the interests of

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the affected households. The monitoring team should be headed by the Ecology Center to ensure that plans and programs promised by the proponent, SBMA and Subic will be fulfilled. The monitoring team should include representatives of the different community organizations of Sitio Agusuhin.

4.2.2.2 Construction Phase

The construction phase will involve the movement and operation of construction equipment and the preparation of the site for the erection of necessary equipment and relevant structures. These activities are expected to affect the existing environment within the primary impact zone. The following construction activities are predicted to impact the environment:

- Land clearing and grubbing
- Earthworks
  - Grading
  - Excavation
  - Dredging
  - Reclaiming
  - Filling and Compaction
- Construction of Facilities

Physical Environment

Topography

Earthmoving activities will alter the existing topography of the project area. Some of the areas will either be excavated or filled to conform with the project design. This impact is unavoidable and permanent.

Geology

Impact on the geology of the project site and the surrounding areas resulting from excavation and dredging will require removal of the upper portion of the recent alluvial and marine deposits. This impact is unavoidable and permanent.

Excavated/dredged materials will be used as fill materials for the reclaimed areas.

Soils and Land Use

Earthworks (clearing, excavation and grading) in the will expose bare soil susceptible to erosion during intense rainstorms. This impact would still be minimal and short term because of the relatively existing flat terrain.

A phase-by-phase construction, which will be divided into three phases, will be implemented to minimize the magnitude of erosion. Additional temporary erosion control measures like siltation ponds, sediment traps and berms and re-routing of surface run-off will alleviate this adverse impact.

The proposed site is a part of the territory under the Subic Bay Metropolitan Authority (SBMA). The proponent will have long term lease a 300-hectare land from SBMA. The

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portion of land to be occupied by the proponent is classified as an industrial area. Presently, the land is being occupied by a number of households and farms including some fishponds. However, these households have no legal rights over the property, living in the area by mere toleration of SBMA.

SBMA do not derive any income from the area because there are neither agreements nor leases between SBMA and the households. The construction of the ship building facility will enhance the industrial development of the area and will result in the substantial increase in local revenues of SBMA from lease payments and permits and licenses.

The proponent shall promptly pay its lease payments and other permits and licenses to SBMA to ensure adequate and timely financial resources for SBMA.

A portion of the 300-hectare area needed by the project is under the community-based forestry management agreement between SBMA and the Agusuhin Community Reforestation Association (ACRA).

The proponent and/or SBMA shall assess the trees, crops and permanent improvements and properly compensate the affected farms/persons based on a reasonable valuation of the improvements.

A municipal ordinance No. 98-02 declared the areas of Binictican Point to Sampaloc point as Subic Marine Sanctuary and Reservation Area. Municipal Ordinance No. 2000-07, which was signed by the mayor on February 10, 2005, extended the scope of the sanctuary to include the "areas from Sitio Agusuhin, Nagyantok, Kinabuksan, Nagbayukan, Naglatorre to Binictican Point."

Section 2 of the ordinance provides that "any marine, and seashore or offshore activity not related to the protection and conservation of the bay's ecosystem is deemed unauthorized. Provided that the consultative process is undergone and/or local government certifications including pertinent permits are secured."

The proponent and/or SBMA shall conduct consultations with the local officials of Subic and secure the necessary documents from the municipality

Hydrology

The project design would require the alteration of the natural drainage within the project area. The Agusuhin River and the North Agusuhin Creek stream courses will have to be modified to allow construction of the facilities.

Adequately designed channels based on anticipated flood events will be constructed to contain and manage streamflows within the project area.

Hydrogeology and Water Resources

Abstraction of groundwater during construction could result to seawater intrusion especially in areas nearer to the shore. Concreted surface would inhibit precipitation from percolating through the alluvial deposits thereby reducing groundwater recharge.

The project, which is divided into three phases, will span 10 years (2005 to 2015). During this period, construction and operation of the shipbuilding facilities will occur simultaneously between project phases. For domestic water needs, a consumption rate

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of 140 liters per person is assumed. **Table 4-2** enumerates the anticipated water demand of the proposed development.

Table 4 - 2. Updated Projected Water Demand (m^3/day)

Water Usage	Phase 1	Phase 2	Phase 3	Total (Phases 1 to 3)
	2005 to 2007	2008 to 2010	2011 to 2015	
Domestic	615	987	372	1,974
Industrial	1,065	1,713	648	3,426
Total	**1,680**	**2,700**	**1,020**	**5,400**

Source: HHIC- Phil Inc.

Seawater intrusion due to continued over abstraction of groundwater is almost irreversible. It would be prudent for the proponent to consider surface water (Agusuhin River and North Agusuhin Creek) to augment groundwater.

The Agusuhin catchment is practically devoid of trees which impedes surface runoff and promotes groundwater infiltration. As part of its corporate responsibility in improving the environment, the proponent in association with the SBMA and with the local government could embark a watershed management plan to protect and enhance the Agusuhin watershed.

The proponent would closely monitor groundwater quality to determine the extent (if any) of sea water intrusion.

Water Quality

Land clearing and excavation – This activity could result in silted run-off from the excavated areas. Since the project site experiences rainfall from June to September, rivers and creeks in the surrounding area like Agusuhin River and North Agusuhin Creek and eventually Subic Bay could be susceptible to siltation.

To prevent siltation of the rivers/creeks and the bay, provision of temporary drainage canals with silt traps or basin will be done to intercept washed out soil particles particularly in areas of excavation. Where natural depression is available, surface runoff will be directed into it by a temporary ditch to allow settlement of suspended soils.

Oil and Grease spillage - Spillage and washings of oil and grease from heavy construction equipment can produce thin film on the surface of water which can reduce the rate of re-oxygenation of the river/creek and consequently affect the biological life in water.

To minimize this potential impact, temporary containment canal around the perimeter of the motor pool will be constructed. The run-off laden with oil spills will be directed to an oil-water separator to remove oil from the water.

Reclamation and Dredging Activities - The Hanjin Shipbuilding Facility involves the reclamation and dredging of a relatively large area in the vicinity of the former CGS (Concrete Gravity Structure) casting basin. Dredging and reclamation will be done using grab dredgers.

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Dredging and other construction works in water will cause re-suspension of sediments and turbid water. Re-suspension of sediments in water leads to an increase in the level of suspended solids (SS) and in the concentration of organic matter, possibly to toxic or harmful levels. It also reduces sunlight penetration.

Reclamation has also potential adverse effects on the level of SS. This construction activity involves a large volume of reclamation, the material for which will be taken mainly from land excavation and dredging of sea bottom

The possible impacts of the required dredging and reclamation activities of the shipbuilding project on the water quality conditions in the area were assessed. The models implemented in the study are described below.

Coastal Oceanographic Model

To determine the dispersion of sediments from the project site in Subic Bay, the temporal and spatial variations of currents and sea surface elevation are needed as input. These can be determined using a coastal circulation model. The basis of the circulation model used in this study is the modified circulation model of Koutitas (1988) with some modifications introduced by the present author to fully describe the physical processes affecting the coastal marine environment of interest. Including momentum diffusion, the partial differential equations describing the non-linear, time-dependent circulation of a nearly horizontal geophysical domain can be written as:

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+\left(0.2u+\frac{a_x}{40}\right)\frac{\partial u}{\partial x}+\left(0.2v+\frac{a_y}{40}\right)\frac{\partial u}{\partial y}=fv-g\frac{\partial \zeta}{\partial x}+\frac{\tau_{sx}}{\rho h}-\frac{\tau_{bx}}{\rho h}+\nu_h\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}\right) \quad (1)$$

$$\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+\left(0.2u+\frac{a_x}{40}\right)\frac{\partial v}{\partial x}+\left(0.2v+\frac{a_y}{40}\right)\frac{\partial v}{\partial y}=-fu-g\frac{\partial \zeta}{\partial y}+\frac{\tau_{sy}}{\rho h}-\frac{\tau_{by}}{\rho h}+\nu_h\left(\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}\right) \quad (2)$$

$$\frac{\partial \zeta}{\partial t}+\frac{\partial (uh)}{\partial x}+\frac{\partial (vh)}{\partial y}=0 \quad (3)$$

where u and v are the depth-averaged current components in the x and y-axes respectively, t is the time, a_x and a_y are wind stress-related variables, ζ is the sea surface elevation, f is the latitude-dependent Coriolis parameter, g is the gravitational acceleration, τ_s is the wind stress acting over the sea surface, ρ is the sea water density, h is the total water depth (still water level h_o + ζ), and ν_h is the horizontal eddy diffusion coefficient. The surface stress terms in Equations (1-2) are generally assumed as quadratic functions of the wind W measured at anemometer level with components in the x and y -axes given by

$$\tau_{sx}=\rho_a c_d W_x W \quad , \quad \tau_{sx}=\rho_a c_d W_y W \quad (4)$$

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where ρ_a is the air density, c_d is a drag coefficient and $W_{x,y}$ are the wind components in the *x* and *y*-axes, respectively.

The Coriolis parameter *f* is equal to $2\,\Omega x\, sin\, \Phi$ in which Ω is the angular rotation rate of the earth and Φ is the latitude. The effect of the Coriolis force is generally weak in low latitudes but nevertheless, it was included in this study since it is one of the physical factors that can affect the current patterns in the study area.

It should be noted that Equations (1-3), while written in two-dimensional forms, can be used to assess the three-dimensional structure of the horizontal flow velocities. It is formulated by assuming that the current profile in the vertical is a quadratic function of the water depth, i.e. $u(z) = Az^2 + Bz + C$, in which *z* is the vertical coordinate and *A,B* and *C* are arbitrary constants to be derived. With appropriate boundary conditions, Koutitas (1988) derived the solution for the horizontal current profile in the vertical to be:

$$u(z)=\left[\frac{3}{4}a-\frac{3}{2}u\right]\left[\left(\frac{z}{h}\right)^2-1\right]+a\left[\frac{z}{h}+1\right] \qquad (5)$$

where *a* represents the relative contribution of the wind stress at the surface and is given by

$$\text{in}\quad a=\frac{\tau_s h}{\rho \nu} \qquad (6)$$

where ν is the eddy viscosity coefficient. The assumption for a constant value for ν at the surface has been retained as in Koutitas (1988). The present circulation model is generally quasi-three dimensional since currents at any depth can be estimated from model calculations using Equation (5). A slight modification has been introduced in the present model by assuming that the bottom friction is a quadratic function of the depth-mean currents corrected with the surface stress terms and has components in the x and y-axes given by

$$\frac{\tau_{bx}}{\rho h}=k\frac{u}{h}\sqrt{u^2+v^2}-\frac{1}{2}\frac{\tau_{sx}}{\rho h}\quad;\quad\frac{\tau_{by}}{\rho h}=k\frac{v}{h}\sqrt{u^2+v^2}-\frac{1}{2}\frac{\tau_{sy}}{\rho h} \qquad (7)$$

where *k* is a bottom friction coefficient. This bottom friction formulation implies that when the depth-mean currents are zero, bottom friction has a non-zero value and acts in the direction of the surface shear. This formulation is more consistent with typical morphologies of observed coastal currents where bottom shear never approaches zero. The present circulation model based on Equations (1-3) is generally a modified form of the momentum and mass continuity equations. It can be used, in conjunction with the preceding equations, to describe the simultaneous evolution of the wind and the tide-driven circulation in the coastal zone by incorporating an appropriate tidal forcing at the open boundary of the computational domain. A Fourier series describing the tidal variation at the open boundary is described below. The numerical solution of the momentum and mass continuity equations followed an explicit finite difference method similar to Koutitas (1988) subject to the CFL criterion for computational stability. As far as the CFL criterion is satisfied, the results of the numerical model are accurate as validated from previous observations of currents and sea surface elevation in Subic Bay.

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- Open Boundary Condition of the Circulation Model

Computational boundary conditions related to the entry of tides have to be specified in the open boundary of the bay. This is to incorporate the action of tide to the general wind-driven circulation described above. While tidal currents or tidal heights can be both prescribed at the open boundaries, the specification of tidal elevation using a suitable form of Fourier series has generally been used in a number of oceanographic models with a reasonable degree of accuracy. The present model prescribes the variation of the tidal level at the open boundary and incorporates the effect of the four major tidal constituents' i.e. main lunar diurnal (O_1), the solitary lunar diurnal (K_1), the main lunar semi-diurnal (M_2) and the main solar semi-diurnal (S_2). The truncated Fourier equation describing the temporal variation of the tidal elevation at the open boundaries is given by

$$\zeta(t) = a_0 + a_1\cos(\omega_1 t - p_1) + a_2\cos(\omega_2 t - p_2) + a_3\cos(\omega_3 t - p_3) + a_4\cos(\omega_4 t - p_4) \qquad (8)$$

where $\zeta(t)$ is the sea surface elevation due to the tide at the open boundary as a function of time t, a's represent the amplitudes, ω's are the frequencies, and p's are the phases of each of the four tidal constituents. Using hourly tidal observations, the amplitudes and phases of the tidal constituents were obtained.

Sediment Dispersion Model

Dispersion of suspended sediments in coastal regions is generally accomplished by the combined action of wind and tide-driven currents. It is facilitated by two major physical processes which include advection and diffusion. Advection is basically mechanical transportation of pollutants by water currents. Currents tend to redistribute pollutants within an ecosystem through advection. In this regard, the non-linear interaction of wind and tide-driven currents is of primary importance as they are responsible in the long-distance and long-term movement of the suspended sediments.

The general equation describing the dispersion of sediments in a two-dimensional coastal environment of limited extent is generally represented by a partial differential equation of the form

$$\frac{\partial c}{\partial t} = -u\frac{\partial c}{\partial x} - v\frac{\partial c}{\partial y} + K_x\frac{\partial^2 c}{\partial x^2} + K_y\frac{\partial^2 c}{\partial y^2} + S - \frac{w_s c}{h} \qquad (9)$$

where c is the depth-averaged sediment concentration in mg/L, u and v are the depth-averaged components of the currents obtained from the coastal circulation model, K_x and K_y are dispersion coefficients along the x and y-axes respectively, S is the source term and w_s is the settling velocity of the suspended sediments which can be assumed constant. The source term is dependent on the dredging and reclamation activities around the project site. The temporal and spatial variation of pollutant concentrations as dictated by advection and diffusion processes can be determined quantitatively using this equation.

The numerical solution of this equation was based on the PEERS[1] Pollution Model

[1] PEERS Consultancy & Research (peerscom@yahoo.com)

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(PPM) developed by the author. This numerical technique is 4th order accurate in space. The scheme itself is mass-conservative and can handle sharp concentration gradients without the wiggle instability problem associated with many numerical schemes. Therefore, there is no numerically-generated mass falsification of calculated suspended sediment concentrations with the present dispersion model.

- Open Boundary Condition of the Sediment Dispersion Model

The sediment transport model has one open boundary where pollutant concentrations need to be determined or specified. This open boundary is located in the southward portion of the bay. The sediment concentrations in the open sea boundary of the bay can be determined using a uniform flux assumption, *i.e.*

$$\frac{\partial^2 c}{\partial n^2} = 0 \qquad (10)$$

where c is the sediment concentration at the boundary and n is the axis normal to the boundary. In a number of applications, the pseudo-implicit form of the Orlanski Radiation Condition as described in Rivera (1997) is superior to Eq. (10). It describes the propagation of the sediment plume towards the open boundary without back reflection inside the computational domain. The present model uses a combination of boundary conditions for sediment dispersion towards the open sea.

Subic Bay Simulation Input Data

A primary input to the computational models was the depth distribution throughout Subic Bay. The most recent bathymetric map of Subic Bay was digitized for this purpose. Every 250 m x 250 m, a depth value is obtained at the middle of the computational grid. This was smoothed and the model bathymetry was shown in **Figure 3-18**.

Initial runs using the numerical models described above used as input the following conditions:

Table 4 - 3. Input Data for the Oceanographic and Sediment Dispersion Simulation.

Input Parameter	Values
Model Grid Distance	250 m
Time Interval for Circulation Model	5 seconds
Time Interval for Sediment Dispersion Model	1 minute
Mean wind conditions (2 meteorological scenarios)	3 m/s from NE and SW
Tidal condition (amplitudes and phases of tidal constituents)	Computed for O_1, K_1, M_2 and S_2 tides
Maximum sediment concentration at source point	250 mg/L
Sediment Diffusion coefficient (constant along x and y)	1.0 m^2/s
Settling velocity of suspended sediments	0.72 m/hr

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Mean meteorological wind conditions of 3 m/s from the northeast and 3 m/s from the southwest are considered in the modeling study since these are observed to be the dominant physical conditions affecting the Subic Bay area. It should be noted that some parts of the Subic Bay area fall within Class SB waters of the Ecology Center of Subic Bay Metropolitan Authority (SBMA) and the Department of Environment and Natural Resources (DENR) and should satisfy the 30 mg/L as maximum TSS increase. These include the protected areas of Grande Island, Triboa and Ilanin Bays. The sediment dispersion simulation done in this study is therefore necessary to determine if these protected areas will be vulnerable to water quality problems during the dredging activities so that a mitigation measure could be set in place.

The use of a maximum sediment concentration of 250 mg/L is tantamount to assuming a constant source term in the advection-diffusion equation. This is considered realistic considering current engineering practices during dredging and reclamation where state-of-the-art dredger and machineries are employed.

The relative abundance of fine sand and silt particles with mean settling velocity of about 0.72 m/hr was also used in the modeling study. This value implies that only the fine materials with a relatively low settling rate would be transported away from the project site. This normally occurs in the coastal environment whereby the coarse particles settle quickly and only within short distances away from the project site. With the weak transport capacity of currents in Subic Bay, this assumption is justified.

Sediment Impact due to the Project

The simulations conducted in this modeling study made use of mean climatological conditions concerning winds and tides. The sediment dispersion model also used a constant TSS concentration as a source function during the dredging and reclamation activities. While these construction activities may create a time-varying TSS concentration, the use of a maximum and uniform concentration of about 250 mg/L, gives a conservative estimate of the possible levels of suspended sediment concentration that can be expected throughout the affected areas.

Assuming that there is no protection or mitigation measure (such as silt curtain) that may contain the suspended sediments in the reclamation and dredging area, the model was run using the results of the coastal oceanographic model described above. The resulting spatial and temporal variations of the suspended sediment concentration are shown in **Figures 4-2** and **4-3.**

- Wet Season Sediment Dispersion

During the wet season, the sediment dispersion model predicts that the suspended sediments would generally disperse throughout the northern portion of the project site (**Figure 4-2**). The predicted TSS concentrations appear to be high only at the dredging and reclamation site. The protected areas of Grande Island, Triboa and Ilanin Bays are not affected at all by the suspended sediments from the project. This is due to the considerable distance of these protected areas from the protected areas. It should be noted that re-suspended sediments during the construction activities normally settle within short distances around the project site.

While the tidal currents in the bay would oscillate back and forth, the influence of the southwest monsoon winds facilitate the movement of the suspended sediments towards the north.

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- Dry Season Sediment Dispersion

During the dry season, the plume of suspended sediments from the dredging and reclamation sites is simulated to be similarly confined in a relatively small area. **Figure 4-3** shows the model simulation result during the dry season (northeast monsoon season). However, sediments during this season appear to disperse towards the south as shown in the figure. This is due to the prevailing wind direction during this season which is from the north to northeast. In general, the water quality standard of 30 mg/L TSS concentration would be situated just within the project site and does not cover a large portion of Subic Bay. The spatial extent and concentrations of TSS are acceptable in a water quality management point of view since the major portion of the bay and the protected areas of Grande Island, Triboa and Ilanin Bays are not affected at all. Even Pequena Island is not threatened by the dredging activities during this season. As shown in **Figure 4-3**, the project does not contribute at all to the sediment-induced turbidity of the protected waters of Subic Bay and hence would not be expected to impair the marine ecology of the protected areas.

Proposed Mitigating Measure

The coastal currents and the dispersion of suspended sediments in Subic Bay were analyzed using state-of the-art computational modeling tools. Using realistic forcing functions for wind and tide in the area, it was found that suspended sediments would hardly affect the protected areas of the bay (e.g, Grande Island, Triboa and Ilanin Bays).

The proposed mitigating measure is silt curtain, the TSS levels would not exceed the water quality standard in most parts of the bay. Protection of water quality requires, therefore, the implementation of mitigation measure around the dredging and reclamation sites during the construction stage. As an additional water quality management option, the reclamation and dredging activities may not be carried out 24 hours a day so that TSS levels would remain acceptable in the areas concerned. A work gap would allow the settling of suspended sediment particles and would result to lower TSS concentrations. This mechanism, combined with natural dilution and dispersion of the suspended sediments would result to TSS concentrations which are considerably lower than those predicted by the model without mitigation measure.
On the other hand, without mitigation measure such as silt curtain, the water quality standard of 30 mg/L is exceeded only in a very small localized area where the dredging and reclamation activities occur.

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Figure 4 - 2. Predicted Increase in TSS (mg/L) During Construction Activities (Wet Season).

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Figure 4 - 3. Predicted Increase in TSS (mg/L) During Construction Activities (Dry Season)

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Solid and Domestic Wastes

Generation of Solid Waste - Construction activities are expected to generate minimal amount of construction spoils and waste. These will include excavated soils, form lumber, empty cement bags, empty containers, wooden pallets, domestic spoils from the workers' camp and others.

Mitigating measures include:

1. *All waste shall be disposed at the SBMA landfill. No waste landfill shall be established within the construction site. Sufficient waste receptacles shall be properly marked and placed at all work areas.*
2. *No disposal of construction debris shall be undertaken without securing a Waste Transport Permit from the Freeport Service Corporation.*
3. *Open burning of any waste shall be strictly prohibited at any time.*
4. *Solid and liquid waste form marine vessels shall be collected for on shore disposal. Ballast water shall not be discharged in the port.*
5. *All land spoils shall be used for backfill for the void areas created due to putting of piles to meet the designed elevation.*
6. *If ever there shall be excess land spoils a spoils disposal area shall be designated. The land spoils shall be compacted and appropriately designed and situated to ensure minimal impact to the waterways, marine ecosystem and its surrounding environment. The area shall be established and operated during the construction and signs and posters shall be posted for identification. The area shall be rehabilitated and planted with endemic plant species after its use.*
7. *All sub-contractors and employees of the project will be required to comply with the project's Ecological Waste Management Program and RA 6969 for hazardous wastes.*

Air Pollution from Construction Equipment

Air emissions from various diesel and gas powered construction equipment and generator set will slightly increase the local ground level concentrations of nitrogen dioxide and carbon monoxide around the areas where these equipments are operating.

The resulting air quality is not expected to significantly deteriorate since construction equipment are not regarded as major air pollution sources and they are not of sufficient number to impact ambient air quality. However, Hanjin will monitor the ambient air quality and the maintenance of equipment.

Dust Generation

Construction activities are sources of dust emissions that may have significant but temporary impact on local air quality. It is expected that the ambient level of total suspended particulate (TSP) will increase around the construction site during site preparation that involves the use of earthmoving equipment. The amount of dust generated by construction activities is generally and positively correlated with the silt content of the soils and the wind speed and negatively correlated with the soils moisture content. A large portion of the increase will result from equipment traffic over temporary roads at the construction site. This problem will be particularly true during the dry season, which last from November to April. Frequent rains during the rest of the year

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will moderate the generation of dust.

Because of the short-term nature of construction activities, wet suppression will be employed as a dust control measure at the construction site. Water from the nearby waterbody could be tapped as a potential water source.

Noise Generation

The operation of heavy construction equipment will add to the ambient noise level at the project site. The elevated noise levels will impact the surrounding area. The elevated noise level near the project site is considered adverse but this will be temporary and intermittent. This impact however, is considered insignificant as the nearest residential area will be the worker's dormitory.

The expected noise levels from typical construction equipment, which will be used during construction, are shown in **Table 4-4**. A conventional impact pile driver emits the loudest noise among the construction equipment listed in the table. This equipment may be used in foundation works for the boiler house. Pile driving will be intermittent and will not be conducted during nighttime.

Table 4 - 4. Typical Noise Levels from Construction Equipment (no attenuation).

Equipment	Typical sound pressure levels, dB (A) at 15 m	Predicted noise levels at various distances, dB (A)			
		30 m	60 m	120 m	240 m
Compressor	75 - 86	69 - 80	57 – 68	57 – 68	51 – 62
Backhoe	71 – 92	65 - 86	53 – 74	53 – 74	47 – 68
Compactor	72 – 74	66 - 68	54 – 56	54 – 56	48 – 50
Concrete mixer	75 – 85	69 - 79	57 – 67	57 – 67	51 – 61
Concrete pump	80 – 82	74 - 76	62 – 64	62 – 64	56 – 58
Crane	76 – 85	70 - 79	58 – 67	58 – 67	52 – 61
Front loader	72 – 81	66 - 75	54 – 63	54 – 63	48 –57
Generator	72 – 82	66 - 76	54 – 64	54 – 64	45 – 58
Grader	80 – 92	74 - 86	62 – 74	62 – 74	56 – 68
Jackhammer	81 – 96	75 - 90	63 – 78	63 – 78	57 – 72
Pile driver (impact)	96 – 102	90 - 96	78 – 84	78 – 84	72 – 78
Pump	69 – 71	63 - 65	51 – 53	51 – 53	45 – 47
Tractor	78 – 94	72 - 88	60 – 76	60 – 76	54 – 70
Truck	83 – 93	77 - 87	65 - 75	65 – 75	59 – 69
Vibrator	68 – 81	62 - 75	50 – 63	50 – 63	45 –57

Source: Canter, 1977

Distance and sound absorbers such as vegetation along the noise path easily attenuate noise so that its nuisance effect is considered minimal. The use of board fence around the construction site as noise buffers will further mitigate adverse noise impacts. Excessive noise construction activities will be confined to daytime hours when practicable. Workers exposed to excessive noise will be provided with personal protection equipment (PPE).

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Biological Environment

Terrestrial Ecology

Temporary impacts are likely to unavoidably occur during the construction period; these are expected to be short in duration. Typical of such impacts is the removal of vegetation cover, while long-term impacts will include changes in land use and the landscape, and on a more enduring level the operational phase of the project. Existing flora are relatively common to the area, with the observed fauna comprising mostly of transient birds that could easily transfer to less disturbed areas in SBFZ (i.e. Mt. Redondo). Properly managed, these long-term impacts would generally prove to be beneficial to the environment and the local community.

- Flora

The removal of vegetative cover resulting in erosion and siltation of nearby waterways.

The mitigating measures are:

1. *Re-landscaping of vacant grounds inside the shipyard facilities. Use of indigenous plant and fast growing / fruit-bearing tree species.*
2. *Adoption of a catchment / basin approach (watershed management) in rehabilitation of disturbed / degraded areas thru reforestation and erosion control.*

- Fauna

The displacement of resident fauna. However, it should be noted that there were no critical wildlife species living in transects examined.

Planting of indigenous and fruit-bearing plant species in vacant spaces and along waterways / rivers is recommended.

Aquatic Ecology

This section provides an assessment of the probable impacts of the proposed shipbuilding facility on the freshwater and marine environment and their aquatic communities such as the plankton, soft bottom benthos, corals, reef fish, artificial reefs, fisheries and fish cages. Two scenarios were presented: impacts related to existing non-project activities (*i.e.*, without the project) and impacts and mitigation related to site construction and operation (*i.e.*, with the project).

From the design of the project facilities at the project area, certain activities will be more important than other in relation to their effects on the environment. Those related to the land clearing and excavation and dredging and reclamation activities are expected to have the more significant and direct impacts on the coastal marine environment within the project area and immediate vicinity. These will be emphasized in this section. The extent of these impacts is dependent largely upon the intensity and duration of the activity and siting of structures relative to the available living coastal marine resources and associated communities.

Land Clearing and Excavation - Siltation and turbidity may occur from land clearing and excavation activities and movements of large volumes of soil unless properly controlled. Sediments introduced by runoff could be carried into the sea and affect the marine communities along its path. It is possible that the recruitment and survival of fish and

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other marine organisms in the nearshore area can be adversely affected by siltation and high turbidity. High deposition of silt may also smother fish eggs and other benthic organisms, diminish food source as a result of the reduction in the availability of light for plant photosynthesis, and destroy habitats including coral reefs. When suspended loads or concentrations become higher than 100 mg/l, they are considered fatal to benthic organisms such as corals (Te, 1992). However, some species of Pacific corals (*e.g.*, some species of *Acropora*, *Porites*, *Psammocora*, *Montipora*, *Favia*, *Favites*, *Leptastrea*, *Lobophylia* and *Fungia*) can withstand episodes of heavy sedimentation (Maragos, 1993) but during heavy sedimentation rates, they exhibit high mortality and low productivity.

These impacts on the coastal and marine environment are temporary and can be mitigated by first installing sheet piles prior to land clearing and excavation. Installation of silt traps along the drainage ways, drainage ditches and settling ponds or catch basins around the construction area to minimize the discharge of silt-laden runoff in water bodies will also be implemented to mitigate and minimize impacts.

Dredging and Reclamation - The major impact of construction on plankton would be the expected increase in turbidity created by the re-suspension of sediments during dredging operations. Turbidity would tend to limit light penetration in the water column that is essential in photosynthesis, a vital process in primary production. Increased turbidity would also lead to the irritation and clogging of gills of pelagic fish larvae and juveniles that could lead to their eventual smothering (Hirsch *et al.,* 1978). This adverse condition would slightly increase in mortality rates among pelagic fish larvae/juveniles including planktonic organisms. Being planktonic, fry or juvenile cannot avoid turbidity impacts because of their inability to swim against currents. However, these impacts, while significant, are localized and temporary. Turbidity is expected to decrease to normal levels immediately following the completion of dredging operations.

One of the significant impacts of the proposed shipbuilding facility project concerns the benthic communities of the dredging and reclamation areas. The dredging and reclamation activities will not only disturb the existing benthic fauna but will entail a complete smothering of all benthic organisms present in the dredging and reclamation area. There is no known remedy for this impact as the reclamation, which is deemed very important will be permanent in the area. However, benthic organisms can easily re-colonize in undisturbed and unreclaimed areas. Benthic re-colonization should be quite rapid and occur within a few months after construction. Complete recovery could be attained within a year or two.

Dredging and reclamation are not expected to pose of any significant impact to the coral patch reef and artificial reef structures because of their distance from the dredging area (approximately 300 and 650 meters away from the shoreline, respectively). Considering that the nearby patch reef is in poor coral cover condition (*i.e.*, 20%) and the artificial reefs are located further offshore at depths of 30-33 meters, dredging will not likely result to significant adverse impacts on these reef resources.

Dredging spoils will be deposited in the proposed reclamation area as fill material. Therefore, the impact of dredging is considered negligible besides its being temporary in nature. There will not be a significant/noticeable impact on the marine food chain.

Removal of patches of seagrass primarily of the species *Enhalus acoroides* and associated benthic communities with the substrate located north of the former CGS casting basin (or near the mouth of Agusuhin North Creek) is expected as a consequence of dredging operation, and therefore cannot be mitigated.

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The impacts of dredging and reclamation works on mobile organisms such as fish would be localized, temporary and minimal because of the inherent ability of these organisms to avoid disturbance. Increased suspended sediment levels and turbidity generated by construction activities would cause adult fish in the project site to migrate to other areas. However, smaller species unable to migrate and chronically exposed to high turbidity may suffocate as their gills become clogged with sediments. This impact is expected to occur within a radius of 1 km from the construction site.

Construction of the proposed shipbuilding facility is not likely to impact marine turtles due to their presumed absence of nesting sites from the proposed project site. Of particular concern would be potential loss of seagrass foraging area (feeding grounds) of the green turtle (*Ch. mydas*) resulting from dredging and reclamation activities in the nearshore seagrass habitat near the mouth of Agusuhin North Creek (south of Petambu Point).

Other impact associated with dredging and reclamation operations that relate to disturbance to nearshore fisheries activities is expected. A required safety exclusion zone along the dredging and reclamation area is recommended; that is, 0.5 to 1.0 km.

Construction activities are not expected to affect fish cage operations in Subic Bay because of their distance. However, the nearest fish cage in operation is located near Mahumaling Point (approximately 1.5 km north of project area). All the rest are located approximately 3 kms north of project area, along Barangay Cawag Proper.

Geotextile silt curtains should be used during the construction period to reduce turbidity and therefore, impact on adjacent marine benthic communities.

The selection of the reclamation site can be considered a mitigating measure in itself. The nearshore area intended for reclamation is largely sandy area where corals and seagrass beds are absent. The closest known coral patch reefs are located in Nagyantok (located approximately 1.5 km south of reclamation area), with an average coral cover of only 5%, categorized as very poor condition. Coral reefs with excellent coral condition (over 90% live coral cover) are found southwest of the Grande Island only (located approximately 4.5 kms. southeast of project area). Construction works will not impact these habitats.

Socio-Economic Environment

Income Restoration

Restoration of the incomes of all affected persons is one of the key objectives of this resettlement policy. After resettlement, all of the affected persons should have incomes, which are at least equivalent to their pre-project income levels.

The proponent/SBMA shall prepare a Resettlement Action Plan (RAP) in coordination with various stakeholders, specifically with the municipality of Subic.

Generation of Employment and Livelihood Opportunities

The proposed development will require workers and personnel for its construction. Skills such as engineers, office personnel, trailer drivers, heavy equipment operators, electricians, utility workers and laborers will be required during the construction phase. Construction for phases 1 and 2 will require 500 workers while three hundred workers

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will be needed in phase 3.

As part of the Contractor's Environmental Program, the proponent shall require its contractors to give priority to local qualified applicants from the impacted barangay of Cawag and the rest of the other barangays in Subic. Special priority should be given to households who would be resettled because of the project.

The proponent shall establish a Community Relations Office with the proper staffing and budget. The main responsibility of this office is to establish, develop and maintain close rapport with the resettled community, adjoining sitios, barangay and the municipality. This office will act as liaison for the proponent with rest of the world on social concerns.

Livelihood opportunities in support of the project construction will be created independent of the ship building project. Requirements of the employees and the proponent such as supply of basic commodities, eateries, tailoring, laundry services, and personal grooming services will developed by the residents because of the increase demands. Residents engaged in these activities are expected to improve their standard of living because of additional income to their families.

This impact is positive, hence, no mitigation is required.

Increase Commercial Activities in the Impact Area

There will be more money in circulation because of the salaries and other benefits of the workers and the support service establishments, which will in turn, generate further economic activities. Residents will improve their living facilities and would be encouraged to buy clothes, appliances and beauty products. When not available in the barangay, initially the residents will buy in the Poblacion. However, enterprising businesspersons will start to transport such goods to the project site. Hence, additional demand for transportation will be developed and filled up by the residents of the municipality. Some residents may buy jeepneys or trucks to satisfy this transport demand. Commercial activities will increase because of greater demand of the residents for goods and services.

Migrants will be attracted to the employment and livelihood opportunities created by the project and would be desirous to participate and earn income. The influx of migrants will create additional demands not only for basic commodities and services but also for housing facilities. Landowners may construct additional housing facilities to accommodate these migrants and in effect earn more income. Overall, the increase commercial activities in the area will benefits the residents by providing them additional income for their families.

The proponent shall prioritize the local construction suppliers to enhance the commercial activities in the municipality provided that their prices are competitive. This will give the local businessmen opportunities to increase their volume of sales and expand.

Additional Income and Benefits to the Local Government Units

Indirectly, the LGUs (barangays, municipality and province) will also increase their yearly revenue because of the corresponding increase in commercial activities in their respective jurisdictions. Additional revenues from the licenses and permits unit will be realized because of the establishment of new businesses in the area. It is also

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expected that new construction and occupation permits will be issued because of the anticipated development in the neighboring barangays.
The proponent shall prioritize the local construction suppliers to enhance the commercial activities in the municipality provided that their prices are competitive. This will give the local businessmen opportunities to increase their volume of sales and expand.

Health and Sanitation

In laying the foundation of the ship building facility, excavation and earth moving will be done in the site. It is very possible that dust particles, possible accidents resulting from passing of supply barges and ships during construction, and air emissions by trucks and heavy equipment during the construction phase will pose health hazards. The incidences of respiratory diseases and allergies may increase to the residents in the neighboring areas.

A water sprinkling system will be adopted in excavation areas to minimize the generation of air borne dust particles in going into the neighboring areas. The construction workers should have adequate protection devices to minimize inhalation of dust particles and fumes. The contractors through the MOA shall be compelled to maintain their heavy equipment and vehicles in top condition. Drivers must practice defensive driving.

The demand for water supply and access to sanitation and waste disposal facilities will increase because of the presence of workers and personnel during construction phase.

Adequate water supply, sanitation and waste disposal facilities shall be included in the Contractor's Environmental Program as a prerequisite to the award of a construction contract. In turn, the contractors and project proponent shall ensure that the rules and regulations regarding sanitation and waste disposal shall be strictly implemented.

During construction phase, the workers will generate solid waste from their personal and construction activities.

The contractors shall implement an ecological solid waste management program during construction phase and shall coordinate with SBMA for the disposition of residual waste.

Lifestyle and Culture

The residents of Sitio Agusuhin are largely migrants who settled in the area to earn, first from the operation of the Subic Naval Base and secondly from the SPEX project. Barangay Cawag is classified as rural and the project is not expected to alter the lifestyle of the residents in the area.

There are three Ayta families in Sitio Agusuhin. It was reported that these are displaced families of the Mount Pinatubo eruption. They have been in the area for more that 10 years and have be acculturated by the residents. Their traditional lifestyles have been diminished by the constant influences of non-indigenous culture of the lowlanders.

It is submitted that because of this constant exposure to non-indigenous cultures, they have be acculturated by the cultures of the lowlanders. As such, they have been

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treated as non-indigenous in this study like the major ethnic groups in the country. There is no known archaeological site in the proposed project site.

No mitigation is required.

Archaeology (Shipwreck)

No impacts are expected to result from construction activities since there will be no more dredging (deepening) work will be performed in the immediate vicinity of the former CGS casting basin where the shipwreck with developing marine life is located offshore about 100 meters from the mouth of the casting basin at 20-21 meter depth.

4.2.2.3 Operation Phase

The operational phase is the actual shipbuilding activities as follows:

- Phase 1 (2006-2007)
  - Fabrication of Hatch Cover (30,000 ton/year)
  - Preparation for Construction of Full Container Ship

- Phase 2 (2008-2009)
  - Construction of Full Container Ship (3400 TEU)
    (2010-2010)
  - Construction of Full Container Ship (3400-5100TEU)
  - Construction of Panamax and Bulk Container (95K)

- Phase 3 (2011-2013)
  - Construction of Cape Size Bulk Container (170K) and Aframax Tanker (115K)
  - Construction of Very Large Crude Carrier Shipbuilding (24 ships/year)
    (2014-2015)
  - Construction of LNG Carrier (150K)
  - Construction of LNG Carrier Full Container (8100TEU)
  - Construction of Very Large Crude Container (300K)

Physical Environment

Topography, Geology and Land Use

No impacts on Topography, Geology and Land Use are likely to occur during the operation phase. On the other hand, natural hazards can impact on the project. A geohazard risk assessment in relation to the project is presented in Section Three.

Soils
Wastes produced from shipbuilding processes (e.g. sandblasting), if left unattended on the ground, could contaminate the soil. This can be avoided through a sound solid waste management practice that the proponent will strictly implement.

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In the sandblasting operation, HHIC- Phil Inc. project uses iron pellets, sand, copper granules. These sandblasting materials are continuously re-used during the sand blasting operation. These materials are collected in an enclosed mechanized/automated container and re-used in the operation. The spent blasting materials, which can still be used for small shipbuilding operations and other purposes are stored in the Central Waste Recovery Area for disposal. HHIC- Phil Inc. project will explore a Waste Exchange Program with other industries, which uses these waste materials in their operation such as small shi builders, steel industry, cement manufacture, etc.

Hydrology

Impacts on surface water during the operation phase are not likely to occur. Necessary mitigating measures such as bank protection, stormwater drainage and diversion canals have been in place during the construction phase.

Hydrogeology and Water Resources

Since the operation phase will be simultaneous with the construction phase, the same water demand presented during the construction phase will apply except for a slight reduction in domestic water requirement after the end of Phase 3 construction phase. At the completion of Phase 3, the operation of the facility will require 372 m^3/day domestic water and 1,020 m^3/day industrial water.

It is planned that a water utility agency will provide the water requirements during this phase.

The proponent in association with the SBMA and with the local govemment would continue to implement a water conservation program and the watershed management program to protect and enhance the Agusuhin watershed.

The proponent would closely monitor groundwater quality to determine the extent (if any) of sea water intrusion.

Solid Waste

Generation of Solid Waste - Operation activities are expected to generate minimal amount of domestic, office and industrial waste.

Mitigating measures include:

1. *All waste shall be disposed at the SBMA landfill. No waste landfill shall be established within the construction site. Sufficient waste receptacles shall be properly marked and placed at all work areas.*
2. *No disposal of construction debris shall be undertaken without securing a Waste Transport Permit from the Freeport Service Corporation.*
3. *Open burning of any waste shall be strictly prohibited at any time.*
4. *Solid and liquid waste form marine vessels shall be collected for on shore disposal. Ballast water shall not be discharged in the port.*

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5. *All sub-contractors and employees of the project will be required to comply with the project's Ecological Waste Management Program and RA 6969 for hazardous wastes.*

Water Quality

Possible degradation of nearby surface water from surface run-offs (i.e. stormwater) that may contain chemicals from pesticides or herbicides from landscaping activities.

Only approved organic chemicals will be used and to ensure that the water discharged to the waterbodies are non-degrading, a wastewater treatment plant will be installed.

HHIC- Phil Inc. project shall comply with RA 6969 "Hazardous Substance and Toxic and Nuclear Wastes Act' and its implementing Rules and Regulations. It will ensure that toxic and hazardous wastes will not leached in the ground and the surrounding environment by implementing appropriate mitigation measures and contingency plan. The spent/waste paints, which are the source of toxic and hazardous wastes in the painting activities, are sprayed efficiently through mechanized/automated sprayers ensures minimal wastes. The residual wastes are collected in a close container.

As part of HHIC- Phil Inc. Waste Management Program, it will require all paint suppliers will be required to retrieve back all paint wastes including containers, spent paints, etc. and shall be disposed according to RA 6969 and its Implementing Rules and Regulations.

Nonetheless, HHIC- Phil Inc. shall implement its Waste Management Program where the residual paint and all other hazardous and toxic wastes will be stored in the Central Waste Storage Area (CWSA) for disposal. The CWSA is lined with impermeable membrane and provided with appropriately designed bund walls for any potential spill. An Emergency Response Program will also be in place in case of any emergency or accidents. Accredited transporters and treatment facilities shall collect the hazardous wastes and shall all comply with all the requirements of RA 6969 and its implementing rules and regulations.

Air Pollution from Generators

Air emissions from the generator set will slightly increase the local ground level concentrations of nitrogen dioxide and carbon monoxide around the areas where these equipments are operating.

The resulting air quality is not expected to significantly deteriorate and Hanjin will monitor the ambient air quality on a regular basis.

Noise Generation

The operation of heavy equipment will add to the ambient noise level at the project site. The elevated noise levels will impact the surrounding area. The elevated noise level near the project site is considered adverse but this will be temporary and intermittent. This impact however, is considered insignificant as the nearest residential area will be the worker's dormitory.

Distance and sound absorbers such as vegetation along the noise path easily

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attenuate noise so that is nuisance effect is considered minimal.

Biological Environment
Terrestrial Ecology

- Flora

During operational phase, the lifespan of the shipping will be threatened by siltation and sedimentation of the Agusuhin River and its tributaries. Accelerated soil erosion is very obvious in the site since the upper catchment areas are almost devoid of tree vegetation.

As a mitigating measure, in addition to structural river taming, it is recommended that a sound watershed management of Agusuhin River Basin be employed to reduce erosion and siltation as well as to promote additional sources of income to the impacted communities. Planting of arboreal trees through reforestation is necessary to hold the soil. However, owing to the very hostile nature of a lateritic soil, strict observance of the procedures/strategies in restoring degraded habitatsis necessary.

- Fauna

During the operational phase, wildlife maybe attracted to come back to the developed area upon establishment of the new landscape and structures. For wildlife that can not adapt to the busy environment of the shipyard facilities, these species would prefer to settle on the outlying brushland and forest cover of Mt. Redondo.

No preferred mitigating measure is required.

Aquatic Ecology

Normal operation of the shipbuilding project is not expected to pose a treat to the nearby patch reef and associated reef fishes. The diversity of marine organisms along the project site is expected to increase. The presence of hard substrate (revetments/armor rocks and quay wall) would tend to attract reef fishes. These structures will enhance the marine habitat of the area. These structures could, in fact, act as artificial hard substrates that could attract colonization by highly diverse marine life and provide shelter to a number of organisms. These structures will generally provide beneficial impacts to reef-associated fishes and invertebrates.

The employment that will be generated by the proposed project is a positive impact. This reduces pressure on fishery and other coastal related activities. This will provide substantial recovery and regeneration of resources.

The effects of chemicals wastes such as residual paints, thinner, solvent and liquid wastes to be generated by the project on the marine biological resources (corals, plankton, benthos, seagrass, other aquatic flora fauna, and fisheries) of the area are expected to be negligible. Nonetheless, HHIC- Phil Inc. shall comply with all the policies, rules and regulations concerning discharges of liquid wastes from its operation. Liquid wastes generated within the project site shall be treated in Waste Water Treatment Facility. HHIC- Phil Inc. shall also implement its Wastes Management Program where the residual paints and all other hazardous and toxic wastes will be stored in the Central Waste Storage Area for disposal. Moreover, periodic monitoring of the water quality around the project site shall be conducted to describe concentrations and distribution of potential pollutants at the surface, and in coastal sediment and biota, and to verify trends.

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No impact of chemical wastes on mangrove is not expected since the small patch of mangrove area within the proposed project site will be cleared. Existing mangrove stand has no nominal terrestrial value. No mitigation required.

Social-Economic Environment

Population/Settlement/Migration

There will be no significant impact on the social demography of the area if the employees to be hired would come from the local communities. However, increase economic activities in the area will attract migrants who are seeking better employment and livelihood opportunities.

Informal settlements may develop along riverbanks, sidewalks and vacant areas because of increase in livelihood opportunities in the area. The demand for basic services will increase and the financial resources of the SBMA/municipality will be strained to meet these additional demands. These areas may have unsanitary conditions because of the lack of adequate sanitation facilities.

The LGU/SBMA shall strictly enforce the land use plan. In addition, the barangay captains and SBMA forest rangers shall monitor the arrival of these informal settlers and prevent the entry of these informal settlers to their respective jurisdictions.

Employment/Livelihood

The primary positive effect of the project as pointed out in the survey is the generation of employment and livelihood opportunities. Residents are expecting that their families and other relatives will be able to work in the ship building facility. Other residents expressed their hopes that some kind of business may be derived from the plant operations. Failure of the proponent to adequately address the high expectations of the residents regarding employment and livelihood will have serious repercussions in its relations with the communities.

Priority shall be given to qualified residents of Subic, especially to the resettled households for employment in operation of the plant. This hiring policy will minimize the influx of migrants who would exert tremendous financial pressures on the delivery of basic services by the host municipality. The community relations office will coordinate with the applicants and pre-screen them before endorsing to human resources department.

There are skills required by the project, which may not be available locally. Hence, migrants would be needed by the project. However, this should be a last resort, after the proponent has extensively exhausted all means to locate qualified residents.

Supplies needed by the shipbuilding facility such as uniforms and food may be sourced locally through peoples' organizations or cooperatives. These outsourcing schemes will directly benefit households in the host and nearby barangays.

There is apprehension that women will not have a fair chance of getting a decent employment considering the traditional biases against women. Flesh trade and prostitution may proliferate.

Skills training and orientation for women shall be implemented for them to be more

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equipped and qualified in facing development and engaging in productive economic activities.

The proponent will implement a livelihood program after proper consultations (planning workshop) with the resettled households as provided for in the Social Development Plan. The proponent in coordination with the Ecology Center of SBMA shall provide the proper training and start up funds to jump-start these livelihood programs.

Additional Revenues to the Local Government Unit

The BCDA Law provides that in lieu of paying local and national taxes, three percent (3%) of the gross income earned by the proponent shall be remitted to the National Government, one percent (1%) each to the local government units affected by the declaration of the zone in proportion to their population area, and other factors. In addition, the proponent shall pay a development fund of one percent (1%) of the gross income to utilize for the Municipality of Subic, and other municipalities contiguous to be base areas. This additional revenue may be appropriated to improve the delivery of basic services such as education, health, road maintenance, water supply and police services.

As an enhancement measure, the proponent shall pay its taxes in time to enable the municipality to deliver the basic needs of the residents also in time.

Increase of Migrant Workers in the Area

During the operational phase, it is expected that local workers will be insufficient to address the huge manpower requirements of the project. Hence, migrants are expected to flock and live in the adjacent area to take advantage of the employment and livelihood opportunities.

Based on consultations with SBMA, there is a policy that resettlement or the establishment of unauthorized new structures will not be permitted within is territorial jurisdiction. SBMA should monitor and control the influx of new migrants to the sitio by mobilizing its security force to prevent additional migrants. If this is not sufficient because of local political dynamics, SBMA should coordinate with the Philippine National Police (PNP) and get additional manpower to implement a moratorium of migrants.

The proponent shall provide adequate living facilities for its key personnel and permanent workers as part of the project. However, the large number of workers required by the project would not be accommodated in these facilities. Market forces would intervene and landowners in the Subic outside of SBMA will be encouraged to put up boarding houses and dormitories to satisfy the housing demand.

It is however vital that the development of additional housing facilities would respect the ownership of private and public lands. The municipality of Subic is tasked by law to monitor and prevent the influx of illegal settlers into its jurisdiction. In its exercise of its legal mandate, Subic should strictly prevent the proliferation of illegal structures in its jurisdiction.

Health

Air and noise pollution is the primary health concern of the nearby residents and other stakeholders because of the proposed assembling activities especially on the

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cutting of sheets, welding and painting.

The proponent shall ensure that the anti-pollution technology and devices are functioning at all times.

The proponent shall continue monitoring the health conditions of the local communities and contribute to the improvement of health services and facilities. Periodic medical missions with free medicines shall continue to be provided by the proponent.

The proponent shall also plant trees and shrubs especially along the boundary of the ship building facility. This will create a buffer zone to disperse the noise that will be generated by the plant operation.

4.2.2.4 Abandonment Phase

In the unlikely event of abandonment, all removable structures will be dismantled and removed from the site to appropriate disposal sites. Materials/equipment can also be sold to prospective buyers. An abandonment plan detailing the proponent's closure activities will be submitted to the SBMA and other concerned agencies.

4.3 RESIDUAL AND UNAVOIDABLE IMPACTS

In the implementation of the project, there will be impacts on the environment that are unavoidable. This is precisely the reason why mitigating measures are performed at different project stages to alleviate, if not, totally control these impacts.

4.3.1 UNAVOIDABLE IMPACTS ON LAND

- Modification of the terrain will occur due to grading and landscaping
- Soil erosion will occur to some extent during the construction phase
- Patches of natural vegetation will be removed during earthmoving activities
- Minor disturbance of existing fauna will occur
- Solid waste and wastewater will be generated during the construction and operation phases

4.3.2 UNAVOIDABLE IMPACTS ON WATER

- The project will require significant domestic and industrial water requirements which may necessitate the use of deepwells or even surface water especially during dry months.
- Slight siltation of waterbodies will occur to some extent during the construction phase.
- Water quality may be adversely affected by chemicals that are leached due to over application and improper management.

4.3.3 UNAVOIDABLE IMPACTS ON AIR AND NOISE

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- There will be several minor fugitive dust from earthmoving activities and exhaust emissions from construction equipment.
- Localized increase in noise level will occur form construction activities.

4.3.4 UNAVOIDABLE IMPACTS ON PEOPLE

- The project will displace the entire Sitio Agusuhin community.
- Increase in population density will heighten urban development pressures on the environment, utility provision, social services and law enforcement.

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5.1 INTRODUCTION

HHIC- Phil Inc. is establishing a shipbuilding facility, hereinafter to as the "yard", in Sitio Augusuhin, Redondo Peninsula, Bgy. Cawag, Subic, Zambales. From the point of view of environmental and health risk assessment and management, development of the yard will involve three (3) phases and include the following a) pre-construction, b) construction and operation, and c) decommissioning/abandonment. In the process of development, workers will be involved in all phases. Residents living in the proposed area and workers of the yard will be affected by the different phases of development. Of particular concern are the possible hazards that could be generated from the yard in all phases of development. The hazards differ in all phases and may include chemical and physical (including natural) hazards. These hazards can cause adverse health effects to residents and workers. At this point, it would be important to state that the assessment made has been based within the confines of what would ordinarily be anticipated risks relative to the development and operation of a shipbuilding facility.

The environmental and health risk assessment (EHRA) for the yard is one of the requirements of the Ecology Center of the Subic Bay Metropolitan Authority (SBMA) as part of the preparation of the Environmental Impact Assessment (EIA) report. The main objective of conducting an environmental and health risk assessment is to protect and promote, if possible, the health of the workers and residents of impact communities and to preserve the integrity of the ecosystem. The protection of workers and community health is a foremost objective of environmental and health risk assessment. This study will be used as future reference of future investigations to monitor changes in diseases and environmental factors.

The EHRA Framework and Basic Processes

Environmental and health risk assessment is a process that involves a series of logical steps which seek to answer the following questions:

- *What can go wrong with the project?*
- *How severe are the adverse consequences to the environment?*
- *What are the likelihood of occurrence of these adverse consequences?*
- *What can be done to reduce risks that are found unacceptable?*

The EHRA constitutes four basic processes, namely: (a) hazard identification; (b) dose-response assessment; (c) exposure assessment; and (d) risk characterization.

Identification involves the creation of an inventory of both occupational and community health hazards. Evaluation involves the assessment of risk to health of the impact communities and workers compared to standard acceptable occupational and environmental health criteria. It takes into consideration the severity of the potential consequence if the hazard is released and the frequency or probability of occurrence of the release. Finally, control measures required to remove or reduce the risk to health of hazards to as low as reasonably practicable. Mitigating measures are also incorporated to avoid acute or chronic adverse health effects in cases where there is actual release of a particular health hazard due to failure of the established control measures.

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5.2 HAZARD IDENTIFICATION

The hazard identification process may be divided into two parts, namely: (a) identification of operational hazards, i.e., those hazards resulting from the engineered systems, associated operating systems including management and control systems related to the yard, which could pose risk to the environment and the health and safety of the communities around the yard; and (b) natural hazards that could compromise the integrity of the process equipment and trigger system failures and upset conditions in the yard that would, likewise, impact the environment.

5.3 DOSE-RESPONSE ASSESSMENT

Dose-response assessment involves an exhaustive review of various critical toxic endpoints manifested by the contaminant of concern (COC) in the hazard identification process. This assessment is limited to health hazards, i.e., adverse health effects arising from exposure to chemical, biological, and physical agents. Dose-response assessment utilizes existing epidemiological and animal studies to describe the exposure dose and toxicity manifested for each COC.

5.4 EXPOSURE ASSESSMENT

The exposure assessment process quantifies the potential exposure dose for specific COC of the general public, workers, and ecological receptors. The process also describes the environmental setting, exposure scenario, potential routes of exposure, and personal protective equipment used in an occupational setting.

5.5 RISK CHARACTERIZATION

Risk characterization is the process wherein the acceptability of the risk is assessed. Results of this process are used to make informed decisions in the risk management process.

The study made use of primary and secondary data, including interviews gathered from residents and health workers, and observation in the study area. Initially, a field visit was made to the proposed project site. Thereafter, an interview with the residents, barangay officials, and the health workers was also conducted. All residents of the impact barangay were considered participants in the study. The available secondary health data on the annual health report from 2001 to 2004 submitted to the Municipal Health Office were also used in the study. The data included the vital health statistics, leading causes of morbidity and mortality, environmental health indices, health personnel, health facilities and public health programs.

Health survey questionnaires were distributed in the impact areas to inquire on the residents' health status, health practices and sanitation.

Based on the health data collected, diseases according to time, place and person were characterized using graphs and frequency tables.

Literature review was done to determine health effects of hazards generated by the yard. The study also includes statement on the possible association of the project hazards and health profile of the community.

The environmental and health hazards associated with the establishment of the yard are summarized in **Table 5-1**.

5.5.1 PROCESS DESCRIPTION

During the Pre-operation Phase, the activities include:

- Hydrographic and Land Survey
- Soil Investigation
- Relocation of Settlers
- Temporary Access Road
- Supply of power, water and communication lines

The Development Stage will indude three Phases (1 to 3).

Phase 1 involves:

- Fabrication of Hatch Cover
- Preparations for Phase 2

Phase 2 involves the construction and operation of a medium-sized shipyard and preparations for Phase 3.

Phase 3 involves the construction and operation of large-sized shipyard (including related facilities).

Risk during the Abandonment Phase will be limited to the hazardous and non-hazardous wastes and dust left behind once the yard terminates operations.

Table 5-1 shows the expected hazardous agents during the establishment/development of the yard.

Table 5 - 1. The Environmental and Health Hazards Associated with the Yard

	Pre-Construction Phase	Development Phase	De-commissioning
Chemical Hazards			
• Dust/SPM	*	*	*
• NO_2	*	*	
• SO_2	*	*	
• CO	*	*	
• Toxic/Hazardous Chemicals			
✓ Explosives	*	*	
✓ Oil and Lubricants	*	*	
✓ Fugitive emissions	*	*	
✓ Volatile Organic Compounds		*	
✓ Heavy metals		*	*
Physical Hazards			
• Noise	*	*	
• Heat	*	*	
• Vibration	*	*	
• Ergonomic Stress	*	*	
• Occupational accidents	*	*	

	Pre-Construction Phase	Development Phase	De-commissioning
Natural Hazards			
• Seismic Hazards		*	
• Volcanic Hazards			
• Excessive Rainfall		*	
• High Relative Humidity			
• Extreme Winds and Waves		*	
• Flooding			

5.5.2 Results Of The ERA Study

5.5.2.1 Hazard Identification

While the more significant hazards are those that result from yard operations, available information suggest that other hazards related to site preparation and construction exist.

5.5.2.2 Chemical Hazards

Air Emissions

Dust and Suspended Particulate Matter (SPM), NO_2, SO_2, and CO

The potentially hazardous air emissions from the development of the yard include dust and suspended particulate matter, NO_2, SO_2, and CO as generated from excavators, bulldozers, loaders, vehicles and heavy duty machines that will be used during the pre-construction, construction and operation phases. Dust will also be produced in large amounts due to the excavation of soil and crushing of rocks and in the roads where vehicles pass through. The vulnerable population includes the surrounding community and the construction/yard workers. Use of personal protective equipment, wetting agents (especially for dust and SPM), and efficient maintenance of the equipment/machines, including the employment of containment devices/mechanisms will greatly reduce the corresponding hazards.

5.5.2.3 Toxic and Hazardous Chemicals

Explosion (Live/Unexploded Ordnances)

During site clearing, care should be taken to find, clear, and handle/manage live or unexploded ordnances. Based from a report (Clearwater Revival Company, Technical Review Report Environmental Baseline Survey Former United States Navy Installation Subic Bay, Philippines, June 30, 1998), the Redondo Peninsula served as Live Firing and Training Ranges when the Freeport was still a naval military base and may still contain unexploded ordnances, metals and explosive residues all of which pose safety and environmental hazards. The vulnerable population includes the surrounding community and the construction/yard workers. Engagement of experts in handling/managing live/unexploded ordinances will greatly reduce hazards posed by these.

Explosion and Fire (Fuel Storage/Leaks)

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Fire and explosion hazards can emanate from storage and use of explosives used for blasting during quarrying and fuel to power generators used onsite. Without the necessary precautions and strict observance for safety, explosives by their inherent nature can cause fire and explosion and may lead to injury and fatalities. Leaks of petroleum products whether liquid or gaseous could escalate into fire and explosion. Explosion, however, is less likely as the fuel (diesel) used is not inherently explosive. Fuel leakage is the most common fault related to uncontrolled fuel releases that could lead to a major accident. However, the fuel used (diesel) is not as readily flammable as other lighter fuels. The vulnerable population includes the surrounding community and the yard workers.

The fuel oil tanks introduce the risk of oil spill in the area. Fuel unloading operations increase the risk of oil spill in the area. Oil spillage from fuel unloading is usually associated with rupture of the fueling line, failure of hose couplings and overfilling of tanks. Tank rupture which could lead to disastrous spill incidents is very rare and usually associated with catastrophic geologic events such as high intensity earthquakes, and uncontrolled fires and explosions. The construction of bunds around the tanks greatly minimizes this risk.

Oils and Lubricants

Other potentially toxic and hazardous chemicals present in all phases of development of the yard include oil and grease – also as generated from excavators, bulldozers, loaders, vehicles and heavy duty machines that will be used during the pre-construction, construction and operation phases. Oil and grease can cause skin irritation, allergy, respiratory tract irritation and bronchitis. Construction of a collection system and an onsite wastewater treatment facility will greatly reduce hazard to both workers and the environment.

Fugitive Emissions

During the pre-construction and construction and operation phases, fugitive emissions can emanate from fuel storage facilities. Fugitive emissions are mainly evaporative losses from fuel storage facilities. Vulnerable group include workers directly maintaining the fuel storage facilities. Inhalation of vapors can possibly lead to lung cancer. Use of personal protective equipment and efficient maintenance of the fuel storage facilities can greatly lessen corresponding hazard.

Volatile Organic Compounds

Some of the chemicals and materials used during the construction and operation phases, especially from paints and related substances, can generate volatile organic compounds (VOCs). Volatile Organic Compounds (VOCs) are organic chemicals that have a high vapor pressure and easily form vapors at normal temperature and pressure. The term "organic" indicates that the compounds contain carbon. The term is generally applied to organic solvents, certain paint additives, aerosol spray can propellants, fuels (such as gasoline, and kerosene), petroleum distillates, dry cleaning products and many other industrial and consumer products ranging from office supplies to building materials. VOCs are also naturally emitted by a number of plants and trees. During operations its generation can be exacerbated in confined or enclosed areas. Vulnerable group include workers directly maintaining the painting facilities and those who may be assigned to work in confined spaces. Inhalation of vapors can possibly

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lead to cancer. Use of personal protective equipment – gloves and respirator, administrative controls, such as formulation and enforcement of procedures for prior entry to confined spaces and training/education of relevant/concerned workers, and engineering controls, such as fume hoods or other form of local exhaust ventilation, can greatly lessen corresponding hazard.

Heavy Metals

Generation of heavy metals is mostly associated with the operation phase, specifically from the cutting of metal sheets, welding, and from painting, although welding will also be extensively done during the construction phase. These come mostly in the form of particulates and metal fumes. Yard workers are most vulnerable to these especially in enclosed areas. These can cause various disorders and diseases. Installation of appropriate control measures to capture/contain fumes and particulates (i.e. dust collectors), as well as, ventilation systems, will greatly reduce corresponding hazard.

Fume and particulate emissions from the cutting of metal is known to vary significantly by the substrate being cut and the presence and type of coatings on the substrate, if any.

Substrates being cut – The composition of the particulates released will be broadly similar to that of the parent metal. Consequently, the contribution of the parent metal to the fume varies from metal to metal. For example: Carbon steel - iron oxide forms the main component of the fume; Galvanized steel - generates zinc oxide fumes; Metal alloys containing cadmium – release cadmium fumes; and Stainless steel - chromium (VI) and nickel will be present in the fume. An evaluation of the base metal being cut will provide information regarding the potential for discharge of pollutants of concern during cutting operations.

Substrate coatings – Coating on the substrate will substantially increase the rate of fume generation from cutting operations. Additionally, the coating may contain metals and organic compounds that can contribute to the mass loading of pollutants of concern. In many cases, the pollutants derived from the coating may be the majority contributor of pollutants. Testing and/or evaluation of the substrate coating can provide critical information regarding the potential for pollutant loading, and whether controls or process changes are required to reduce the fume emissions.

The project will utilize Plasma Arc Cutting (PAC). It is a process that severs metal by using a constricted electric arc to melt a localized area of a work piece, removing the molten material with a high-velocity jet of ionized gas issuing from the constricting orifice. Plasma arcs typically operate at temperatures of 10,000 to 14,000°C. PAC generates significant amounts of metal oxide fumes and other pollutants during cutting operations. Most of the particulate matter produced by PAC is submicron in size and, as such, is considered to be all PM-10. The elemental composition of the fume will vary with the PAC process utilized and with the work piece composition. Hazardous metals that have been identified in fume include manganese (Mg), nickel (Ni), chromium (Cr), cobalt (Co), and lead (Pb). Fume particulates can be deposited on surfaces throughout the work area or job site, which if not contained or collected poses hazard to workers, and or which can be exposed to rainfall and contribute to storm water pollutant loading into the nearest water body.

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Heavy metals (Iron oxide, Manganese, Cadmium oxide, Zinc oxide, Chromium, Nickel, and Flouride) will be generated from welding. **Tables 5-2** list the common air contaminants of different welding process. Shield metal arc welding of mild steel, or "stick welding," is the most common use of welding. The main exposure is to iron oxide, and pulmonary deposition of this non-fibrogenic particulate has resulted in the development of benign pneumoconiosis. Exposure to manganese and fluoride fumes may be considerable when certain welding rods are used.

Table 5 - 2. Air Contaminants of Selected Welding Processes

Process	Base Metal	Contaminants
Shield metal arc (stick welding)	Mild steel	Dust, iron oxide, manganese
Shield metal arc (stick welding)	Stainless steel	Chromium, nickel, manganese, fluorides
Gas metal arc	Stainless steel	Chromium, nickel, manganese, nitrogen oxides, ozone
Tungsten inert gas	Aluminum	Ozone, aluminum oxide
Gas, brazing, cutting	Variable	Nitrogen oxides, cadmium oxide, metal fumes

The corrosion-resistant properties of stainless steel are a result of a high concentration of chromium (18-30%). Nickel and manganese may also be present in different stainless steel alloys. Exposure to chromium (including Cr VI), nickel and manganese may considerable, particularly with gas metal arc process. The stainless steel surface reflects ultraviolet radiation, with formation of oxides of nitrogen and ozone. Low hydrogen welding of stainless steel generates high concentrations of fluoride fumes.

Most aluminum welding uses the tungsten inert gas method. As with stainless steel, the gas-shielded process results in formation of ozone as a consequence of the action of ultraviolet radiation on the nascent oxygen in the atmosphere. Total dust and aluminum oxide generation are also considerable.

Brazing and gas welding both generate metal fume. An acetylene torch is used to generate an intense flame. Exposure to cadmium oxide from cadmium containing silver solder has caused acute lung injury and death after brazing in enclosed spaces. Similar consequences have occurred from generation of the oxides of nitrogen during gas welding. In all cases, improper ventilation was the critical factor in creating the hazard.

Coatings or contaminants may present additional hazards, particularly when their presence and potential hazard are unknown or unsuspected. The formation of toxic gases, fumes, or vapors is usually due to the heating of a coated or treated metal, although phosgene exposure is related to the action of ultraviolet radiation or heat on chlorinated hydrocarbon vapors (similar to the formation of ozone from oxygen and oxides of nitrogen from nitrogen). Some fluxes, such as rosin, are skin sensitizers and may cause allergic dermatitis or asthma.

Lead. Potential contamination of the workplace with lead dust requires careful attention to hygiene. Lead is also an important ingredient of paints which is widely used in shipyards and thus increasing the hazard for exposure among yard workers. Lead contamination can cause damage to kidney, reproductive system, liver, brain, and

central nervous system of humans and other organisms. High levels of lead in the aquatic environment can also cause teratogenic effects, reduced growth, and increased mortality of many organisms.

5.5.2.4 Physical Hazards

Noise

Yards are inherently noisy. Noise levels of above 85 dB(A) may be experienced – especially in enclosed areas – in addition to those generated by operational vehicles and heavy equipment within the yard.

Some operations in the shipyard produce excessive noise which may lead to hearing loss. Some of these activities include:

- Abrasive blasting
- Needle gunning
- Scaling
- Grinding
- Metal straightening
- Carbon Arcing/Arc gouging
- Pneumatic pumps
- High-pressure steam or water cleaning
- Ventilation equipment

Heat, Vibration, Ergonomic Stress, and Occupational Accidents

Welders and cutters may work outdoors, often in inclement weather, or indoors, sometimes in a confined area designed to contain sparks and glare. Outdoors, they may work on a scaffold or platform high off the ground. In addition, they may be required to lift heavy objects and work in a variety of awkward positions, while bending, stooping, or standing to perform work overhead. Welding and brazing workers need good eyesight, hand-eye coordination, and manual dexterity. They should be able to concentrate on detailed work for long periods and be able to bend, stoop, and work in awkward positions. Thus, other physical hazards, such as heat, vibration, ergonomic stress and occupational accidents exist during all phases of the development of the project. Heat is usually present in enclosed, poorly ventilated areas. Vibration occurs when mechanical energy from an oscillating source is transmitted to another structure.

Table 5-3 enumerates the injuries due to occupational accidents and diseases acquired in the physical environment.

Table 5 - 3. Occupational and Environmental Related Diseases

Occupational injuries	Diseases due to Physical Environment
1. Contusion, bruises, hecatomb	Diseases due to Noise and Vibration
2. Abrasions	Deafness (due to noise)
3. Cuts, lacerations, punctures	White fingers disease
4. Concussion	Muscular-skeletal disturbances

5. Avulsion	Fatigue
6. Amputation, loss of body parts	Diseases due to Temperature and Humidity
7. Crushing injuries	Hot Temperature
8. Spinal injuries	Heat strokes
9. Cranial injuries	Heat cramps
10. Sprains	Dehydration
11. Dislocation/fractures	Heat exhaustion
12. Burns	Ergonomic Stress
	Exhausting physical work
	Prolonged standing
	Excessive mental effort
	Unfavorable work posture
	Static monotonous work

Available information suggests the prevalence of malaria and dengue in the area and thus poses health hazards to workers to be deployed in the area. This will be greatly minimized with the immunization of workers and the residents of the surrounding community.

5.5.2.5 Natural Hazards

Natural hazards are identified and discussed under Section 3.1.4 of the Environmental Baseline Conditions.

5.5.2.6 Hazards from Decommissioning/Abandonment

As mentioned earlier, hazards associated with the decommissioning and abandonment of the facility is limited to hazardous and non-hazardous waste and dust. Hazardous waste may include those which have been generated during the time the facility was operational and which were left undisposed/unmanaged.

5.5.3 Dose-Response Assessment

5.5.3.1 Sulfur Oxides (SO_x)

The oxides of sulfur associated with the construction and operation of the yard include sulfur dioxide (SO_2) and sulfur trioxide (SO_3). They form when sulfur containing compounds, such as fuel oil, undergo combustion. Sulfur dioxide is the more predominant oxide of sulfur which is produced during combustion of fuel oil. It is a non-flammable, colorless gas with a characteristic, pungent, irritating odor. These oxides react with water vapor to form aerosols of sulfurous acid (H_2SO_3) and sulfuric acid (H_2SO_4). The mist of sulfurous and sulfuric acid formed through the reaction of SO_x with water can irritate the respiratory system. Specifically, the epithelial tissue of humans and animals. These acids can also cause yard injury.

SO_2 is considered a highly toxic gas which acts as a systemic poison. Inhalation of this gas leads to the formation of sulfuric acid in the lungs. Consequently, the epithelial tissues will burn and corrode and the exposure will lead to cellular necrosis. Inhalation primarily affects the upper respiratory tract and the bronchi. Animal studies indicate that SO_2 manifests reproductive toxicity. Mutagenicity assays in human cell systems also indicate that this gas is a potential mutagen. Epidemiological studies of inhalation of SO_2 indicate the following systemic effects: (1) pulmonary vascular resistance; (2) respiratory depression; and (3) other pulmonary changes. Its carcinogenicity has not been elucidated but data indicate that it is a tumorigen and a teratogen.

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Sulfur dioxide may cause edema of the lungs or glottis, and can also lead to respiratory paralysis. Its transformation in the presence of water vapor makes sulfur dioxide an irritant to the eyes, skin, and mucous membranes. The effects of various SO_2 levels are listed in Table 5-4.

Table 5 - 4. Effects of Various SO_2 Levels

Sulfur Dioxide Level (ppm)	Resulting Conditions/Effects in Humans
0.3	Sulfur dioxide initially detected by taste.
2.0	OSHA[1] Permissible Exposure Limit (PEL)
3.0	Odor becomes easily detected.
5.0	OSHS[2] Threshold Limit Value (TLV)
6.0 – 12.0	Irritation of the nose and throat
20.0	Irritation of the eyes
50.0 - 100.0	Maximum exposure for a 30-minute period
400.0 - 500.0	Dangerous concentration which can cause edema of the lungs and glottis; death after prolonged exposure.

[1] U.S. Occupational Health and Safety Administration

[2] Occupational Safety and Health Standards, DOLE

5.5.3.2 Oxides of Nitrogen (No_x)

The oxide of nitrogen that predominates the exhaust of diesel-powered generators employed in the yards is nitrogen dioxide (NO_2). Other oxides such as nitrous oxide (N_2O), nitric oxide (NO), nitrogen trioxide (NO_3), and dinitrogen pentoxide (N_2O_5) are also present but in lower concentrations.

5.5.3.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a reddish brown gas with an irritating odor. Animal studies indicate that NO_2 is toxic through the inhalation route of exposure. In humans, epidemiological studies indicate that it is also toxic through inhalation yielding systemic effects which include: (1) pulmonary vascular resistance changes; (2) cough; (3) dyspnea; and (4) other pulmonary changes. Other animal studies show evidence that NO_2 leads to mutagenesis, teratogenesis and can manifest reproductive toxicity.

OSHS of DOLE prescribed a ceiling value of 5 ppm to NO_2 exposure. Other occupational exposure limits for nitrogen dioxide are: 1.0 ppm short term exposure limit (U.S. OSHA); 3.0 ppm (ACGIH TLV); 5.0 ppm (ACGIH) short term exposure limit.

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5.5.3.4 Nitrous Oxide (N_2O)

Nitrous oxide is a colorless gas which is also known as laughing gas. It has a slight sweet odor and is used in dental medicine as anesthesia. Nitrous oxide is moderately toxic by inhalation. The human systemic effects following inhalation of N_2O include: (1) general anesthesia; (2) decreased pulse rate without accompanying decrease in blood pressure; and (3) body temperature decrease. Evidence from animal studies indicates that N_2O is a teratogen and it manifests reproductive toxicity. Nitrous oxide is an asphyxiant. It does not burn but is flammable and supports combustion. It is a moderate explosion hazard and can form an explosive mixture with air.

The American Conference of Governmental Industrial Hygienists (ACGIH) TLV for nitrous oxide is 50.0 ppm.

5.5.3.5 Nitric Oxide (NO)

Nitric oxide (NO) or nitrogen monoxide is a colorless gas. It is poisonous and is a severe irritant to the eye, skin, and mucous membrane. Results of mutagenicity assays indicate that it is a potential mutagen.

Inhalation of nitric oxide leads to the formation of nitric and nitrous acid in the alveolar airspace. The acids formed are irritating and can lead to congestion in the throat and bronchi and often lead to edema in the lung parenchyma. The acids can potentially be neutralized by the alkalis present in the epithelial tissues with the formation of nitrites and nitrates. The accumulation of nitrites and nitrates can lead to arterial dilation, hypotension, headache and dizziness, and a potential for the formation of methemoglobin. However, the nitrite effect of methemoglobinemia is of secondary importance.

Due to its low solubility in water, the odor threshold for oxides of nitrogen is extremely low and the irritating effects in the mucous membranes of the upper respiratory tract is hardly noticeable at low dosage. Exposure to 60-150 ppm leads to immediate irritation of the nose and throat with coughing and burning in the chest and throat. Removal from the exposure source at this point, however, clears the symptoms especially upon breathing fresh air and the exposed individual can feel well for several hours. Approximately 6 - 24 hours after exposure, a sensation of burning of chest and tightness develops, followed by shortness of breath, restlessness, and sleeplessness. Dyspnea and air hunger may increase rapidly with the development of cyanosis, followed by unconsciousness and death.

In cases where the exposed individual overcomes pulmonary edema, there is usually no permanent damage, but pneumonia could potentially develop later. Exposure to concentrations ranging from 100-150 ppm are dangerous for exposure periods of 30-60 minutes. Exposure to concentrations of 200-700 ppm can be immediately dangerous to life and health. Chronic exposure to low doses of the fumes may be insufficient to cause pulmonary edema, however, it can lead to chronic irritation of the respiratory tract with headaches, cough, loss of appetite, dyspepsia, gradual loss of strength and corrosion of the teeth.

The occupational exposure limits for nitric oxide is a TLV of 25 ppm prescribed by both OSHS of DOLE and ACGIH.

5.5.3.6 Carbon Monoxide (CO)

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Carbon monoxide is a colorless, odorless, poisonous gas. It is produced by the incomplete burning of solid, liquid, and gaseous fuels.

The health effects of CO depend on the level of CO and length of exposure, as well as each individual's health condition. The concentration of CO is measured in parts per million (ppm). Health effects from exposure to CO levels of approximately 1 to 70 ppm are uncertain, but most people will not experience any symptoms. As CO levels increase and remain above 70 ppm, symptoms may become more noticeable (headache, fatigue, nausea). As CO levels increase above 150 to 200 ppm, disorientation, unconsciousness, and death are possible.

Carbon monoxide toxicity is due to two main mechanisms:

CO binds to hemoglobin and decreases the oxygen content of blood; this results in acute tissue hypoxic injury

CO binds to mitochondrial cytochrome oxidase and impairs oxidative phosphorylation and causes cell damage

Carbon monoxide (CO) binds very strongly to the iron atoms in hemoglobin, the principal oxygen-carrying compound in blood. The affinity between CO and hemoglobin is 240 times stronger than the affinity between hemoglobin and oxygen.

5.5.3.7 Acute hypoxic injury due to carboxyhemoglobin

CO binds to the hemoglobin, producing carboxyhemoglobin (HbCO), and blocks these sites on hemoglobin where oxygen would normally bind. The reduction in oxygen carrying capacity of the blood results in acute tissue hypoxia. An additional factor impairing oxygen release to the tissues is the left shift of the oxyhemoglobin dissociation curve that occurs due to CO.

A sufficient exposure to carbon monoxide can reduce the amount of oxygen taken up by the brain to the point that the victim becomes unconscious, and can suffer brain damage or even death from anoxia. The brain regulates breathing based upon carbon dioxide levels in the blood, rather than oxygen, so a victim can succumb to anoxia without ever noticing anything up to the point of collapse. Hemoglobin acquires a bright red color when converted to carboxyhemoglobin, so a casualty of CO poisoning is described in textbooks as looking pink-cheeked and healthy. However, this "classic" cherry-red appearance is very uncommon being only seen in 2% of cases, so care should be taken not to overlook the diagnosis if this color is not present.

Fetal hemoglobin has an even higher affinity for CO than adult hemoglobin. HbCO also takes longer to clear from the fetal circulation. Mothers who seem to have only moderate CO poisoning may consequently have a fetus which is very severely damaged.

5.5.3.8 Delayed neurologic damage due to mitochondrial damage

People who survive an acute episode of severe poisoning often (14-40% of cases) develop delayed neurological dysfunction. The level of COHb in the blood does not correlate very closely with symptoms or with outcome and cannot explain the phenomenon of delayed neurologic sequelae.

The mechanism for the delayed neurologic injury is due to the adverse effects of the intracellular uptake of carbon monoxide. CO binds to the mitochondrial enzyme cytochrome oxidase,

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impairing oxidative phosphorylation and causes oxidative stress in the cell. Additionally, nitric oxide released from platelets and endothelial cells leads to formation of the free radical peroxynitrite which further damages neurones, and the vascular endothelium of the cerebral vessels. Consequently, lipid peroxidation occurs in the brain during 'recovery' from the acute CO poisoning. The injury results also in an increased release of the excitatory neurotransmitter glutamate which causes further damage in the brain. The result is cognitive defects (especially affecting memory and learning) and movement disorders. The movement disorders are related to a predilection of CO to damage the basal ganglia.

These delayed neurological effects may develop over days following the initial acute CO poisoning.

With chronic low-level exposure, similar neurologic injury may occur. Carbon monoxide acts as a potent neurotoxin, creating irreversible lesions in the brain's white matter (i.e., the myelin sheath). Such lesions, which are similar to those found in multiple sclerosis, can result in severe cognitive impairment.

5.5.3.9 Lead

Toxic lead exposure is the most significant and prevalent disease of environmental origin in the world today. Despite all that is known regarding the hazards of lead exposure for young children, it has taken more than a century for primary prevention to be adopted in the most highly developed countries. The rest of the world is woefully behind in the development of programs to protect children from lead poisoning. The phasing out of lead in gasoline, which began in the United States in 1972, and was completed in 1995, has resulted in almost fourfold reduction in median blood lead levels in children. The demonstrable success and social benefits of preventing lead exposure are unarguable.

Lead is a heavy metal that is not biodegradable. It is indestructible and cannot be transformed into a non-toxic form. Worldwide mining each year produces over 3 million cons of lead for consumer products. Well over half of the 300 million tons of lead ever removed from the earth was released as contamination and is available to human exposure.

The ever-increasing global use of lead is occurring at a time when lead uses in gasoline, canning and paints are restricted or banned in most developed countries. Lead is increasingly used in storage batteries and other electronic equipment, major areas of international economic growth. The greatest global demand for lead has occurred in Asia over the past 20 years.

Lead is absorbed and largely deposited in bone. Although lead serves no useful physiologic purpose, lead stays in the body for many years. Young children and fetuses are especially vulnerable to the toxic effects of lead. Lead impairs brain development in children, retarding mental and physical development and cause behavioral and learning disabilities. Lead exposure demonstrable lowers intelligence quotients in school-age children. A 10 ug/dl increase in blood lead is associated with a 2.5- point decrease in the IQ of exposed children. Although a slight decrease in IQ may not seem like much on an individual basis, across a population, such a decrement results in a substantial increase in the number of chidren falling into the category of mentally retarded. Most recent research links elevated lead levels in childhood to behavior disorders in older children and teens including delinquency and criminal behavior.
The U.S. Public Health Service and the Centers for Disease Control and prevention designate the maximum permissible concentration of blood lead as 10 ug/dl, to protect the health of children, and 20 ug/dl as the level for medical intervention. Although 10ug/dl is currently

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considered a threshold limit for concern, there is no blood lead level above zero that has not been shown to cause adverse neurologic effects.

The Centers for Disease Control and Prevention estimate that 434,000 children in the U.S.A. have blood lead levels at or above 10ug/dl. Blood lead levels of urban populations, especially children, often reach alarmingly high levels. It is estimated that among urban children in developing countries, 100% of those younger that 2 years of age, and more than 80% of those between the ages of 3 and 5 years, have blood lead levels greater than 10 ug/dl. Preliminary studies show that blood lead levels of virtually all children in Africa and Latin America exceed 10 ug/dl.

Lead is also toxic to adults in concentrations once thought to be safe. Several studies relate increased blood pressure and hypertension in adults to elevated blood lead levels. This, in turn, increases the risk of cardiovascular disease. The impact of lead on blood pressure, a major risk factor for coronary artery disease and stroke, is seen at levels quite prevalent in the general population. A review of available studies indicates that a 1 ug increase in ambient lead concentrations may cause substantial increases in hypertension, nonfatal heart attacks, and premature deaths.

Exposure to lead causes an economic loss to society in a number of ways. The reduction of intellectual performance results in reduced productivity and diminished lifetime earnings. Children with learning disabilities may require special assistance. Adults with comfort, require medical care, and may die prematurely. In the United States, for example, the benefits of phasing out lead are estimated to outweigh the costs by more than 10 times.

5.5.3.10 Volatile Organic Compounds

Levels of VOC exposure in enclosed spaces vary widely depending on:

- the volume of air in the room/building
- the rate at which the VOC is off-gassed
- the building ventilation rate
- outdoor concentrations
- time spent in the effected environment

VOCs are an important health and environmental concern for several reasons:

- Some VOCs can be hazardous to health when inhaled. For example, benzene is a probable human carcinogen and toxic. Likewise, formaldehyde is both an irritant and a sensitizer. Many VOCs are flammable.
- VOCs from outgassing of fabrics, building materials etc. are an important contributor to sick building syndrome (SBS).
- VOCs such as hydrocarbon (gasoline, petroleum distillates) emissions from cars and trees are important contributors to photochemical smog.
- Some VOCs such as methyl tert-butyl ether (MTBE, once added to gasoline to make it burn more cleanly) have a fair solubility and rather high mobility in groundwater, leading to the contamination of drinking water wells.

Health effects of VOC exposure

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Acute	Chronic
Eye irritation / watering	Cancer
Nose irritation	Liver damage
Nose/Throat discomfort/irritation	Kidney damage
Headaches	Central Nervous System damage
Nausea / Vomitting	
Dizziness	
Asthma exacerbation	
Allergic skin reaction	
Dyspnea	
Emesise	
Epistaxis	
Fatigue	

Most studies to date have been conducted on single chemicals. Less is known about the health effects of combined chemical exposure. Persons with respiratory problems such as asthma, young children, elderly, and persons with heightened sensitivity to chemicals may be more susceptible to illness from VOC exposure.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effect. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics in the workplace. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

5.5.3.11 Noise

Noise exposure may exceed 85 decibels (dB) in welding process, particularly cutting or gouging operations; in plasma welding (where intense heat is generated), levels also influence noise generation. Yard workers are most vulnerable to noise generated by yard operation. This group may be exposed to high noise levels at extended periods that could impair their sense of hearing. High noise intensity could cause hearing damage and other physiological problems. It is clearly established that exposure to loud noise causes hearing loss which can lead to hearing handicaps and deafness. In most cases, hearing loss is caused by a gradual shifting of threshold of hearing due to repeated exposure to noise. It was shown that the length of exposure is as important as the magnitude of noise level in producing hearing loss.

Hearing loss due to noise exposure is caused by damage to nerve cells in the inner ear. Damage to these cells caused by continuous noise exposure is irreversible.

The Occupational and Safety and Health Standards (OSHS) of the Department of Labor and Employment (DOLE) prescribes the permissible noise exposure of workers in **Table 5-5**.

Table 5 - 5. Permissible Noise Exposure (Source: OSHS, 1990)

Duration per day, hours	Sound Levels, dBA
8	90
6	92
4	95

3	97
2	100
1-1/2	102
1	105
½	110
¼	115
Ceiling Value: No exposure in excess of 115 dBA is allowed.	

5.5.3.12 Heat/Radiation (infrared, ultraviolet), vibration, and ergonomic stress.

Radiation and heat result in the most common injuries to welders: photokeratitis (welder's flash) and thermal burns. These are often related to improper use of protective goggles, gloves and screens. Flying sparks or debris may cause burns or eye injury as well. Electrical shock is a constant hazard and requires careful grounding and shielding of cables and equipment. Most manual process place isometric stress on the welder, particularly involving the shoulders and the upper extremities.

5.5.3.13 Clinical findings

Acute Exposure

- Photokeratitis – Photokeratitis is the result of exposure of the cornea to ultraviolet B radiation in the 280- to 315-nm range. Following exposure of the unprotected eye to the welding arc for several seconds, the worker develops pain, burning, or a feeling of "sand or grit" in the eye.
- Metal fume fever - Metal fume fever is a benign, self-limited condition characterized by the delayed onset (8-12 hours) of fever, chills, cough, myalgias, and metallic taste.
- Upper respiratory irritation – may result from exposure to a variety of welding contaminants, including dusts, ozone, aluminum oxide, nitrogen oxides, cadmium oxide, and fluorides. Asthma may also be triggered as a result of nonspecific irritation or allergy (chromium, nickel).
- Lung injury – While unusual, exposure to oxides of nitrogen and cadmium oxide may cause acute lung injury and delayed pulmonary edema. A history of gas welding or brazing in enclosed or poorly ventilated spaces or sheet metal work should raise this concern and serve as an indication for careful medical evaluation and observation.
- Musculoskeletal trauma – Injuries resulting from isometric stress on the upper extremity during welding may present as symptomatic shoulder and neck pain following prolonged activity. Asymptomatic muscle damage may result in slight increases in creatine phosphokinase levels of the serum.

Chronic Exposure

- Siderosis – results from accumulation of nonfibrogenic iron oxide particles in the lung. While the radiographic appearance may be dramatic, with evidence of diffuse reticulonodular densities, reports of deficits of pulmonary function are inconsistent, suggesting a mild or minimal effect. In welders who have also been exposed to

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crystalline silica or asbestos, radiographic differentiation of hemosiderosis from pulmonary fibrosis is difficult. Pleural thickening or calcification has not been related to welding in the absence of asbestose exposure.

- Other chronic effects – Welders report an excess of respiratory symptoms and have increased work absences from respiratory disease. Demonstration of clear deficits in pulmonary function attributable to welding have been inconsistent. At present, there is limited evidence that welding results in chronic respiratory impairment. In the evaluation of a welder with chronic lung disease, a careful medical and occupational history is essential, focusing on both welding exposures and other confounding factors.

Studies of lung cancer in welders have also been inconsistent, sharing the limitations of many of the respiratory studies. Some researchers attribute the small excess in lung cancer cases seen in several studies to exposure to chromium and nickel in welding of stainless steel. Studies involving welders who worked in shipyards during the first half of this century are confounded by significant secondary exposure to asbestos.

Other studies indicate that welders may have decreased sperm counts and be at risk for adverse reproductive outcomes. Subtle neuropsycholgical effects are also reported.

5.5.4 EXPOSURE ASSESSMENT

The potential exposure dose of the general public, workers, and other ecological receptors to specific hazards generated by the operation of the yard will be discussed in this section.

5.5.4.1 Environmental Setting

Community Health Profile of Influenced Barangays

The municipality of Subic has a population of 76,956 distributed to 16 barangays. There is one municipal health unit (MHU) and nine (9) barangay health units (BHU) distributed in the several barangays that manage medical health and problems of residents. Patients that need further evaluation and management of diseases are referred to Olongapo City.

Table 5-6 enumerates the comparison of health indices between Subic and the National Statistics of the Philippines in rates/1,000 population. It shows that the live births, all types of death rates are much lower in the municipality of Subic than in the Philippines as a whole. This means that the health of the people in Subic, as reflected in the health indices, is better than the average health picture in the Philippines.

Table 5 - 6. Subic and Philippine Health Picture

	Subic (2004)	Philippines (1997)
Population	76,956	71,549,790
Crude Birth Rate	8.55	23.1
Crude Death Rate	3.05	4.7
Infant Mortality Rate	0.10	17.0

Neonatal Death Rate	0.06	9.5
Maternal Mortality Rate	0	0.9

Subic and Philippines are similar in the leading causes of diseases for diarrhea, pneumonia, hypertension, pulmonary tuberculosis and malaria. However, the rates of these diseases per 100,000 population is much lower in Subic compared to that in the Philippines. This reflects the better delivery of health programs to control these diseases in Subic compared to the average of the Philippines (**Table 5-7**).

The health programs implemented in the municipality of Subic are shown in **Table 5-8**.

Subic statistics has dog bites and sexually transmitted diseases that are not included in the top ten morbidity of the Philippines. This means that there is a public health concern for these diseases that has to be addressed in Subic. However, the rate of STD has decreased in rate in the last 4 year.

Table 5 - 7. Leading Causes of Morbidity, Subic and Philippines (rate/100,000 population)

Causes	Subic (2001)	Subic (2004)	Philippines (1998)
1. Diarrhea	635	488.59	1273
2. Pneumonia		130.10	884
3. Bronchitis			868
4. Influenza			770
5. Hypertension	725	396.33	217
6. Pulmonary Tuberculosis	356	283.27	179
7. Diseases of the Heart			98
8. Malaria	28	104.87	96
9. Dengue			60
10. Chicken Pox		5	44

Table 5 - 8. Public Health Programs

Program/Activities
1. Maternal and Child Care
a. Pre-natal Care
1. Pregnant woman with 4 or more visits
2. Pregnant women given TT2+
3. Pregnant women given:
TFAP/OFS
Iron
Iodine
b. Post Partum
1. Total post partum home visits
2. Women receiving at least 1 PP visit
II. Expanded program for immunization (EPI)
Immunization: BCG
DPT1
DPT2
DPT3
OPV1
OPV2

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Program/Activities
OPV3
Measles
FIC fully immunized child
Hepa B1
Hepa B2
Hepa B3
Children given Vitamin A during measles Immunization
III. Control of Diarrheal Diseases (CDD)
Diarrheal Cases seen: <1 year
1 – 4 years old
Treated with Oresol: <1 year
1 – 4 years old
IV. Nutrition
Identification of 0 – 72 mos. children
OPT – Operation Timbang
Children 0 – 72 mos. Given: TFAP
Vitamin A
Iron
VI. Family Planning Program
New acceptors: pills, condom, DMPA, NFP/LAM, IUD
Continuing User
VII. Tuberculosis Control Program
VIII. Control of Acute Respiratory Infection
Treatment of early pneumonia cases
Pneumonia
Pneumonia

Table 5-9 shows the leading causes of deaths (rates per 100,000 population) in the Municipality of Subic and the Philippines. The common diseases for both are diseases of the heart, vascular system (hypertension), pneumonia, cancer, tuberculosis, diabetes and other respiratory problem as bronchial asthma (as other respiratory problem). The rates of these diseases are higher in the Philippines compared to that of Subic, except for cancer. There is still a need for the Department of Health to prioritize and mobilize the health programs dealing with the common causes of deaths in Subic.

Table 5 - 9. Leading Causes of Mortality, Subic and Philippines

Causes	Subic	Philippines
1. Diseases of the Heart	44.18	763
2. Diseases of the Vascular System	42.88	56
3. Pneumonia	19.49	46
4. Cancer	49.37	43
5. Accidents		40
6. Tuberculosis, all forms	22.09	38
7. COPD		19
8. Diabetes Mellitus	9.09	12
9. Other diseases of the Pulmonary	16.89	10
10. Nephritis, Nephrosis, Nephrotic		10

Results of the Public Health Survey

Causes of Morbidity

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Table 5-10 shows the leading causes of diseases in impact barangay (Bgy. Cawag - Sitios Agusuhin, Nagyantok and Natulong) extracted from the public health survey. The leading causes of diseases in the survey are generally similar to the findings in the secondary health data of Subic Municipality. However, diseases that are common in Agusuhin that are not leading diseases of Subic include allergic rhinitis, conjunctivitis, cerebro-vascular diseases, dengue fever, musculoskeletal diseases, anemia, chicken pox and typhoid fever. Allergic rhinitis and conjunctivitis are allergic reactions to dust, pollens from plants and other suspended particles in the atmosphere. Dengue fever and malaria are diseases spread by infected mosquitoes that breed in water bodies in the surroundings. Typhoid fever, diarrhea and parasitism are infections of the intestinal tract that are spread through intake of contaminated food and water. Infected individuals can spread the microorganisms through unsanitary way of waste disposal in unsanitary toilets that can easily contaminate water in the environment. Since most of the responders are adults, majority complains of musculoskeletal diseases. Anemia is part of malnutrition. There is a need for the BHU/MHU to address this problem.

Leading causes of mortality in the barangay area are stroke/cerebro-vascular accident and dengue fever. These diseases were not detected in the Municipal Health Unit of Subic since these are cases could have been hospitalized in Olongapo City.

Table 5 - 10. Leading Causes of Morbidity from 2004 to Present

Causes	*Agusuhin*	*Nagyantok*	*Nagtulong*	Frequency
Acute Respiratory Infection	998	98	45	1,141
Allergic Rhinitis	40	-	-	40
Diarrhea/ Amebiasis	22	1	-	23
Conjunctivitis	19	-	1	20
Stroke/Cerebro-vascular Accident	18	-	-	18
Dengue Fever	15	-	-	15
Joint/ Muscle Pains	7	-	6	13
Anemia/ Pallor	11	1	-	12
Chicken Pox	11	1	-	12
Influenza (Flu)	12	-	-	12
Ascariasis/ Parasitism	10	-	-	10
Nasal Disorder	10	-	-	10
Skin rashes / allergy	9	1	-	10
Typhoid Fever	9	-	1	10
Kidney Disease	9	-	-	9
Tonsillo / Pharyngitis	7	2	-	9
UTI	9	-	-	9
Malaria	8	-	-	8

Causes of Morbidity by Occurrence to Age Group in 3 Sitios

Among the respondents (and their households), Acute respiratory infection is highest in the middle age group (25 to 39 years). This is the age group that work and mobilize so often facilitating spread of the disease. Diarrhea could be highest in ages 5 to 14 years because of more frequent intake of contaminated food and water taken outside homes. Food taken outside homes could either be not cooked properly or not handled properly (unsanitary) to cause spread of infectious microorganisms. The younger age group (5

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to 14 years) are susceptible to Subic statistics has dog bites and sexually transmitted diseases that are not included in the top ten morbidity of the Philippines. This means that there is a public health concern for these diseases that has to be addressed in Subic. However, the rate of STD has decreased in rate in the last 4 year.

Table 5 - 11. Ten Leading Causes of Morbidity by Age, 2004 to Present

Diseases/ Morbidity / Age Group	Ten Leading Causes of Morbidity / Diseases from 2004 to Present									
	Acute Resp	Diarrhea	Flu	Lung Disease	UTI	Malaria	Allergy	Stroke	Oral Lesion	Tooth-ache
Under 1	1									
5 to 14	32	25	24	12	3	1	3		1	
15 to 24	24	10	5	4	6	5				
25 to 39	64	11	12	7	11	1	3			1
40 to 59	27	5	8	4	5			3		
60 and over	2	1	1		1		1	2		
Total	150	52	50	27	26	7	7	5	1	1

Medical personnel include: one physician, one dentist, one medical technologist, rural sanitary inspector and non-technical worker and two nurses based in the central or municipal health unit of Subic only. There are ten midwives, three dental aides, two laboratory aide and 70 barangay health workers (BHW) who attend the sick residents in the distant barangay areas. Residents living in far barangays have to travel to the municipal health office and other private clinics to be seen by a physician. Most of the respondents (161) in the health survey go to the Municipality of Subic to seek medical assistance and avail free medicines. Other respondents (154) commonly go to the Barangay Cawag Health Center also for check-ups and free medicines however, its services are not regularly available.

A few respondents (34 respondents) go to Hospitals or to private clinics such as Monte Falcon (48 respondents) in Subic for medical consultation due to high expenses. Some still resort to self-medication or alternative medicine (quack doctors).

The ratio between doctors, dentist, nurses and midwives is acceptable based on DOH requirement as shown in **Table 5-12**.

Table 5 - 12. Health Manpower by Year (Rate/100,000 Population), Municipal Health, Subic, Zambales

	2004	Standard DOH Requirement
Municipal health officer	1	1:20,000
Public health dentist	1	1:50,000
Public health nurse	2	1:10,000
Rural health midwives	10	1:5,000
Medical technologist	1	1/municipal
Rural sanitation inspector	1	1:20,000

Medicines are commonly availed by the respondents from the Municipality Health Unit and the Bgy. Cawag Health Center. Unavailable medicines are bought from Pharmacy Stores in Subic or at a variety store within their Sitio.

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Medicines usually taken by respondents are consistent with the requirements of the usual diseases in the impact area. These medicines include Paracetamol for fever and pain, Antibiotics for infections (ARI, UTI, pneumonia, etc), non-steroidal analgesics for severe pain for musculoskeletal diseases and toothache.

The presence of diarrhea and intestinal parasitism and skin infections are based on the provision of sanitary toilet facilities, access to safe water and health practices of residents. Eighty-five percent of households have sanitary type of toilets in 2004 and seventy-nine percent have access supply to safe water. However, there are still some households without toilets and sanitary toilets. About 9% households still do not have access to safe water supply (**Table 5-13**).

Most of the residents from Agusuhin, Nagyantok, and Nagtulong already own a decent toilet facility which are water-sealed (46%) or flush type (7%). Others share to a communal or public toilet (11%). However, 36% of the residents are still using other methods such as the antipolo type or thru open pit which might contaminate the ground water or the river streams where they get their domestic water. These factors contribute to the causes of diarrhea and intestinal parasitism presenting as part of the leading causes of diseases in the impact barangays. The Environmental Sanitation and Program Control of Diarrheal Diseases will have to be more active in preventing and controlling these diseases.

Table 5 - 13. Sanitation and water Facilities by Year (*rate/100,000 population*), Municipal Health, Subic, Zambales

	2004
Households with sanitary toilets	10,092 (85%)
Households with unsanitary toilets	315 (1.81%)
Households without toilet	233 (1.81%)
Households with access to safe water	10,092 (79%)
Households without access to safe water	1,125 (8.8%)

Vulnerability Analysis of the Primary Impact Communities

The barangay will be vulnerable to the following:

- rapid in-migration of people seeking employment in the yard resulting in increasing congestion, demand and competition for available public health and community services;
- increasing pollution in the area brought about by motor vehicle emissions, discharges and the emissions from the operations of the yard; and
- depletion of water supply in the community due to the increasing demand of the operations of the yard.

Health Effects (Consequences)

Air pollution

Table 5-14 shows the possible health effects of NO_2, SO_2 and PM10 (dust) with exposure levels above acceptable limits of vulnerable population:

Table 5 - 14. Health Effects and Exposure Limits

Air Pollutants	Health Effects	Exposure Limits *
NO_2	Possible increase in upper respiratory tract infection especially among children < 2 years old.	0.053 ppm (200ug/m3) Annual arithmetic mean
SO_2	increase respiratory symptoms like cough, colds, difficulty of breathing, wheezing and bronchitis more common among children and the elderly	0.03 ppm (365 ug/m3) 24 hour averaging
PM10	increase respiratory symptoms like cough, colds, difficulty of breathing, wheezing and bronchitis more common among children and the elderly	Standard for PM10 150 ug/m3 24 hour averaging

Source: National Ambient Air Quality Standards, 1987. USA

Water Pollution

With the construction and use of oil/water separator units and waste water treatment facility to prevent discharges, no significant contamination of nearby water body is expected. Any small oil and chemical discharges are expected to be controlled by the yard's waste water treatment facility. Appropriate containment or capture of particulate dusts (dust collectors) – and including best practices established – generated from the cutting of metal sheets and welding will further reduce the possibility of these being exposed to storm water and thus prevented from being discharged into the nearest water body.

A small increase in the risk of water contamination maybe expected during tank cleaning of main fuel storage tanks which will generate significant amounts of sludge requiring adequate disposal. However, tank cleaning is a non-routine operation and is done only once every five years. Tank cleaning operations will be handled by trained and accredited contractors that will supply the fuel needs of the project.

No adverse health impact is expected due to contamination or release of oil and other chemicals into the river with the presence of oil and water separators as well as the water treatment facility of the yard.

Risk Characterization

Risk characterization is the process wherein the acceptability of the risk is assessed. Results of this process are used to make informed decisions in the risk management process.

Community Health

Based on foregoing discussions, most of the risks posed by the operation of the yard to the surrounding communities are considered minimal. The community surrounding the yard will be resettled according to plan and thus thereafter further reduce possible

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exposure. With the development of the yard it is expected that a new but planned community (workers) will be established which will be less vulnerable to adverse health effects of the yard operations. The exposure of the community to air emissions is considered minimal since concentrations of pollutants localized or generated within the yard.

The risks posed to community health are considered acceptable and no additional control and recovery measures are required of the proposed yard.

Occupational Health

The proposed establishment and operation of the yard will introduce significant occupational health hazards in some of the work processes. These include metal cutting, welding and painting and in some areas where individual workers maybe exposed. The risk to health from these hazards maybe reduced to as low as reasonably practicable through the establishment of a comprehensive occupational health program.

The occupational health risks identified are generally acceptable with the incorporation of risk reduction measures.

5.6 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.6.1 COMMUNITY HEALTH

5.6.1.1Community Health Risk Assessment

No significant community health risk is expected from the project because of the following considerations:

- morbidity and mortality profile of the primary impact communities reflects a relatively healthier population compared to the Philippine standard;
- although there is some level of inadequacy for health care resources and health care delivery system at the primary impact communities – these can be supplemented with the health programs to be developed as soon as project is established/operational;
- acceptable design parameters of the yard, especially with the establishment of a waste water treatment facility. Use of control systems (collection/containment/capture) will further enhance the safety factor of the yard; and
- NO_2, SO_2, TSP, CO generated will be localized (within the yard compound) and thus least likelihood of untoward exposures resulting in adverse health effects.

5.6.1.2 Community Health Status Monitoring

Monitoring

Baseline mortality and morbidity statistics should initially be obtained for comparison during the succeeding years' statistics. Secondary data of health profile of the

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residents in the impact areas is the easiest and fastest way of monitoring their health status. This should be regularly gathered from the project site and from the barangay and municipal health office. This will be able to monitor the leading causes of deaths and diseases and other health indices every year. Changes in disease pattern in the impact communities will need further investigation to determine the contribution of the project to disease causation.

Public health surveillance should be done regularly to investigate the people in impact communities who are asymptomatic for the purpose of classifying them with respect to their likelihood of having a particular disease. The purpose of health surveillance is that early detection, before the development of symptoms, will lead to a more favorable to a more favorable prognosis because treatment begun before the disease becomes clinically manifest will be more effective than later treatment.

Health monitoring of at risk communities is based on the premise that environmental health hazards are uncontrolled and regularly exceed community standards of DENR. Health monitoring for community-acquired illnesses is recommended for the following reasons:

Projected emissions (air, water and soil) of the yard operations are expected to be below the set standards using prescribed fuel, yard design, and pollution control devices. A good baseline data and health statistics during the construction and operation phase of the yard would be beneficial in case there are future health concerns among community residents and even yard workers.

Data from the barangay health center on patient consultations should be regularly monitored by the proponent and properly recorded. Vital health data and indicators such as: infant mortality rate, malnutrition prevalence, epidemics and maternal mortality rate should also be collected.

The proponent through its community relations officer should provide assistance for the local health unit (barangay health center) to improve its medical services to the community and enhance its recording system to monitor mortality and morbidity trend in the impact barangays for future references. Assistance can be in the form of training, funds for supplies and materials, and other resources to enhance the operation of the health center and the efficiency of the health personnel.

Aside from community health monitoring function, the data will also assist the company on possible health projects to promote in the impact area.

Regular ambient air, and water monitoring is recommended together with health monitoring for the following reasons:

- environmental monitoring is easier to conduct, cheaper and does not require high level participation of the community residents;
- it is easier to detect changes in the environmental levels compared to changes in health status therefore problems are earlier identified and acted upon;
- environmental monitoring is proactive since adverse health effects to community residents which will be detected at a later date by health status monitoring, have not yet occurred.

The following recommendations are made with regards to environmental health monitoring:

Routine ambient air and water discharges monitoring be conducted and recorded by the yard management in the following sites:

For air emission: at point source and along the environmental pathway from the point source up to the community. A quarterly monitoring of SO_2, NO_2 and TSP would be appropriate for health reasons. Particulate levels should also be included.

For water discharges: at various points during the process and at the point of discharge.

Information and Education

Workers involved in metal cutting, welding, and painting are directly involved in the possible adverse effects of chemicals involved in the project. They should be aware of the signs and symptoms of chemical toxicity secondary to lead in paints and heavy metal toxicity from welding.

The residents of impact communities should also be informed of the efforts of the project in devising safety measures so as not to cause any adverse effects on the health of the people.

Occupational Health

Occupational Health Risk Assessment

The proposed establishment and operation of the yard will introduce significant occupational health hazards in some of the work processes. These include metal cutting, welding and painting and in some areas where individual workers maybe exposed. The risk to health from these hazards maybe reduced to as low as reasonably practicable through the establishment of a comprehensive occupational health program.

The occupational health risks identified are generally acceptable with the incorporation of risk reduction measures.

Planning an occupational health and safety program for the yard operations is ideal at this stage of the pre-project construction and operation.

Work Site Occupational Health Program

Once the final site and yard design has been established, it is recommended that the project proponents establish and organize an occupational health program that will meet the health needs of the workers. The occupational health program should have the following components:
Establishment by management of a Health, Safety and Environment Policy (HSEP), which will guide the behavior of both management and labor in the yard with regards to health, safety and environmental protection. The policy should be endorsed by the president or chief executive of the company to show strong management support.

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Copies of the policy should be prominently displayed in the different work areas to remind workers of the HSE responsibilities.

Company management should appoint a health, safety and environment focal point which shall serve as a coordinator for all HSE activities in the workplace. The primary role of the focal point is advisory in nature since HSE is a line management responsibility.

The HSE officer should receive various accreditation training from the following training institutions:

For occupational health: Attendance to a post-graduate course in occupational health and safety conducted by the College of Public Health of the University of the Philippines, Manila.

For Industrial Safety: Accreditation training from the Safety Organization of the Philippines (SOPI).

For the Environment: Pollution officer accreditation course given by the Pollution Control Offices Association of the Philippines (PCAPI).

For the company management to identify the HSE organization of the company from the senior management down to the different working groups and areas in the yard since HSE is a line management responsibility.

Organization of the HSE committee which will be chaired by the HSE focal point of the company with line management and labor representatives. The HSE committee will be a forum or a working group where HSE issue can be discussed and implementation plan prepared and implemented.

Health Hazards of Welding

Prevention

Most acute injuries or poisonings related to welding processes are preventable. Strict adherence to appropriate safety procedures will prevent burns, eye injuries, and electric shock. Awareness of the potential hazards, with attention to the provision of adequate ventilation, is the best safeguard against accidental overexposure to air contaminants. In enclosed space, air-supplied respirators are essential, particularly with processes that result in generation of nitrogen oxides. Training and certification of welders is also one way of ensuring not only the quality of work but a high level of awareness of potential hazards and thus the prevention of hazardous exposure.

Careful designed and controlled studies in the future will better assess the potential impact of welding on respiratory function and on the development of lung cancer. These effects, if present, will certainly be minimized by measures to reduce welding exposures through engineering, ventilation, and proper use of personal protection.

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5.7 ENVIRONMENTAL AND HEALTH RISK MANAGEMENT PLAN

5.7.1 Risk Reduction Measures of Health Hazards

Table 5-15 shows the identified health impacts and mitigating/risk reduction measures for the proposed shipbuilding facility project.

Table 5 - 15. Matrix of Health Impact and Risk Reduction Measures

Hazards	Mitigating/Risk Reduction Measures
Workers	
Pre-Operation/Construction	
Dust and Suspended Particulate Matter (SPM)	• Use of personal protective equipment, wetting agents
NO_2	• Use of personal protective equipment, wetting agents • Efficient maintenance of the equipment/machines
SO_2	• Use of personal protective equipment, wetting agents • Efficient maintenance of the equipment/machines
CO	• Use of personal protective equipment, wetting agents • Efficient maintenance of the equipment/machines
Explosion (Live/Unexploded Ordnances)	• Engagement of experts in handling/managing live/unexploded ordinances
Explosion and Fire (Fuel Storage/Leaks)	• Construction of bunds around the tanks • All other measures applicable as found in the Construction Safety Plan
Oils and Lubricants	• Construction of a collection system
Fugitive Emissions	• Use of personal protective equipment and efficient maintenance of the fuel storage facilities
Noise	• Workers should be educated on the adverse effects of noise • Use of ear plugs/earmuffs • Training of personnel on the proper use and maintenance of hearing protective devices (earplugs, earmuffs) • Regular inspection of workers at worksite to ensure that equipment for hearing protection are worn and worn correctly • Prohibiting worker access to areas involving hazards such as manufacturing/process operations that generate excessive noise • Use of sound-dampening materials to reduce noise levels (mufflers) • Proper maintenance of equipment and machinery • Observance of threshold level values (permissible noise exposure) for exposure to noise • All other measures applicable as found in the Construction Safety Plan
Heat	• Appropriate protection including body covering, masks, eye protection, boots and gloves • Provision of appropriate ventilation systems • All other measures applicable as found in the Construction Safety Plan

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Hazards	Mitigating/Risk Reduction Measures
Vibration	• Regular work shifts and breaks to avoid too much physical exertion and vibration • Appropriate protection including body covering, masks, eye protection, boots and gloves • Health facilities of the workers • All other measures applicable as found in the Construction Safety Plan
Ergonomic Stress	• Regular work shifts and breaks • Health facilities of the workers • All other measures applicable as found in the Construction Safety Plan
Occupational Accidents	• Health facilities of the workers • Sight conservation program • Hearing conservation program • Heat stress control program • Personal protection program • Respiratory protection program • Acute injury and illness management program • Workplace inspection program • Accident prevention program • Health surveillance and monitoring • Worker health training and management • Proper training of workers • Implementation of safety programs of company • All other measures applicable as found in the Construction Safety Plan
Workers	
Operations	
Explosion and Fire (Fuel Storage/Leaks)	• Construction of bunds around the tanks • All other measures applicable as found in the Operations Safety Plan
Oils and Lubricants	• Construction of a collection system and an onsite wastewater treatment facility
Fugitive Emissions	• Use of personal protective equipment and efficient maintenance of the fuel storage facilities
Heavy Metals	• Installation of appropriate control measures to capture/contain fumes and particulates (i.e. dust collectors), as well as, ventilation systems • Lead control program • Appropriate protection including body covering, masks, eye protection, boots and gloves • All other measures applicable as found in the Operations Safety Plan
Volatile Organic Compounds (VOCs)	• Use of proper engineering controls such as a fume hood or other form of local exhaust ventilation • Use of administrative controls • Appropriate personal protective equipment such as gloves, respirator, etc.
Oxygen-deficiency (confined space entry)	• Training of workers • Check level of oxygen prior to entry • Confined area should be well-ventilated • Rescue procedures in place • Concerned workers should be aware (signage informing workers on the status of an area as to

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Hazards	Mitigating/Risk Reduction Measures
	oxygen-deficiency and work being done to address situation) • Implementation of a program for work involving confined space entry
Noise	• Job rotation will help restrict the length of exposure to potentially hazardous levels • Workers should be educated on the adverse effects of noise • Training of personnel on the proper use and maintenance of hearing protective devices (earplugs, earmuffs) • Regular inspection of workers at worksite to ensure that equipment for hearing protection are worn and worn correctly • Prohibiting worker access to areas involving hazards such as manufacturing/process operations that generate excessive noise (sand/shot blasting) • Use of sound-dampening materials to reduce noise levels (mufflers) • Proper maintenance of equipment and machinery • Noise levels monitored regularly • Observance of threshold level values (permissible noise exposure) for exposure to noise • All other measures applicable as found in the Operations Safety Plan
Heat	• Appropriate protection including body covering, masks, eye protection, boots and gloves • Provision of appropriate ventilation systems • All other measures applicable as found in the Operations Safety Plan
Vibration	• Regular work shifts and breaks to avoid too much physical exertion and vibration • Appropriate protection including body covering, masks, eye protection, boots and gloves • Health facilities of the workers • All other measures applicable as found in the Operations Safety Plan
Ergonomic Stress	• Regular work shifts and breaks • Health facilities of the workers • All other measures applicable as found in the Operations Safety Plan
Occupational Accidents	• Job hazard analysis • Safe and healthful working conditions • Safe work practices by employees/workers • Health facilities of the workers • Sight conservation program • Heat stress control program • Hearing conservation program • Personal protection program • Respiratory protection program • Acute injury and illness management program • Workplace inspection program • Accident prevention program • Health surveillance and monitoring

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Hazards	Mitigating/Risk Reduction Measures
	• Worker health training and management • Workplace inspection program • Proper training of workers • Implementation of safety programs of company • All other measures applicable as found in the Operations Safety Plan
Community	
Construction	
Dust and Suspended Particulate Matter (SPM)	• Wetting agents • Coordination with the community • Awareness (continuous information, education, and communication programs)
Explosion (Live/Unexploded Ordnances)	• Coordination with community • Awareness (continuous information, education, and communication programs)
Oils and Lubricants	• Construction of a collection system and an onsite wastewater treatment facility • Awareness (continuous information, education, and communication programs) • All other measures applicable as found in the Construction Safety Plan
Community	
Operations	
Explosion and Fire (Fuel Storage/Leaks)	• Construction of bunds around the tanks • Awareness (continuous information, education, and communication programs) • All other measures applicable as found in the Operations Safety Plan
Oils and Lubricants	• Construction of a collection system and an onsite wastewater treatment facility • All other measures applicable as found in the Operations Safety Plan

5.7.1.1 Public/Community Health

In the future, population may increase so new communities will be created, in addition to present communities, around the project site. The residents of the surrounding communities should be informed about the nature of the project and its operations through meetings and seminars. They should also be informed on safety measures that the project proponent are implementing in order to avoid health hazards.

Dust and air pollutants from moving motor vehicles will generate from road sites. This can be avoided by constructing roads away from residential areas. Dusts could be minimized using sprinklers to wet the roads. Proper maintenance of motor vehicles will lessen air pollution and the accompanying odor.

Accidents can happen in areas involved with the transportation system leading to the proposed project site. To minimize or avoid accidents, roads should be constructed in strategic areas. Warning signs should be posted in areas that are accident-prone.

There should be attempts to determine the influence of exposure to the hazards associated with project activities on the health of the residents in the surrounding communities. This is done

through regular health surveillance that will detect the possible changing patterns of diseases due to the presence of project operations. There should be close coordination and cooperation with the Municipal Health Office in the recording of diseases and implementation of health programs in controlling and preventing diseases. Health promotion and education on the common diseases of the area should be extended to the workers and residents of the surrounding communities.

5.7.1.2 Workers

Pre-Operation Phase

Protection of Personnel from Chemical Hazards

During the construction phase, to avoid the increase in wind-blown dust and SPM in the atmosphere, sprinklers could be used to water down bare areas. Protective body coverings and facemask should be used by workers at all times in highly affected areas.

NO_2, SO_2, and CO from motor vehicles and machines may be kept to a minimum concentration since the exposures are in open areas. Heavy equipment and motor vehicles should be maintained at all times to minimize concentrations of air pollution in exhaust.

An explosives expert/company will be engaged to handle/manage/dispose live/unexploded ordinances during site clearing and related pre-construction activities.

Protection of Personnel from Physical Hazards

Exposures to direct sunlight and the inability of one's body to release heat adequately can cause heat stress and strokes. Regular work shifts and breaks will allow the body to handle and release heat better. Workers exposed to heat most of the time should be provided with water and juices to avoid dehydration.

Workers working with or near motor vehicles or machinery for long periods of time may be exposed to noise. Deafness can result after prolonged exposure. The best remedy to prevent exposure to excessive noise is to reduce the source. Technology is available for solving many typical problems arising from the use of machinery either by structural and mechanical modifications or the use of mufflers, vibration isolators or enclosures. Sound transmission can be controlled through the use of partitions as barriers. Improved area planning to increase the distance between people and the noise source is possible.

Job rotation will help restrict the length of exposure to potentially hazardous levels.

Workers should be educated on the adverse effects of noise and should be warned in (a) the possible consequences of excessive noise exposure; (b) the means of protection, e.g., ear plugs, earmuffs and/or helmets; and (c) the limitations of these protective devices.

Noise level should be maintained, as much as possible, within the safe standard limits of 85 dB required.

Noise levels should be monitored regularly. Control measures may require reduction in the use of heavy equipment and use of traffic vehicles or even operation in the site despite all controlling measures if only to meet the safe limits of noise.

Exhaust from motor vehicles and heavy equipment may emit offensive odor to workers.

Oil may have an odor irritating too to some people. Maintenance of vehicles and heavy equipment and distance from sources may minimize this problem.

Regular work shifts and breaks can avoid too much physical exertion and vibration causing muscle strain and body fatigue. Workers should be instructed on the proper ways of carrying and handling heavy equipment to avoid back pains and other forms of musculo-skeletal pains (MSD).

Operational Phase

Protection of Workers from Chemical Hazards

Dust will be generated basically in the same areas as in the pre-operation phase. Dust is expected to be higher in areas where diggings and quarrying takes place. Workers exposed to dust should wear the proper protection including body covering, masks, boots and gloves.

Workers assigned in welding and painting will be exposed to heavy metals and lead, respectively. These workers should be informed of the health effects of the chemicals they are dealing with and how to minimize exposures. Appropriate protection including body covering, masks, eye protection, boots and gloves should be used at all times.

Protection of Workers from Physical Hazards

Strokes and heat stress and occupational accidents and Injuries are also common problems during the operation phase.

Safety and Health of Workers

The yard management should create a safety and health committee that will be in charge with the formulation of the safety procedures, rules and regulation, training, inspection and monitoring in the project site. The committee will be responsible in the investigation, analysis, reporting and recording of all occupational injuries and accidents in the area. These records will be useful guides in further improving the Safety Programs and in preventing similar accidents in the future.

The Objective of Safety Program

The objective of the occupational and safety program is to promote safety and to limit, reduce, and control hazards and risk. This is to foster a safety conscious environmental to encourage contractors to actively manage safety in order to limit losses from personal injuries and property damage. The ultimate objective is to achieve greater efficiency and reduced direct and indired cost associated with losses and control.

The effectiveness of the construction safety program depends upon the active participation and cooperation of the contractor's project managers, and employees in

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coordination of their effort with the authority in carrying out the following basic procedures:

Detection. Maintain a system of prompt detection and correction of unsafe practices and conditions.

Education. Establish and conduct an educational program to stimulate and maintain interest and cooperation of all employees. Education will be conducted through safety meetings, safety training programs, and the use of personal protective equipment and mechanical guards.

Investigation. All incidents and claims will be investigated to determine their causes and take reasonable corrective action when possible.

Planning. Plan all work to minimize the potential for personal injury, property damage and loss of productive time.

Regulations. Comply with federal, state and local laws, ordinances, regulations, industry standards, and authority regulations and requirements.

Accident Prevention

Workers should observe the measures proposed by the occupational health and safety program to avoid occupational accidents, injuries and even deaths in the work areas. The layout of the workplace should include the use of suitable machine guards and suitable structures to avoid accidents and injuries.

Contractors have the responsibilities to correct hazardous conditions and practices. Foreman shall have the authority to take action to prevent physical harm or significant property damage. If determined there's imminent danger, the foreman or safety engineer shall:

Take immediate action to remove workers from the hazard and stabilize or stop work until corrective actions made

Immediately identified contractor's safety plan of the condition
Identify and implement corrective action to eliminate the hazard

Employee shall immediately report to their immediate superiors any condition suspected to be unsafe or unhealthy

When any condition has been determined to constitute a safety hazard, work will not continue until the danger is corrected, guarded, or removed from the jobsite.

Personnel requirements and compliance

It is the yard management's intention to maintain a health and safe workplace. To succeed, all parties must be actively involved and maintained cooperation between all contractors, subcontractors, and their employees. Contractors and subcontractors are responsible for orienting employees on the specific safety rules that must be followed by all persons working on the project. Non-compliant employees should be notified, removed or suspended. The grounds of removal should include continued violations,

drugs and alcohol intake, fighting, gambling or horseplay and if caught with deadly weapons.

Like the health programs of public health, occupational health and safety program also should be implemented to protect the health and safety of workers. **Table 5-16** shows the proposed health and safety program in the workplace.

Table 5 -16. Some Health Service Programs and Activities in the Workplace

Programs	Activities
Workers	
Construction	
Heat Stress Control	• Provision of suitable protective covering • Training of personnel on the proper use and maintenance of suitable protective covering • Regular inspection of workers at worksite to ensure that proper suitable protective clothing are worn and worn correctly • Provision of appropriate ventilation systems • Job rotation of workers • Requiring workers in hot environments to take breaks in cool rest areas and providing fluids for rehydration
Sight Conservation	• Provision of equipment for eye protection (goggle, welding mask, sunglasses) • Training of personnel on the proper use and maintenance of equipment for eye protection (goggle, welding mask, sunglasses) • Regular inspection of workers at worksite to ensure that equipment for sight protection are worn and worn correctly • Provision of adequate lighting • Job rotation of workers
Hearing Conservation	• Provision of hearing protective devices (earplugs, earmuff) • Training of personnel on the proper use and maintenance of hearing protective devices (earplugs, earmuffs) • Regular inspection of workers at worksite to ensure that equipment for hearing protection are worn and worn correctly • Prohibiting worker access to areas involving hazards such as manufacturing/process operations that generate excessive noise • Use of sound-dampening materials to reduce noise levels (mufflers) • Proper maintenance of equipment and machinery
Personal Protection	• Provision of protective clothing, hardhat, safety belts, rain boots, and dust mask • Training of personnel on the proper use and maintenance of personal protective equipment • Regular inspection of workers at worksite to ensure that personal protection equipment are worn and worn correctly
Respiratory Protection	• Provision of respiratory protective devices • Regular checking of equipment • Training of personnel on the proper use and maintenance of respiratory protective devices (dust mask, respirator) • Regular inspection of workers at worksite to ensure that respiratory protective devices are worn and worn correctly • Proper maintenance of equipment and machinery

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Programs	Activities
Acute injury and illness management	• Recording of accident and illness that is always open for inspection by authorized personnel: date, name, sex and age, nature of injury, diagnosis of illness, magnitude of disability, period of disability, damage of materials, equipment and cost involved and reporting to the DOLE. • Accomplishment of annual work accident/illness exposure data report to be submitted to the DOLE
Workplace Inspection Program	• Regular inspection of site/workplace • Training of personnel in the conduct of inspection • Reporting
Accident Prevention Program	• Training of personnel • Regular inspection site/workplace • Promotion and adoption of safe work practices • Proper maintenance of equipment and machinery
Health surveillance and monitoring	• Identification and assessment of the risks from health hazards in the workplace • Determine condition of planning and organization of work maintenance, condition of machinery and other equipment, and substances used in work • Surveillance of conditions and practices in the workplaces including sanitation and housing • Monitoring of workers health versus exposure to work hazards • Analysis of occupational accidents and diseases • Interpretation, reporting and dissemination of health data
Worker health training and management	• Promotion and adoption of safe work practices to the workers • Collaboration in providing information and training on hygiene and ergonomics • Participation in the development of programs for the improvement of working practices as well as testing and evaluation of health aspects of new equipment • Training on occupational health, safety and hygiene, ergonomics and individual and collective protective equipment • Organization and training on first-aid and emergency treatment
Therapy and immunization	• Therapy, prophylaxis and immunization of workers at risk of contact with live organisms and travelers to areas of endemic infection: Tetanus, measles, mumps and rubella (MMR), hepatitis A and B, typhoid fever and cholera • Immunization against malaria
Operations	
Heat Stress Control	• Provision of suitable protective covering • Provision of appropriate ventilation systems • Job rotation of workers • Requiring workers in hot environments to take breaks in cool rest areas and providing fluids for rehydration. • Prohibiting worker access to areas involving hazards such as lasers or energized electrical equipment
Sight Conservation	• Provision of equipment for eye protection (goggle, welding mask, sunglasses) • Training of personnel on the proper use and maintenance of equipment for eye protection (goggle, welding mask, sunglasses) • Regular inspection of workers at worksite to ensure that

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Programs	Activities
	equipment for sight protection are worn and worn correctly • Provision of adequate lighting • Job rotation of workers
Hearing Conservation	• Provision of hearing protective devices (earplugs, earmuff) • Training of personnel on the proper use and maintenance of hearing protective devices (earplugs, earmuffs) • Regular inspection of workers at worksite to ensure that equipment for hearing protection are worn and worn correctly • Prohibiting worker access to areas involving hazards such as manufacturing/process operations that generate excessive noise (sand/shot blasting) • Use of sound-dampening materials to reduce noise levels (mufflers) • Proper maintenance of equipment and machinery
Personal Protection	• Provision of protective clothing, hardhat, safety belts, rain boots, and dust mask • Training of personnel on the proper use and maintenance of personal protective equipment • Regular inspection of workers at worksite to ensure that personal protection equipment are worn and worn correctly
Respiratory Protection	• Provision of respiratory protective devices • Regular checking of equipment • Training of personnel on the proper use and maintenance of respiratory protective devices (dust mask, respirator) • Regular inspection of workers at worksite to ensure that respiratory protective devices are worn and worn correctly • Proper maintenance of equipment and machinery
Acute injury and illness management	• Recording of accident and illness that is always open for inspection by authorized personnel: date, name, sex and age, nature of injury, diagnosis of illness, magnitude of disability, period of disability, damage of materials, equipment and cost involved and reporting to the DOLE. • Accomplishment of annual work accident/illness exposure data report to be submitted to the DOLE
Workplace Inspection Program	• Regular inspection of site/workplace • Training of personnel in the conduct of inspection • Reporting
Accident Prevention Program	• Training of personnel • Regular inspection site/workplace • Promotion and adoption of safe work practices • Proper maintenance of equipment and machinery
Lead Control Program	• Use of respirators for lead work • Use of other personal protective equipment • Training on the proper use of respirators and other personal protective equipment • Regular inspection of workers at worksite to ensure that personal protection equipment are worn and worn correctly • Sampling and testing for lead at the work place • Regular air monitoring for lead at the work place • Medical surveillance – including regular blood lead monitoring and re-assignment of workers to other areas that may cause low or non-lead exposure • Provision of vacuums (capable of sucking in lead dust) and ventilation systems (with scrubbers)

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Programs	Activities
	• Proper storage and disposal of waste containing lead • Proper maintenance of equipment and machinery
Health surveillance and monitoring	• Identification and assessment of the risks from health hazards in the workplace. • Determine condition of planning and organization of work maintenance, condition of machinery and other equipment, and substances used in work. • Surveillance of conditions and practices in the workplaces including sanitation and housing. • Monitoring of workers health versus exposure to work hazards. • Analysis of occupational accidents and diseases. • Collection of public health data and case reports that are related to environmental hazards. • Interpretation, reporting and dissemination of health data.
Worker health training and management	• Promotion and adoption of safe work practices to the workers. • Collaboration in providing information and training on hygiene and ergonomics. • Participation in the development of programs for the improvement of working practices as well as testing and evaluation of health aspects of new equipment. • Training on occupational health, safety and hygiene, ergonomics and individual and collective protective equipment • Promotion and adoption of safe work practices to the workers • Organization and training on first-aid and emergency treatment
Therapy and immunization	• Continuous therapy, prophylaxis and immunization of workers at risk of contact with live organisms and travelers to areas of endemic infection: Tetanus, measles, mumps and rubella (MMR), hepatitis A and B, typhoid fever and cholera • Continuous immunization of against malaria
Community	
Construction	
Health surveillance and monitoring	• Collection of public health data and case reports that are related to environmental hazards. • Interpretation, reporting and dissemination of health data.
Information, education, and communication programs	• Residents of the surrounding communities should be informed about the nature of the project and its operations through meetings and seminars • Residents of the surrounding communities should also be informed on safety measures that the project proponent are implementing in order to avoid health hazards.
Therapy and immunization	• Immunization against malaria
Operations	
Health surveillance and monitoring	• Collection of public health data and case reports that are related to environmental hazards. • Interpretation, reporting and dissemination of health data.
Continuous information, education, and communication programs	• Residents of the surrounding communities should be continuously informed about the nature of the project and its operations through meetings and seminars • Residents of the surrounding communities should also be continuously informed on safety measures that the project proponent are implementing in order to avoid health hazards.
Therapy and immunization	• Continuous immunization against malaria

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Health Facilities of the Workers

The work area should be provided with a primary health unit for the employees to be manned by a physician or a nurse for primary care. The unit should be provided with an ambulance or any vehicle for easy access to the municipal health office or hospitals for cases that will need further medical management. There should be adequate medical equipment/facilities that can be used to attend to primary medical cases and emergencies of the employees. Telephones or any form of communication should be available in work areas to be able to attend to the emergencies immediately.

Medical kits for emergency cases should be made available at all times in work areas distant to the medical clinics.

The company physician should be assigned to do complete health examination on all applicant workers prior to hiring to assure good physical fitness at the start of work. Even contractual workers from other companies should be checked to assure good health prior to work. There should be continuous annual health examination of workers in the project site. Annual medical examination should be conducted to meet the requirement of the Department of Labor and Employment (DOLE). The basic content of the annual medical examination should include the following: medical history, physical examination, dental evaluation, chest x-ray, ECG and visual screening. All occupational injuries and diseases should be recorded, analyzed and submitted to the DOLE.

Hearing Conservation Program

Line management, through the proposed HSE focal point, should design and implement a hearing conservation program which should have the following components:
Application of engineering control as appropriate to reduce the exposure to noise hazard especially in the enclosed areas.

Information, instruction and training of staff potentially exposed to noise hazard.

Baseline audiometry for all workers who are potentially exposed as a consequence of their employment to noise levels of more than 90 dBA. Repeat audiometry should be done yearly for workers who are regularly assigned to areas exposed to operations that generate loud noise.

Establishment of a noise map of the site to identify areas or locations with noise level exceeding standards. Noise mapping should be conducted once a year in noisy areas and for every major equipment change or installation of additional noise control measures.

Putting up of sign boards warning of sites with potential noise hazards.

Provision of personal protective equipment for ear protection. Recommended protectors are ear plugs because of increased comfort and better fit compared to an ear muff. Ear muffs during warm weather can cause skin irritation around the ear resulting in lower utilization by workers.

Conduct a more detailed health risk assessment of the yard as soon as it becomes operational.

Coordinate with health care delivery system in the barangay/municipality.

Development of a strong referral system to enable the medical clinic to refer patients to appropriate specialists in the area or for admission to accredited hospitals.

Establishment of an appropriate health recording and reporting systems to meet government health regulatory requirements and to protect the company from improper claims due to perceived adverse health effects of the yard operations.

Regular health audits to ensure the efficient implementation of the health program.

Emergency Response Plan Recommendations

The yard management should put in place emergency response plans that will address contingency situations such as fire, explosion, earthquakes, typhoons, volcanic eruptions, and oil spill. The management should consider the following in formulating the yard's emergency response plans:

Ensure that all persons on site have appropriate training in the implementation of the emergency response procedures.

In consultation with the local Disaster Coordinating Council, formulate and agree on an off-site emergency response plan applicable to the surrounding community.

Ensure that on-site emergency response plan inside the facility is established and coordinated with emergency services.

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6. ENVIRONMENTAL MANAGEMENT PLAN 6-1

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This section covers the development and discussion of the recommended Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP), Contingency/Emergency Response Plan, Social Development Plan (SDP), Waste Management Plan and Information Education and Communication (IEC) Plan specific to the proposed project. The EMP describes the impacts, the appropriate mitigation and enhancement measures, and institutional mechanisms for implementing the proposed measures. The EMoP describes the parameters of the affected condition to be monitored, the location, frequency, the cost of monitoring activity and responsible parties. The SDP discusses the community based outreach programs that will be proposed by the proponent.

6.1 EMP SUMMARY

The mitigation and enhancement measures during the construction and operation of the proposed shipbuilding facility are summarized in **Tables 6-1** and **6-2**.

6.2 CONSTRUCTION / CONTRACTORS' ENVIRONMENTAL PROGRAM

The proponent will hire many contractors to construct different facility components of the project. An important part of the project implementation is site development and actual construction.

The contractor should state their commitment to environmental enhancement and in doing so should incorporate environmental policies particularly on health and safety aspects into the management practice. An agreement between the proponent and its contractor will be executed indicating the contractor's commitment in mitigating the negative impacts during the construction.

The contractors shall take into account the following identified limitations and recommendations earlier made during construction phase of the project.

6.2.1 TEMPORARY FACILITIES SUCH AS HOUSING, SANITATION AND WASTE DISPOSAL

Temporary shelter for construction workers in the work site shall be made available including sanitation facilities such as toilet and bath areas.

Waste disposal receptacles shall be located in strategic places for wastes generated from the daily personal and construction activities. These receptacles shall be emptied and cleaned regularly. All efforts shall be undertaken to minimize, reclaim or recycle wastes. All residual waste shall be coordinated with local officials for final disposition.

These responsibilities shall be on the account of the contractors to prevent spread of diseases among the construction workers.

6.2.2 TRAFFIC ROUTE TO JOB SITE

The project will produce a significant increase in land and sea traffic. The contractors shall closely coordinate with SBMA and the municipality of Subic and exercise utmost diligence in the delivery of construction materials to avoid accidents. The contractor shall ensure that their drivers and heavy equipment operators shall exercise utmost diligence in their work to avoid accidents.

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Table 6 - 1. Summary Matrix of Environmental Management Plan (Construction Phase)

Environment	Impact	Mitigation Measure	Institutional Responsibility
Physical	• Increase in solid waste generation	• Concrete Solid Waste Management Program following the guidelines set by the Ecological Solid Waste Management Act of the DENR	Proponent / Contractor / SBMA EC
	• Erosion due to cut and fill activities	• Installation of retaining walls and revegetation of cut areas	Proponent / Contractor
	• Alteration of Agusuhin River and North Agusuhin Creek courses	• Adequate channel design • Riverbank protection	Proponent / Contractor
	• Potential sea water intrusion due to over abstraction of groundwater	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent / SBMA / LGUs
	• Depletion of groundwater resource	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent
	• Water quality degradation due to land clearing and excavation	• Installation of drainage canals with silt traps. • Settlement of suspended solids in natural depressions • Water Quality Monitoring	Proponent / Contractor
	• Water quality degradation due to oil and grease	• Containment canal around motor pool • Oil and Grease separators • Water Quality Monitoring	Proponent / Contractor
	• Water quality degradation due to reclamation and dredging	• Installation of silt curtains • Scheduling of reclamation and dredging activities	Proponent / Contractor
	• Air pollution from equipment, machinery and generator set	• Regular maintenance of equipment, machinery and generator set • Air quality monitoring	Proponent / Contractor
	• Dust generation	• Periodic watering of bare soil in construction area	Proponent / Contractor
	• Noise generation	• Installation of buffer areas/ PPEs to workers exposed to excessive noise	Proponent / Contractor
Biological	• Removal of vegetation	• Watershed management • Re-landscaping of bare grounds	Proponent

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Environment	Impact	Mitigation Measure	Institutional Responsibility
	• Displacement of resident fauna	• Replanting of indigenous plants in vacant spaces and along waterways.	Proponent
	• Degradation of Aquatic Ecology	• Installation of sheet piles • Installation of silt curtains • Selection of reclamation site	Proponent
Socioeconomic	• Change in Land Use	• Prompt payment of lease and other permits	Proponent
	• Affect reforestation area	• Compensation for improvements to the reforestation area	Proponent
	• Affect Marine sanctuary	• Consultations with LGUs and community and securing proper documentation	Proponent
	• Displacement of households	• Resettlement Action Plan	SBMA
	• Generation of employment and livelihood opportunities	• Prioritizing qualified residents near the project site • Establishment of a Community Relations Office	Proponent
	• Increase in commercial activities	• Prioritizing local suppliers in buying company requirements	Proponent
	• Additional income and benefits to LGUs	• Prioritizing local suppliers in buying company requirements	Proponent
	• Health concerns (Air and Noise pollution)	• Installation of a water sprinkling system • Face masks for construction workers • Proper maintenance of equipment • Hiring of qualified drivers	Proponent

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Table 6 - 2. Summary Matrix of Environmental Management Plan (Operation Phase)

Environment	Impact	Mitigation Measure	Institutional Responsibility
Physical	• Solid waste generation	• Concrete Solid Waste Management Program following the guidelines set by the Ecological Solid Waste Management Act of the DENR	Proponent / SBMA EC
	• Potential sea water intrusion due to over abstraction of groundwater	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent / SBMA / LGUs
	• Depletion of groundwater resource	• Consider surface water to augment groundwater usage • Initiate Water Conservation and Watershed Management Plans	Proponent
	• Water quality (Surface Water)	• Water Quality Monitoring • Wastewater Treatment Plant • Use of organic chemicals in landscaping activities	Proponent / SBMA EC
	• Air quality	• Air Quality Monitoring • Regular maintenance of machinery and equipment	Proponent / SBMA EC
	• Noise generation	• Installation of fences and buffer area	Proponent
Biological	• Flora	• Re-landscaping of bare grounds • Watershed management	Proponent / SBMA EC
	• Return of Wildlife	• Preservation	Proponent
	• Return of Aquatic Organism	• Preservation	Proponent
Socioeconomic	• Influx of informal dwellers	• Implementation of land use plan • Prevention of influx of informal dwellers	Proponent / SBMA / Subic LGU
	• Generation of employment and livelihood opportunities	• Prioritizing of qualified local residents • Prioritizing of local suppliers for company needs (livelihood generation)	Proponent
	• Additional revenue for LGU	• Prompt and correct payment of taxes	Proponent
	• Health (Air and Noise Quality)	• Installation of air pollution devices • Health monitoring • Revegetation	Proponent / SBMA EC

6.2.3 POLLUTION CONTROL

The contractor shall avoid discharging hazardous chemicals on the site or to the storm water system. Dust pollution from excavation and other dust generating activities shall be kept to a minimum by using dust suppression techniques, such as spraying of water in the affected area.

The contractor shall also take into consideration the sleeping hours of the residents in the neighboring communities in scheduling work especially the use of noisy equipment. In this respect, the contractor shall maintain its equipment in tiptop condition to minimize the generation of excess fumes.

6.2.4 HOUSEKEEPING

The contractor shall ensure that the contractor's camp and working areas are kept clean and tidy at all times. This will ensure the health on its workers and facilitate operations.

6.2.5 PROVISION FOR SAFETY MEASURES/PRECAUTIONS OF CONSTRUCTION WORKERS

To ensure the health and well being of its workers, the contractor shall be required to provide their workers with the necessary safety measures and provisions such as hard hats, gloves, dust/gas masks, overall, etc. Provisions for adequate signage shall be placed in strategic locations to avoid accidents.

All construction activities shall be restricted to working areas designated on the drawings and/or demarcated and approved by the proponent. Materials including spoil, shall be stockpiled on designated areas and coordinated with the proper authorities for disposition.

6.2.6 FIRE RISK AND BURNING

HHIC- Phil Inc. shall ensure that the risk of fire in the site is kept to a minimum. It shall maintain fire-fighting equipment in the project site in proportion to the fire risk presented in the type of construction and other on-site activities and materials used on site. This equipment shall be kept in good operating order. Fuel, lubricants, transmission and hydraulic fluids shall only be stored in designated areas.

HHIC- Phil Inc. shall also ensure that automatic sprinkler, water spray fixed system or monitor nozzles, automatic alarm/detection system and other appropriate fire protection equipment as required by law and SBMA shall be acquired to adequately safeguard and protect the facility from fire. Moreover, training programs on the use of these equipments, fire prevention, control and response shall be implemented.

6.2.7 DEMOBILIZATION

The contractors will be responsible for the removal of all the debris and waste material from the site upon completion of the project.

6.3 CONTINGENCY/EMERGENCY RESPONSE PLAN

A number of potentially hazardous situations may occur in the plant that requires immediate response. These include typhoon, earthquakes and medical emergencies, in addition to project-specific events such as oil spills, fires (see **Appendix 1**- SBMA Fire Department Fire Safety Guidelines), chemical spills and trucking accidents. Although emergencies are of many types, a set of general procedure may be designed and carried out in any situation while more specific

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procedures are being considered. In particular, emergencies with potential adverse impact to the environment such as fuel delivery/receiving accidents resulting in oil spills or fires will be addressed in a rapid, deliberate manner that protects human lives above everything.

This set of procedures will be formally documented. It will be organized clearly and logically, covering both common and extreme situations that might require quick response. The plan may be written down in a binder that may be readily referred to in emergencies.

Oil spills from liquid fuel storage areas can occur both on land and water. In this project, oil spills on land can take place as a result of leaking storage tanks and containers or during accidents while transferring lubricants and fuel. Spills can be small, such as when lubricating oils and hydraulic fluids are involved.

Spills are preventable if all safety measures are followed, and if maintenance and inspection schedules are adhered to. Placing storage tanks as far away from the water bodies minimizes water contamination and increases the possibility of oil recovery. Impacts from oil spills can also be mitigated if all storage and transfer points are fitted with secondary containment, such as bunds that can contain the fluid inside the tank should all its contents are released.

6.4 SOCIAL DEVELOPMENT PLAN

The Social Development Plan (SDP, **Table 6-2a**) seeks to address the concerns of persons who will be adversely affected by the project. The SDP will be formulated through a participatory workshop that will be conducted specifically to draft this plan. Among the participants will be the representatives of the project proponent, project affected persons, municipal and barangay officials, and other stakeholders.

The purpose of the planning workshop is to provide the details of the operations of the SDP and address the various concerns on the socio-cultural, economic, environmental and health aspects. The SDP will focus on the following:

1. Employment and livelihood issues and concerns
2. Possible livelihood projects;
3. Health and sanitation;

The SDP will take special efforts to gather and resolve sectoral concerns from the marginalized sectors including women, fisherfolk, youth and the elderly. Considering the vital role of the SBMA/LGU especially in the resettlement issue, the SBMA and municipal officials will play an important role in formulation of a detailed SDP. The output of this workshop will be an agreement among the participants outlining their responsibilities in fulfilling and implementing the SDP.

Table 6- 2a Social Development Program Matrix

Program/Plan	Time Frame	Responsible Entity	Estimated Budget
IEC Campaign	Pre-construction	SBMA/ HHIC- Phil Inc.	100,000
Grievance Mechanism	Pre-construction	SBMA, HHIC- Phil Inc., Subic Peoples' Organization	100,000
Relocation of Households	Pre-construction	SBMA, HHIC- Phil Inc., Subic	To be determined
Compensation of Structures, Trees and Crops	Pre-construction	SBMA/ HHIC- Phil Inc.	To be determined

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Replacement of Community Structures	Pre-construction	SBMA/ HHIC- Phil Inc.	To be determined
Skills Training	Construction and Operations	HHIC- Phil Inc.	To be determined based on needs
Employment and Livelihood Priorities of Affected Residents	Construction and Operations	HHIC- Phil Inc.	Included in CRO budget
Construction of Docking Area and Access	Construction and Operations	HHIC- Phil Inc.	To be determined
Institutional Mechanism for SDP	Construction and Operations	HHIC- Phil Inc. Community Relations Office (CRO)	1 million a yr
Patronize Local Products/Services	Construction and Operations	HHIC- Phil Inc.	No Extra Cost implication
Periodic Medical Missions	Operations	HHIC- Phil Inc.	300,000/yr
Multipartite Monitoring Team	Construction and Operations	SBMA, HHIC- Phil Inc., NGO's, Subic Peoples' organization	500,000/yr

HHIC- Phil Inc. shall provide an institutional mechanism or set-up that will implement the social development program and the RAP by establishing a Community Relations Office with the proper staffing and budget. The main responsibility of this office implement the social development plan and to establish, develop and maintain close rapport with the resettled community, adjoining sitios, barangay and the municipality. This office will act as liaison for the proponent with rest of the world on social concerns.

The institutional mechanism to implement the RAP will be under SBMA because based on their agreement with the proponent. SBMA will be responsible for compensation, and relocation issues.

Formulation of the Final SDP (identification of the specific projects and activities to be implemented) as well as the IEC should be a conditionality of the ECC. In addition to monitoring the IEC implementation, the MMT or the monitoring body to be set up for the project should also monitor the implementation of the SDP and the RAP.

6.5 WASTE MANAGEMENT PLAN

The project recognizes the need to effectively manage all the wastes generated from the activities during construction and operation of the project to address potential sources of environmental degradation and health risk. An Ecological Waste Management System shall be implemented to ensure the proper disposal of domestic wastes from collection, temporary storage, transport and final disposal to an Accredited Landfill throughout the life of the project.

1. Domestic wastes shall be segregated from the source i.e. from the workplaces and offices of the contractors, sub-contractors and employees. Sufficient number of garbage containers shall be provided and shall be located on designated areas, marked, duly labeled and covered for protection from wind, rain and animals.

2. Hazardous wastes shall be marked, labeled and stored in a covered area with appropriate spill protection. Under no circumstances, hazardous wastes such as used oil, vegetable oil, batteries, waste paint, solvents, and florescent lamps are disposed of with regular garbage.

3. The wastes shall be regularly collected, transported and temporary stored at the Plant's Central Waste Storage Area (CWSA). It shall be further segregated, marked, labeled and temporarily stored on its specific designated areas. The storage and handling of the wastes

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shall be in accordance with the Ecological Waste Management Act, RA 2000-0093 and the Toxic and Hazardous Waste Management Act, RA 6969 and it's implementing Guidelines, DENR-DAO 36-2004. The biodegradable materials which are not recyclable are processed and converted into compost in a composting pit and the generated fertilizer will be used for the reforestation and re-vegetation activities.

4. Regular collection and transport of the solid and hazardous wastes shall be made by accredited transporters. The residual solid wastes shall be disposed at the SBMA Landfill, while the hazardous wastes shall be treated and disposed in Accredited Waste Treatment Facilities.

5. The PCO will ensure that all the required documents/manifesto for the treatment and disposal of hazardous wastes are strictly complied in accordance with the DAO-36-2004.

6. Regular monitoring and inspection will be conducted to ensure that no improperly dumped wastes are found within the project site. Appropriate mitigation measures and penalties shall be done if violations should be found and confirmed.

7. Open burning of wastes will be strictly prohibited at anytime.

8. Orientation and training shall be conducted yearly or as the need arises to the workers and employees regarding the Plant's Waste Management Program particularly their roles and responsibilities and the corresponding penalties and sanctions for those who will be found to be not complying.

The Project's Waste Management Plan shown in **Table 6-3** will ensure the proper management of all wastes generated throughout the project.

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Table 6 - 3. Summary Matrix of Waste Management Plan

Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
Construction Phase	**I. Domestic and Non-Hazardous Wastes**					
	a. San itary waste (human waste, washings and urine) from Contractors and Sub-contractors quarters/offices	Provide sanitary waste water sewage system as required by law– one toilet for every 20 persons and one urinal for every 50 persons	Regular cleaning and human waste collection and disposal.	Accumulated Human wastes shall be collected by a duly SBMA accredited and registered sewage transporter and disposal company	Budget/funds for the rental or acquisition of the required portalets and corresponding water source shall be provided.	The cost of the required portalets and the construction of CWSA with complete facilities shall be incorporated in the project plan.
	b. Sanitary waste (human waste, washings and urine) from the offices and housings of Hanjins Employees Officers.	Construction and operation of a Centralized Sewage Treatment Facility		Management and implementation of the program shall be made by the PCO or Environmental Unit.		
	c. Organic waste (Food scraps, trimmings, food packaging, rags, tissue, etc)	Stored in marked sealable containers/drums and placed in identified locations for collection	The Central Waste Storage Area (CWSA) strategically located within the plant shall serve as temporary storage station.	Duly accredited SBMA Solid Waste Transporter SBMA landfill Management and implementation of the program shall	Contract between SBMA-Accredited and Registered Solid Waste Transporter. Contract between SBMA and Hanjin	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
			Monthly	be made by the PCO or Environmental Unit.		
	d. Paper waste, cartons, newspapers, envelopes, magazines, wrappings	Bundled and placed in location for collection and transport to the CWSA ;	The CWSA strategically located within the plant shall serve as temporary storage station. Monthly	Duly accredited SBMA Solid Waste Transporter Waste recycler Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contract between an SBMA-accredited and registered Solid Waste Transporter. Contract with Recycler	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
	e. Un-recyclable Biodegradable wastes (plant trimming, kitchen wastes, dead animals, tissue, used diapers, etc.)	Placed in marked and labeled containers for collection and transport to the CWSA.	Shall be generated form the re-segregation of biodegradable wastes in the CWSA. Daily	Shall be grounded and disposed at the composting pit of the CWSA. Management and implementation of the program shall be made by the PCO or Environmental Unit.	Acquisition and operation of the process equipment for the compost conversion.	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
	II. Construction Wastes					
	f. Plastic and glass bottles, PVC pipes, plastic wastes, fiber glass, metals, rubbers etc.	Provide clearly marked bins for reuse at the source, collected and transported to the CWSA.	The CWSA strategically located within the plant shall serve as temporary storage station Monthly	Duly accredited SBMA Solid Waste Transporter Accredited Waste recycler Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contract between an SBMA-accredited and registered Solid Waste Transporter Contract with Recycler.	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
	g. Timber (wood, plaster board, form materials, packaging timber, plyboards, etc.)	Provide clearly marked bins or identified location for reuse or collection	Monthly	Duly accredited SBMA Solid Waste Transporter Waste recycler Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contract with SBMA-Accredited and Registered Solid Waste Transporter/recycler.	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
	h. Steel (structural steel, pipes, valves, plates, mechanical parts, metalwork off cuts, etc.)	Stored in clearly marked and labeled bins for collection	The CWSA strategically located within the plant shall serve as temporary	Duly accredited SBMA Solid Waste Transporter/Recycler Management and	Contract between the SBMA-Accredited and Registered Solid Waste Transporter./Rec	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
			storage station Monthly	implementation of the program shall be made by the PCO or Environmental Unit.	ycler	
	i. Electrical and mechanical wastes	Placed in marked and labeled containers for	The CWSA strategically	Duly accredited SBMA Solid Waste	Contract between the SBMA-	The cost of all contracts to be
	materials such as used cables, terminals, fixtures, switch gears, engine filters, air filters, used valves, etc.	collection and transport to the CWSA.	located within the plant shall serve as temporary storage station. Monthly	Transporter and Recycler Management and implementation of the program shall be made by the PCO or Environmental Unit.	Accredited and Registered Solid Waste Transporter./Recycler	executed with Service providers and the SBMA shall be part of the plan
	j. Membrane and geo-textiles wastes	Provide bins for safe disposal	The CWSA strategically located within the plant shall serve as temporary storage station. Monthly	Duly accredited SBMA Solid Waste Transporter and Landfill Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contracts: 1. Between SBMA-accredited and registered solid waste transporter 2. With an accredited landfill company	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
	k. Concrete waste materials (Broken	Provide clearly marked bins or identified locations for	These shall be used as	Shall utilize internal transport facility	Contract between SBMA-accredited	The cost of all contracts to be

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
	culverts/ hollow blocks, concrete pipes, kerbs, etc.). Paving materials (Bitumen, crushed rock, etc.)	collection and disposal as filling materials for the project.	dumping materials for the filling activities. Monthly	Management and implementation of the program shall be made by the PCO or Environmental Unit.	and registered solid waste transporter.	executed with Service providers and the SBMA shall be part of the plan
	I. Residual wastes	Shall be stored in marked, labeled and sealable containers at the CWSA.	These are the residual wastes generated after segregation of biodegradable, recyclable and hazardous wastes at the CWSA. . Monthly	SBMA- Accredited and Registered Solid Waste Transporter SBMA Landfill Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contracts with Transporter and SBMA	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
	III. Hazardous Wastes: m. Vegetable oil, florescent lamps, batteries, Engine soots and used oil/hydro Oil from operations of two generators, waste chemicals, insulating materials,	Stored in marked, labeled and sealable containers in designated areas, for collection and transport to the CWSA Emptied, dried, crushed containers	The CWSA strategically located within the plant shall serve as temporary storage station. Quarterly	SBMA and DENR Accredited, Registered and Trained Hazardous Waste Transporter. DENR-Accredited, Registered Hazardous Waste	Contract between SBMA and DENR Accredited, Registered ad Trained Hazardous Waste Transporter.	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
	waste/expired resins, paints, epoxy and other hazardous waste materials. Paints/solvent/ thinners containers		As required	Treatment Facilities Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contracts between for various hazardous wastes.	
	n. Ballast water	Provide approved water separator for ballast discharge strategically located on shore.	As required	Approved SBMA Waste Water Separator Provider Management and implementation of the program shall be made by the PCO or Environmental Unit.	Contract between the SBMA Waste Water Separator Provider	The cost of all contracts to be executed with Service providers and the SBMA shall be part of the plan
Operation Phase:						
Domestic works	Same as above	Same as above	Same as above	Same as Above Management and implementation of the program shall be made by the PCO or Environmental Unit.	Same as above	Same as above
Shipbuilding Operations	Same as above			Same as above		

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures
Cutting, Blasting, Painting, Bending, Piping , Machining Assembly, Ship Cabin and auxiliary Assembly, Electrical Works, Power plant operations, etc.				Management and Implementation of the program shall be made by the PCO or Environmental Unit.		
Blasting works	Spent Blasting Slags	Provide a storage area strategically located near the Blasting Area, duly marked and labeled.	Monthly	Management and implementation of the program shall be made by the PCO or Environmental Unit. Accredited and Registered Solid Waste Transporter Recycler. Possibility of an agreement with a cement plant which uses the spent slags in their operations.	Contract between SBMA-Accredited and Registered Solid Waste Transporter-Recycler	The cost of all Contracts to be executed with Service providers and the SBMA shall be part of the plan

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Project Phase/Activity	Potential Waste Generation	Mitigation and Enhancement Measures	Collection Frequency	Responsible Party/ies	Guarantee	Cost of Proposed Measures

6.5.1 WASTE MANAGEMENT PLAN

HANJIN shipbuilding project ensures its compliance to the Republic Act 2000-0093 "Ecological Waste Management Act" and Republic Act 6969, "Toxic and Hazardous Waste Management Act" its implementing Guidelines, DENR-DAO 36-2004 through the implementation of its Waste Management Program in all the phases of the project.

6.5.1.1 Construction Phase

1. All waste shall be disposed at the SBMA landfill. No waste landfill shall be established within the construction site. Sufficient waste receptacles shall be properly marked and placed at all work areas.

2. No disposal of construction debris shall be undertaken without securing a Waste Transport Permit from the Freeport Service Corporation.

3. Open burning of any waste shall be strictly prohibited t any time.

4. Solid and liquid waste form marine vessels shall be collected for on shore disposal. Ballast water shall not be discharged in the port.

5. All land spoils shall be used for backfill for the void areas created due to putting of piles to meet the designed elevation.

6. If ever there shall be excess land spoils a spoils disposal area shall be designated. The land spoils shall be compacted and appropriately designed and situated to ensure minimal impact to the waterways, marine ecosystem and its surrounding environment. The area shall be established and operated during the construction and signs and posters shall be posted for identification. The area shall be rehabilitated and planted with endemic plant species after its use.

7. All sub-contractors and employees of the project will be required to comply with the project's Ecological Waste Management Program and RA 6969 for hazardous wastes. Specifically, the following guidelines shall be strictly implemented:

   7.1 All wastes will be segregated from the source into different containers duly labeled as to recyclables, biodegradable wastes, non-biodegradable wastes and hazardous wastes prior to collection.

   7.2 Hazardous wastes such as used oil, solvents, etc. shall be separately stored prior to collection. into a covered area with appropriate protection for spillage to ensure the spilt wastes will not spread into the surrounding environment.

   7.3 Generators area, storage areas for fuel, hazardous substance and waste shall be constructed with appropriate bund walls as protection for spillage.

   7.4 Regular collection of the wastes from various work areas shall be made. These will be transported to a waste transfer station or a "Centralized Waste Storage Area" (CWSA). The CWSA shall be designed with structures and protection mechanisms for hazardous wastes spillage. Appropriate equipment and storage auxiliaries shall be installed for the conversion of the biodegradable wastes into compost. The handling and management of the CWSA shall be in accordance to applicable occupational, health and environmental regulations.

      7.4.1 The duly segregated and stored wastes for recycling at the CWSA shall be retrieved by a duly SBMA accredited and registered Recycling

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Company/Organization on a periodic basis. In addition, Memorandum of Agreement shall be executed by HHCI- Phil Inc. management with the designated recycler. The recycler shall be required to comply with the Environmental, Occupational Health and Safety Policies particularly on the wearing of appropriate PPE and used of road worthy trucks/vehicles.

7.4.2 Hazardous wastes shall also be temporarily stored and managed at CWSA in accordance to RA 6969 and its implementing Rules and Regulations DENR-DAO 36-2004 particularly on the identification, labeling, storage, handling, transport, treatment and disposal. The accredited hazardous wastes transporters shall be duly trained by accredited training institutions and accredited by SBMA/DENR

7.5 The biodegradable wastes shall be grounded and converted into fertilizer in a compost pit. The compost that will be generated shall be used as organic fertilizer for the project's vegetable farm and ornamental plants around the project.

7.6 The residual waste consisting of non-biodegradable and non-recyclable wastes shall be separately collected, stored and periodically transported to the SBMA landfill by an accredited and duly registered transporter. The types of waste, control measures and frequency of monitoring are detailed in the waste management matrix shown in **Table 6-3**.

7.7 Construction workers shall be provided with portable toilets (one toilet per 20 persons/one urinal per 50 persons)) strategically located on the construction site to ensure sanitary disposal of human wastes. The human wastes shall be collected periodically by an accredited service provider.

7.8 The human waste generated by the project staff shall be treated in a centralized sewage system. The sewage sludge shall be collected by an SBMA accredited treatment facility.

6.5.1.2 Operation Phase

1. Since the construction activities shall be present in all the phases for 10 years (from 2006 to 2015) and plant operations shall commence on the first year, 2006, the above Project Waste Management Program shall be implemented and continuously improved. The temporary storage station, Central Waste Storage Area shall be maintained and expanded if it warrants, handling blasting wastes and paint/solvents-contaminated vinyl materials and other hazardous wastes generated during the operation. Appropriate bund walls shall be constructed as control measure for spillage of hazardous wastes materials.
2. Spent blasting materials shall be collected regularly by duly accredited SBMA wastes recyclers/transporters. The project shall explore the possibility of an exchange agreement with companies that uses the spent blasting materials in their operation.
3. Environment-friendly anti-fouling substances for paints and insulation materials shall be used in the shipbuilding activities.

6.5.2 WASTE MANAGEMENT MONITORING

The Pollution Control Officer (PCO), in conjunction with the respective Manager shall in accordance to the requirement of the law, implement and continuously improve the Agreed Project Waste Management Program and its corresponding Mitigation Measures as stipulated in **Table 6-3**.

The PCO shall strictly implement and monitors the waste collection schedule, the waste segregation, collection, storage, transport and disposal practices. Documentation of the activities shall also be undertaken, which includes the logging of the quantity and volumes of the different

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types of wastes generated per month and assessment of the implementation of the program. This information shall be used as the basis in making the necessary improvements. All the monitoring reports particularly the Self Monitoring Report, documentations, wastes tracking manifests and other reports as required by law shall be truthfully accomplished and timely submitted to the regulating agencies..

6.5.3 AWARENESS BUILDING AND TRAINING

1. Prior to the start of each contractors and sub-contractors activity, orientation shall be conducted regarding the Plant's Waste Management Program particularly their role on its implementation. Corresponding penalties and sanctions shall be fully discussed to ensure strict compliance.
2. An environmental awareness program shall be conducted yearly to the company's staff, contractors and subcontractors by the PCO regarding the Plant Environmental Program, its implication to the company's operation and the role of every worker and staff to attain the objectives of the program. They shall be encouraged to give suggestions and recommendations to enhance the Waste Management Plan.

6.6 ENVIRONMENTAL MONITORING PLAN

An integral part of environmental protection is the continuous monitoring of the condition of the receiving environment to determine if any undesirable changes are occurring as a result of the project. The effects to the living receptors are received mainly through the surface water, air, and surrounding area. Environmental monitoring principally requires quantitative measurements of the amount of pollutants present in the environmental media.

The environmental monitoring plan for the proposed project is presented in **Table 6-4**. The proposed monitoring of all relevant environmental parameters, with a description of the sampling stations, frequency of monitoring, analysis procedures, and applicable standards, are presented. The relevant environmental parameters of concern are those related to air and noise quality, surface and groundwater quality including soil quality.

The Project Proponent will create an Environmental Management Unit (EMU), which will be composed of technical personnel and headed by a Pollution Control Officer (PCO). The EMU will be tasked of overseeing the implementation of the Environmental Monitoring Program (EMP), operation and maintenance of pollution control equipment and facilities as well as coordination works on environmental matters with relevant groups and government agencies.

If ever required by Ecology Center, a Multi-partite Monitoring Team (MMT) will be formed. Its composition will include the representatives from the Project Proponent, Local Government Unit (LGU), Non-Governmental Organization (NGO), local communities, Ecology Center and DENR. This Team shall operate in accordance with the result of the Environmental Impact Assessment (EIA) study and mutually agreed upon Terms of Reference (TOR) as may be suggested by Ecology Center. Normally, the Ecology Center initiates the formation of this Team.

Presented in **Appendix 14** (see Vol. 1 of this report) is a format of the Memorandum of Agreement (MOA) for the creation of the MMT.

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Table 6 - 4. Summary Matrix of the Environmental Monitoring Plan

Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
Construction Phase						
Dust	4 stations 50 m from site	Monthly during dry season and quarterly during rainy season	Gravimetric	DAO 14	Proponent	P 12,000
TSS	3 stations at northern tributary, 1 station at confluence	Quarterly	Gravimetric	DAO 34	Proponent	P 12,000
Color	3 stations at northern tributary, 1 station at confluence	Quarterly	Visual comparison	DAO 34	Proponent	P 4,000
Oil & Grease	3 stations at northern tributary, 1 station at confluence	Quarterly	Gravimetric (petroleum ether extraction)	DAO 34	Proponent	P 16,000
BOD_5	3 stations at northern tributary, 1 station at confluence	Quarterly	Azide modification (dilution technique)	DAO 34	Proponent	P 24,000
pH	3 stations at northern tributary, 1 station at confluence	Quarterly	pH meter	DAO 34	Proponent	P 6,000
DO	3 stations at northern tributary, 1 station at confluence	Quarterly	DO meter	DAO 34	Proponent	P 6,000
Siltation	3 stations at northern tributary, 1 station at confluence	Quarterly	Visual inspection	Presence of silted areas	Proponent	P 4,000
Solid and liquid wastes	Construction site	Quarterly	Visual inspection	Presence of accumulated wastes	Proponent	P 1,000
Aquatic Ecology	Coastline	Quarterly	Visual inspection	Presence of different living organisms	Proponent	P 120,000
Operation Phase						
SO_2	4 stations within 1000m from site	Quarterly	Pararosaniline Method	DAO 2000-81	Proponent	P 50,000

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Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
NO_2	4 stations within 1000m from site	Quarterly	Greiss-Saltzmann	DAO 2000-81	Proponent	P 50,000
TSP	4 stations within 1000m from site	Quarterly	Gravimetric	DAO-2000-81	Proponent	P 50,000
Noise	Outside plant, closest homes	Weekly for the first quarter after start of operations, quarterly thereafter	Noise meter	sleep disturbance annoyance	Proponent	P 10,000
Temperature	Settling pond Upstream, downstream and at proposed outfall	Quarterly	Hg thermometer	DAO 34	Proponent	P 6,000
pH	Upstream, downstream and at proposed outfall	Quarterly	pH meter	DAO 34	Proponent	P 6,000
COD	Upstream, downstream and at proposed outfall	Quarterly	Azide modification	DAO 34	Proponent	P24,000
BOD_5	Upstream, downstream and at proposed outfall	Quarterly	Azide modification (dilution technique)	DAO 34	Proponent	P24,000
Oil & Grease	Upstream, downstream and at proposed outfall	Quarterly	Gravimetric Method	DAO 34	Proponent	P 16,000
DO	Upstream, downstream and at proposed outfall	Quarterly	Gravimetric Method	DAO 34	Proponent	P 24,000

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Parameter	Station	Frequency	Procedure	Applicable Standard	Responsible Party	Estimated cost/yr
Aquatic Ecology	Coastline	Annually	Visual inspection	Presence of different living organisms	Proponent	P 30,000
Employee health status		Annually		DOLE OSHS	Proponent	P 200,000
ESTIMATED GRAND TOTAL PER YEAR						**P 695,000**

6.7 INFORMATION, EDUCATION AND COMMUNICATION (IEC) PLAN

6.7.1 ISSUES AND CONCERNS

It is normal for people to be indecisive or be unwilling to relocate as it would mean major lifestyle changes on their part, hence, there is always resistance at the onset of development projects. This indicates the need to promote the project's acceptability and benefits as well as enhance decisions to relocate particularly on issues/concerns regarding compensation for properties and existing conditions in the relocation area. The following table summarizes the issues and impacts raised by the residents which dictate their willingness, indecision or unwillingness to relocate:

Table 6 - 5. Summary of Issues and Concerns

Issues/ Concerns of Residents	Responses from the Project Facilitators (KKCS as Consultants, SBMA and Project Proponent)
Where will be the relocation site and how much will they be compensated for their houses and improvements?	The relocation and compensation issues will be handled by SBMA as the owner of the land. There is a long-term lease agreement between SBMA and Hanjin. Based on the lease agreement SBMA will be responsible for these issues.
There were questions on the location of the relocation area, sizes of the lots, payment and other conditions.	It was explained that SBMA has formed a group that will study and recommend how to handle the relocation and compensation issues
What will happen to the farm lots that are not included in the 300-hectare area to be occupied by the proponent?	It was explained that the scope of the study is only for the 300-hectare area, hence, in so far as the study is concerned, the area will be limited to the area to be occupied by Hanjin.
Is it true that SBMA would not permit the transfer or relocation of affected families into other SBMA areas?	It was explained that SBMA would formulate and implement a policy about relocation. The details of the policy are not yet available.
Some participants suggested that they be permitted to relocate to other SBMA areas. In this way, they will not be charged anymore for the amortization of their relocation lots because SBMA will not buy anymore from owners of nearby lands.	KKCS will study the viability of such proposal and come up with the findings and recommendations to SBMA.
There are residents who have a 2.5 hectares land stewardship under the CBFMA. Are they permitted to transfer to these areas for their relocation?	It was reiterated that the final relocation site would be decided by SBMA as the responsible entity for relocation after considering a variety of factors including financial, social and legal aspects.
It was suggested that the members of the reforestation association be permitted to be relocated in their respective areas under CBFMA.	KKCS will study this option and will provide recommendations as to the financial, legal and social viability.
A participant asked if the relocation site will have similar community facilities to that existing in their community such as chapels and schools.	A relocation site should have basic services such as provisions for education, health, power, water and roads. The details are now being studied by SBMA.

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Issues/ Concerns of Residents	Responses from the Project Facilitators (KKCS as Consultants, SBMA and Project Proponent)
Accessibility of fishermen to their animals and boats from the relocation site.	KKCS to study and will endorse to SBMA concerns about the animals and bancas.
Will the length of stay in the area be a factor in determining compensation?	KKCS will study if the length of stay may be included as one of the factors in determining compensation considering the nature of the stay of the residents within SBMA land. It should be emphasized that there are other factors to be considered.
What will happen to the trees they planted and the crops they grow? Agriculture.	The trees and crops will be properly compensated. The valuation of the trees and crops will be based on the rates of the Municipal Assessor's Office or Department of Agriculture
Will scholarship for students be offered?	The access to education will be provided for but scholarship will be at the discretion of SBMA or the project proponent. The study may recommend educational support for deserving but financially challenged households.
Employment for affected communities	Priority will be given to qualified residents of the affected communities. Applicants who are not qualified for employment may undergo skills training to acquire the needed qualifications to be employed in the project.
Can they still be hired even if they are relocated?	Priority employment will be given to qualified residents of Sitio Agusuhin and the neighboring sitios of Nagyantok and Nagtulong.
Issue on newly transferred migrants and their houses?	KKCS will study the matter and recommend measures to SBMA how to handle and address this issue.

Based on these issues and concerns as well as the recommendations of community residents to resolve such, a Social Development Plan (SDP) will be developed as part of the project development and implementation process. As the SDP intends to address concerns of people who will be adversely affected by the project, it will be formulated through a participatory workshop that will be conducted specifically to draft this plan. Among the participants will be the representatives of the project proponent, project affected persons, municipal and barangays officials, and other stakeholders. The workshop will thresh out the details of SDP operations and address the concerns on the socio-cultural, economic, environmental and health aspects. The SDP will focus on the following:

- employment and livelihood issues and concerns;
- possible livelihood projects; and
- health and sanitation.

The SDP will take special efforts to gather and resolve sectoral concerns from the marginalized sectors including women, fisherfolk, youth and the elderly. Considering the vital role of the SBMA/LGU especially in the resettlement issue, the SBMA and municipal officials will play an important role in formulation of a detailed SDP. The output of this workshop will be an agreement among the participants outlining their responsibilities in fulfilling and implementing the SDP.

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Enhancing the awareness of stakeholders regarding the project would greatly enhance the success of developing the SDP, and this is where the IEC plan would complement its formulation.

The IEC Plan would focus first on a campaign to inform stakeholders about the project, its operation and the benefits. It will also seek to enhance the understanding of people directly impacted by the project about the project and by upgrading their knowledge about the project itself and its dynamics. The IEC campaign will target mainly those who are directly impacted by the project and will include other stakeholders based on their role or circumstances in relation to the project.

6.7.2 EXISTING COMMUNICATION RESOURCES

In the IEC, it is important to know the existing communication resources being used by the target stakeholders for their information needs, this would facilitate easy use of communication materials and familiarity with the resources and facilitate better understanding of the message being conveyed. The existing communication resources in the target communities as gathered during the socio-economic study are:

- Telecommunications – served by Philippine Telephone Co. (PILTEL) plus major cellular phone networks (Smart and Globe and their subsidiaries); radio communications system operated by the LGU
- Postal and Telegraph Service Facilities operated by the government
- TV, AM and FM Radio Stations
- National and Local newspapers with daily, weekly and monthly publications
- Human Sources – Parish priest, other family members, neighbor, barangay/municipal officials & local leaders, project employees.

6.7.3 COMMUNICATION PROBLEM ANALYSIS

Results of socio-economic survey indicated that about half of the respondents need to be more informed about the project for them to have better awareness levels. Results showed a significant number of respondents who are undecided about accepting the project or go against it, plus some respondents who have no reactions. Very few are against the project.

Hesitance and unwillingness to accept the project is an indication of the lack of understanding of the issues involved in project development as well as the lack of assurance that their concerns, especially with regards to relocation and change.

Hence, the IEC process will focus on communicating information that would make stakeholders gain a better understanding of the project. More than just being aware of the project, understanding the project, its dynamics and benefits would assure stakeholders that their concerns will be addressed and facilitate win-win solutions to issues and concerns.

6.7.4 COMMUNICATION OBJECTIVES

The goal of the IEC plan is to increase awareness and understanding level of the identified stakeholders regarding the project, its dynamics, benefits and how issues will be addressed. The specific communication objectives are the following:

- Increase the number of residents who are aware – from 53% to 100% of all households – of the project, its dynamics, benefits and measures to address concerns.

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- Increase the number of residents who would be willing to accept the project and relocate to identified relocation areas.
- To instill a better understanding of the project among the community residents and the need for them to participate in developing solutions to their concerns.
- Mobilize stakeholders to participate in developing the Social Development Plan which will be formulated through a series of consultations and discussions with different stakeholder groups.
- To gain the support of barangay and municipal officials in disseminating the right information regarding the project.
- To have the local officials enact relevant policies and institutional support to facilitate resolution of concerns of the residents regarding the impact of the project.
- To have local officials provide key information necessary to facilitate formulation of the SDP.
- To elevate awareness and gain commitment of local leaders from local associations (POs, religious groups, women's groups, youth sector) in the concerned sitios for them to help facilitate awareness campaign about the project in their respective areas.
- To enhance understanding of key people who are regarded as sources of information in the community (i.e., parish priest, teachers, etc.) about the project, its dynamics, benefits and measures to resolve issues and concerns raised by the community.
- To mobilize local community leaders to promote project acceptance in the community and participate in developing the SDP.
- To equip SBMA and Hanjin officers with the right knowledge and answers to concerns of the community regarding the project for them to facilitate acceptance of project and encourage support from the community, especially in developing the SDP.
- To feed the local and national media with timely information and mobilize them in disseminating and promoting knowledge and awareness about the project as well as to tap them in the process of showing the transparency of the project development process.
- To make use local and national media's influence in terms of convincing and mobilizing people to accept the project and develop win-win solutions for the issues and concerns associated with the project.
- To increase the level of awareness of the business community within and outside the project and mobilize them to participate in developing the SDP, especially in opening up new opportunities for livelihood development.

6.7.5 COMMUNICATION STRATEGY

Informed stakeholders are empowered stakeholders. The IEC plan seeks to provide information to stakeholders regarding the project increase their awareness and understanding about its dynamics, benefits, how issues and concerns will be resolved and how the resolutions will be institutionalized to gain the optimum benefits from the project and minimized the projected negative effects.

Awareness about the shipbuilding project is the key to its acceptability and would also pave the way to develop concrete steps to enhance the benefits of the project and offset its negative effects particularly that of relocation which would a major change in the lifestyle of the community directly impacted by the project.

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6.7.5.1 Target Stakeholders for the IEC

Primary Target Stakeholders

The following matrix outlines the primary target stakeholders and their role as to the success of the project:

Table 6 - 6. Primary Target Stakeholders and Their Importance in the IEC Process

Stakeholders	Importance in the IEC Process
Residents of Sitios Agusuhin, Nagyantok and Nagtulong	Being the ones directly impacted by the project, their awareness and understanding of the project, its benefits and effects are critical to the project's acceptability and success. Knowledge of their own situation would greatly enhance the formulation of solutions to their concerns and facilitate project acceptance.
Local Decision- and Policy-makers	Local executives from the local government unit – provincial, municipal and barangay levels -- can help facilitate project acceptance and will contribute to development of institutional support to facilitate project activities.
NGOs, POs & Local Leaders, Religious Groups and other Civil Society Groups	Local leaders coming outside the local governance system usually have the trust of the community residents, their awareness and understanding of the project, its dynamics and effects would be critical to the acceptance of the project and facilitate its success.
The Business Community in and around SBMA	The business community can help firm up project acceptance and the development process in the area as the project would also open up other opportunities for them.
Concerned SBMA Offices and Hanjin Executives/ Employees	As main facilitators of project acceptance and promotions, their awareness and understanding of the project, its operations, benefits and actions for project development would enhance their capability to answer questions and address concerns from other stakeholders, especially those directly impacted by the project.

Secondary Target Stakeholders

Secondary targets are those who can help facilitate spreading information about the project. These would include members of the local and national media. Feeding them the right information will control reporting of unwarranted information that may create confusion among the primary target stakeholders.

Another secondary target stakeholder in the area are local businesses who are set to benefit from the project as they will be able to disseminate information regarding the long-term economic benefits of the project and identify other opportunities that would enhance livelihood activities in the area.

The communication objectives stated can be fitted to the primary and secondary stakeholder groups targeted by the IEC Plan.

6.7.5.2 Interventions

To generate awareness and acceptance for the Hanjin Shipbuilding Facility project under the administration of the SBMA in the community in and around the project site.

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Promotions

Orientation Materials

Produce orientation and advocacy materials such as flyers, leaflets, brochures, flipcharts, and basic audio-visual productions (videos and other AVPs) which will be used to orient stakeholders in the community about the project and its benefits. Likewise, these materials should provide answers to the concerns raised by the target stakeholders as summarized in the communication issues and concerns section. These materials will be distributed to the community and key informants and local leaders in the community.

Billboards and teasers will also be established to encourage people to ask about the project and thus pave the way for information exchange. This will be complemented by a standard roadshow exhibits about the project, which can be set up in the Municipal Hall or at the respective community centers.

Other orientation materials which should be prepared are interactive CDs about the project, project portfolios outlining benefits and measures to resolve issues and concerns as well as multi-media presentations. These materials would be for decision- and policy-makers as well as local leaders.

Information to be included in the orientation materials should be verified for consistency and transparency by the primary sources of information, especially those advocating solutions to the concerns of the stakeholders.

The main aim of the materials is to generate awareness and acceptance of the shipbuilding project, facilitate exchange of information and perspectives about the project leading to the willingness of primary stakeholders to relocate and give way to project development.

Media

Local and national media (print and broadcast) should be tapped to publicize interventions and perspectives on the project and its benefits and how issues and concerns will be addressed as well as mobilization to generate participation in formulating the Social Development Plan.

Hands-on Awareness Campaign and Establishment of Community Information Center

Engage in the stakeholders in site visits, and other activities such as regular community clean-ups, sponsorship of events that would generate interest in the project and encourage them to ask about the project and gain understanding about it.

The Community Information Center would facilitate the conduct of regular consultations with stakeholders whether the projects is progressing to their liking and thresh out unanticipated concerns and issues regarding the project. Likewise, they will be the focal points to assess and evaluate the effects of distributed orientation materials.

Development of Website and Electronic Communications Hub

Websites can help generate support for the project on a wider scale and encourage

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people from other areas to gain knowledge about the project. This would help promote the project. Likewise, members of the local and national media would find it easy to access information about the project through this medium and facilitate faster information exchange and clarification of perspectives regarding the project.

Information and Advocacy Materials

Publish guide booklets and monographs that can be used a reference by the local community groups and organization as well as local government units, in their education drive about the project as well as solutions to concerns. Likewise, these materials can be given to line government agencies and the business community both at the local, regional and national level to generate and forge partnerships in providing solutions to the concerns of the stakeholders to be impacted by the project.

Guidebooks and booklets could include:

- Handbook on the Ins and Outs of the Shipbuilding Facility;
- Handbook on Sustainable Livelihood Options (intended to complement capabilities of relocated communities, etc).

Monographs series could include:

- Situational Analysis: A review of the Hanjin Shipbuilding Project;
- Building Partnerships in Community Development;
- A Review of Community Participation in the Hanjin Shipbuilding Project

Overall these materials intend to review development communication and social mobilization tools for advocacy, lobbying, media management and other interventions to promote and establish the measures that would directly address and answer the needs of the community in order for them to accept and be willing to relocate. This would also upgrade the knowledge of local leaders in performing their tasks.

All in all guidebooks and monograph series would center on the on the issues and concerns to be raised in the Social Development Plan such as:

- Employment and Livelihood Issues and Concerns
- Sustainable Livelihood Options
- Health and Sanitation

<u>Capacity Building</u>

- Conduct of Training Workshops and Consultations – this is intended to fine tune the development agenda of the project especially with regards to developing support for relocated communities and institutionalizing local government support to effect the mitigating measures to offset the impacts of the Project.
- Training Workshops on Alternative and Supplemental Livelihoods for local communities especially those providing skills that would be used to gain employment once the project becomes operational.
- Setting up of a community information center, radio or local TV programs highlighting local community participation and efforts, etc.

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6.7.6 MONITORING AND EVALUATION

The goal of monitoring and evaluation of the IEC Plan is to identify the deviations from the planned activities so that they can be corrected at an early stage and avoid delaying the communication process.

Monitoring results will be used to improve the communication plan with new strategies, messages and materials while evaluation assesses the impact of the campaign on the target audience. It may result in the modification, reinforcement or total change of the IEC Plan.

Monitoring will focus on the production of the orientation and advocacy materials and how are they distributed and how the information gained are being used. Its impact would be evaluated through surveys focusing on their awareness about the project and their willingness to accept it as well as conduct of focus group discussions to measure project acceptability.

6.7.7 KEY STEPS IN THE EXECUTING THE IEC PLAN

- Development of Orientation Materials and verification of contents.
- Distribution of orientation materials to primary target stakeholders, establishment of billboards and roadshow exhibits.
- Assessment of information needs of target stakeholders to develop information and advocacy materials (guide booklets and monographs).
- Setting up of Information Centers in the community to monitor and evaluate whether there are marked changes in the awareness and acceptance of the people regarding the project. The information centers would facilitate information and perspecytive exchange between the proponents, SBMA and the community.
- Revisions of Orientation materials as necessary and conduct of hands-on awareness campaign (cross visit to project development site, etc) about the project to facilitate exchange of information and perspectives.
- Production of Advocacy Materials and assessment of capacity building needs of the stakeholders.
- Conduct of training workshops to enhance capacities of relocated communities.

6.8 GUARANTEE MECHANISM

6.8.1 ENVIRONMENTAL MONITORING FUND

The proponent shall open an account in Trust to finance the Environmental Monitoring Fund (EMF) at any mutually acceptable commercial bank in Subic (to be determined). The purpose of the EMF will be to finance the monitoring activities to be conducted at the project site and affected areas.

6.8.2 ENVIRONMENTAL GUARANTEE FUND

The Environmental Guarantee Fund (EGF) shall be established and used exclusively for the following purposes:

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- Immediate rehabilitation of areas affected by damages in the environment and the resulting deterioration of environmental quality as a direct consequence of project construction, operation and abandonment;

- Just compensation of parties and communities affected by the negative impacts of the project;

- Conduct of scientific or research studies related to the project that will aid in the prevention or rehabilitation of accidents and/or environmental damages; and

- Contingency clean-up activities, environmental enhancement measures, damage prevention programs and social equity measures (e.g. livelihood, social development programs) including the necessary IEC and capability building activities related to the project.

The EGF shall have two (2) components as follows:

1. Trust Fund – The proponent shall secure an Insurance Policy in the amount to be determined which will guaranty payment in fifteen (15) days from date of receipt of formal demand from the EGF COMMITTEE to pay a certain party by reason of the damage caused by the project as ascertained by the Committee; and

2. Environmental Guarantee Cash Fund – The proponent shall open an account for the Environmental Guarantee Cash Fund at a mutually acceptable commercial bank in the area in the initial amount to be determined which shall be earmarked for immediate rehabilitation and compensation of affected communities in case of damage or accidents. It shall also be used to cover the operational costs of the EGF Committee.

A format of the Memorandum of Agreement (MOA) for the establishment of the EMF and EGF is also included in **Appendix 14** (see Vol. 1 of this report).

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CNG0432W5C/PPA1990309/[20191122-11:27:16]

7.1 TOPOGRAPHY, SOILS AND LAND USE

Bureau of Soils and Water Management, 1987. Erosion Map.

National Mapping and Resources Information Authority. Topographic Map of San Antonio Quadrangle (Sheet 7072-IV), Scale 1:50,000.

URS - Woodward Clyde, 2002. Subic Bay Protected Area Management Plan Project, Volume 10 – Marine Geology.

_____, 2002. Subic Bay Protected Area Management Plan Project, Volume 14 – Land Use.

7.2 GEOLOGY AND NATURAL HAZARDS

Arcilla, C. A., Ruelo, H. B., and Umbal, J. V., 1989. The Angat ophiolite: Lithology, structure, and problems in age interpretation. Tetonophysic, 168, 127-136.

Bautista, B.C., M.L.P. Bautista, R.S. Stein, E.S. Barcelona, R.S. Punongbayan, E.P. Laguerta, A.R. Rasdas, G. Ambubuyog, and E.Q. Amin, 1996. Relationship of regional and local structures to Mount Pinatubo activity, Fire and Mud, eds. C.G. Newhall and R.S. Punongbayan, University of Washington Press, Seattle, USA, p.351-370.

Bureau of Mines and Geosciences, 1981. Geology and Mineral Resources of the Philippines: Volume 1 -Geology. BMG Press. Manila, 406p.

Cabato, J., K.S. Rodolfo, F. Siringan, T. Valencia, and A. Bravo, 1997. Mapping of faults in Subic Bay, Zambales using high-resolution seismic and synthetic aperture radar (SAR) data, Proceedings of the 10th Annual Geological Convention of theGeological Society of the Philippines, December 3-5, 1997, Dusit Hotel Nikko, Makati City, Philippines, p.12.

Cardwell, R.K., B.L. Isacks, and D.E. Karig, 1980. Spatial distribution of earthquakes, focal mechanism solutions, and subducted lithosphere in the Philippine and northeastern Indonesian islands. In D.E. Hayes (ed), The Tectonic and GeologicalEvolution of Southeast Asian Seas and Islands, Geophysical Monograph Series 23, p. 1-36.

De Boer, J., L.A. Odom, P.C. Ragland, F.G. Snider, and N.R. Tilford, 1980. The Bataan orogene: eastward subduction, tectonic rotations, and volcanism in the western Pacific (Philippines), Tectonophysics, 67, p. 251-282.

Delfin, F.G. Jr., 1983. Geology of the Mount Pinatubo geothermal project, Philippine National Oil Company unpublished report, 35p.

Dimalanta, C.B., 1994. Interpretation of geophysical anomalies over the southern Zambales area: Evidence for the Subic Bay Fault Zone, J. Geol. Soc. Phil., v. 49, p.1-13.

Fitch, T. J., and Molnar, P., 1970. Focal mechanisms along inclined earthquake zones in the Indonesian-Philippine region. J. Geophys. Res., 7, 1431-1444.

Fukushima, Y and T. Tanaka, 1990. A new attenuation relation for peak horizontal acceleration of strong earthquake ground motion in Japan, Seismo. Soc. Am. Bull., p.757-783.

Geoscience Technologies Inc., 2005. Geotechnical Investigation Report, Hanjin Subic Project.

Hamburger, M.W., Cardwell, R. K., and Isacks, B., 1983. Seismotectonics of the northern Philippine island arc. In: The Tectonic and Geologic Evolution of Southeast Asian Seas and Islands, ed. Hayes, D. E., American Geophysical Union Monograph 27, p. 1-22.

Javellosa, R. S., 1995. Morphogenesis and neotectonism of the Santo Tomas Plain, southwestern Zambales, Luzon, Philippines. International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands, Master's thesis, 103 p.

Karig, D. E., Sarewitz, D. R., and Haeck, G. D., 1986. Role of stike-slip faulting in the evolution of allochthonous terranes in the Philippines, Geology, 14, 198-202.

Lewis, S.D. and D.E. Hayes, 1984. A geophysical study of the Manila Trench, Luzon, Philippines, 1. Crustal structure, gravity and regional evolution, J. Geophys. Res., 89, 9171-9195.

Ludwig, W. J., Hayes, D. E., and Ewing, E., 1967. The Manila trench and west Luzon trough, 1. Bathymetry and sediment distribution. Deep Sea Research, 14, 533- 544.

Manila Observatory Center for Environmental Geomatics, 2005. Mapping Philippine Vulnerability to Environmental Disasters, http://www.observatory.ph.

Newhall, C.G., A.S. Daag, F.G. Delfin, R.P. Hoblitt, J. McGeehin, J.S. Pallister, M.T.S. Regalado, M. Rubin, B.S. Tubianosa, R.A. Tamayo and J.V. Umbal, 1996. Eruptive history of Mount Pinatubo, Fire and Mud, eds. C.G. Newhall and R.S. Punongbayan, University of Washington Press, Seattle, USA, p.165-196.

Paladio-Melosantos, M.L.O, R.U. Solidum, W.E. Scott, R.B. Quiambao, J.V. Umbal, K.S. Rodolfo, B.S. Tubianosa, P.J. delos Reyes, R.A. Alonso, and H.B. Ruelo, 1996. Tephra falls of the 1991 eruptions of Mount Pinatubo, Fire and Mud, eds. C.G. Newhall and R.S. Punongbayan, University of Washington Press, Seattle, USA, p.513-536.

Philippine Institute of Volcanology and Seismology, 1999. Unpublished catalogue of historic earthquakes in the Philippines covering the period from 1900 to September 1999.

Ruaya, J.R., and C.C. Panem, 1991. Mount Natib, Philippines: A geochemical model of a caldera-hosted geothermal system. J. Volc. Geotherm. Res., 45, 255-265.

Taylor, B., and Hayes, D. E., 1980. The tectonic evolution of the South China Sea Basin. In: The Tectonic and Geologic Evolution of Southeast Asian Seas and Islands, ed. Hayes, D. E., American Geophysical Union Monograph No. 23, p. 89-104.

Thenhaus, P.C., S.L. Hanson, S.T. Algermissen, B.C. Bautista, M.L.P. Bautista, B.J. Punongbayan, A.R. Rasdas, J.T.E. Nillos, and R.S. Punongbayan, 1994. Estimates of regional ground-motion hazards in the Philippines, Proceedings of the National Conference on Natural Disaster Mitigation in the Philippines, October 19-21, 1994, Quezon City, Philippines, p. 45-60

Torres, R.C., 1992. Vulnerability of the PNPP site to the hazards of Natib Volcano, PHIVOLCS Observer, 8:3, 1-4. Villones, R. D., 1980. The Aksitero Formation – Its implication and relationship with respect to the Zambales ophiolite, Philippine Bureau of Mines and GeosciencesTechnical Information Series No. 16-80, p.21.

Yumul, G.P. Jr., 1994. A Cretaceous to Paleocene-Eocene South China Sea Basin origin for the Zambales Ophiolite Complex, Luzon, Philippines, Island Arcs, 3, 35-

7.3 HYDROLOGY AND HYDROGEOLOGY

Driscoll F.G., 1986. Groundwater and Wells. 2nd ed. Johnson Filtration Systems Inc., St. Paul, Minesota.

Malampaya Concrete Gravity Structure (MCGS) Casting Basin Geotechnical Report (02-CP-9030 Rev D1 May 1999)

Mines and Geoscience Bureau, 1997. Groundwater Availability Map of the Philippines

CNG0432W5C/PPA1990309/[20191122-11:27:16]

National Mapping and Resource Information Authority (NAMRIA). Topographic Map of San Antonio (Sheet 7072-IV) , scale 1:50000.

Ove Arup & Partners, 1998. Hydrological Study

Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA). Rainfall Intensity Duration frequency for Manila Port Area station.

Ward A. D., and Elliot W.J., eds., 1995. Environmental Hydrology. CRC Press LLC, Boca Raton, Florida.

Woodward-Clyde Phil., Inc., June, 1999. Additional Information - Environmental Impact Assessment (EIA) for the Shell Philippines Exploration's (SPEX) Concrete Gravity Structure.

7.4 WATER AND SEDIMENT QUALITY

Long, E.R. and L.G. Morgan. 1991. The potential for biological effects of sediment-sorbed contaminations tested in the nationals status and trends program. Technical Memorandum NOS OMA 52, August 1991, NOAA.

MacDonald Environmental Sciences Ltd., 1993. Development of an integrated approach to the assessment of sediment quality. Vol. 1: *In* Florida, Vol. 2 Supporting Document. Report prepared for Florida State Department of Environmental Regulations. NTIS No. PB92-188465.

7.5 PHYSICAL OCEANOGRAPHY

Ekebjaerg and Justesen, 1991. An explicit finite difference scheme for advection-diffusion modeling in two-dimensions. Apld. Mech. & Eng.

Koutitas, C., 1988. Mathematical models in coastal engineering. Pentech Press. New York. 120 p.

Rivera PC, 2004. Modeling the impacts of the Water Front Development Project on Coastal Hydraulics, Sediment Transport and Sediment Bed Morphology. Submitted to the National Institute of Oceanography – Karachi, Pakistan. November 2004.

Rivera, PC, 2004. Numerical simulation of BOD and coliform dispersion in Sarangani Bay, Philippines. Submitted to the Department of Environment and Natural Resources (DENR-Region 11). March 2004.

Rivera PC, 2004. Numerical Simulation of Oil Spill Trajectory and Dispersion in Karachi Coast. Submitted to the National Institute of Oceanography – Karachi, Pakistan. January 2004.

Rivera, PC, 2003. Oceanography, climatology and marine pollution in Sarangani Bay. Submitted to SMICZMP Project, DENR-11. October 2003.

Rivera PC, 2003. Application of the PEERS Successive Over-Relaxation Technique (SORT) for thermal plume dispersion analysis. PEERS Technical Report No. 4. May 2003.

Rivera PC & Dayanghirang CD, 2002. Sediment morphological change in South Harbor (Manila Bay) under extreme hydrodynamic conditions. Proceedings of the National Geological Convention. Dec. 2002. PhiVolcs. Quezon City.

Rivera, P.C.,1997. Hydrodynamics, Sediment Transport and Light Extinction Off Cape Bolinao, Philippines. 244 p. Balkema Press, The Netherlands.

CNG0432W5C/PPA1990309/[20191122-11:27:17]

URS-Woodward Clyde, 2001. Subic Bay Protected Area Management Plan Project, Volume 1 – Resource Inventory Integration Report (Final Report)

7.6 METEOROLOGY, AIR AND NOISE QUALITY

De las Alas, JG, 2001. Airshed Characterization over Subic Bay. Subic Bay Protected Area Management Plan Project. Ecology Center. SBMA, Olongapo City.

SBPDP EIA, 2002. Subic Bay Port Development Project. Pacific Consultants International. SBMA, Olongapo City.

Environmental Monitoring Report, Armour Rock, Filling Materials and Boulders Quarry Project, Monark Constructors Corporation, Subic, Zambales, 2005

Environmental Monitoring Reports, CGS Project, SPEX BV, Subic, Zambales

DENR Administrative Order 2000-81

OSHA, Department of Labor, USA.

7.7 TERRESTRIAL ECOLOGY

Woodward-Clyde Philippines, Inc., 1995. Subic Bay Environmental Baseline Study Inception Report.

Convention on International Trade in Endangered Species – Appendix I to III.

Guide to Flora and Fauna Vol. II and III. 1986

Department of Environment and Natural Resources. 1987. DENR Administrative Order No. 78, Series of 1987. Manila, Philippines.

_____, 1990. DENR Administrative Order No. 34, Series of 1990. Manila, Philippines.

_____, 1991. DENR Administrative Order No. 48, Series of 1991. Manila, Philippines.

_____, 1994. DENR Administrative Order No. 18, Series of 1994. Manila, Philippines.

DENR-Protected Areas and Wildlife Bureau, 1995 Annual Report 1995.

DENR. The Subic-Bataan Natural Park Management Plan.

Haribon Foundation and Birdlife International. Red data Book

Kennedy. A guide to the Birds of the Philippines

Manual on Vegetation Analysis for Grassland and Forest Ecosystem. PCARRD Book Series No. 50. 1987. Los Baños, Laguna.

7.8 RIVER AND MARINE ECOLOGY

Ahlstrom, E.H., 1976. Maintenance of quality in fish eggs and larvae collected during the plankton hauls. pp. 313 *In* H.F. Steedman (ed.) Zooplankton fixation and preservations. UNESCO Monogr. Oceanogr. Method.

CNG0432W5C/PPA1990309/[20191122-11:27:17]

Aswandy, J.W.W. Kastoro, A. Aziz, I.A. Hakim and Mujiono, 1991. Distribution , abundance and Species Composition of Macrobenthos in Seribu Islands, Indonesia. Proc. of Regional Symposium on Living Resources in Coastal Areas. Manila, Philippines, pp. 183-190.

Basson, P.W., J.E. Burchard, J.T. Hardy and A.R. Price, 1981. Biotopes of the Western Arabian Gulf: marine life and environments of Saudi Arabia. Published by the Aramco Department of Loss Prevention and Environmental Affairs, Dhahran, Saudi Arabia. 284 pp.

Beers, J.R., 1976. Determination of zooplankton biomass. pp.73-84 *In* H.F. Steedman (ed.) Zooplankton fixation and preservations. UNESCO Mongr. Oceanogr. Method.

Dartnall A. J. and M. Jones (eds), 1986. A Manual of Survey Method for Living Resources in Coastal Areas ASEAN-Australia Cooperative Program on Marine Science. The Australian Institute of Marine Science. 167 pp.

Day, J. H., 1967. A Monograph on the Polychaeta of Southern Africa. Part II. Sedentaria. Trustees of the British Museum (Natural History), London, Publ. No. 656, pp. 459-878.

English, S., C. Wilkinson, and V. Baker, 1994. Survey manual for tropical marine resources. Asean-Australia Marine Science Project. Townsville, Australia. 368 pp.

_____, 1997. Survey manual for tropical marine resources. Asean-Australia Marine Science Project. Townsville, Australia. 368 pp. (revised).

Estudillo, R.A., 1979. Distribution and relative abundance of zooplankton with special reference to planktonic crustaceans in the Visayan Sea. The Philippine Journal of Fisheries. Vol. 17 (1) January-June 1979. 146 pp.

Estudillo, R.A., C. L. Gonzales and J.A. Ordoñes, 1987. The seasonal variation and distribution of zooplankton, fish eggs and larvae in Malampaya Sound. The Philippine Journal of Fisheries. Vol. 20 (1 and 2) January-December 1987. 112 pp.

Fortes, M.D., 1987. Taxonomy and ecology of Philippines seagrasses, In Proceedings of the First National Conference on Seagrass Management, Research and Development. National Environment Protection Council

Fortes, M.D. 1990. Seagrasses: a resource unknown in the ASEAN Region. ICLARM Education Series 5, ICLARM. Manila, Philippines. 46 pp.

Froese, R. and D. Pauly (Editors), 2000. FishBase 2000: concepts, design and data sources. ICLARM, Los Baños, Laguna, Philippines. 344 pp.

Jillett, J.B., 1971. Zooplankton and hydrology of Hauraki Gulf, New Zealand. Bull. N.Z. Dept. Sci. Ind. Res. N.Z. Oceanogr. Inst. Memoir. (53):103 pp.

Kulbicki, M., G. Mou Tham, P. Thallot and L. Wantiez, 1993. Length-weight relationships of fish from the lagoon of New Caledonia. NAGA, the ICLARM Quarterly, 16(2-3): 26 – 30.

Letourneur, Y., 1998. Length-weight relationship of some marine fish species in Reunion Island, Indian Ocean. Naga, 21(4): 37-38.

Menez, E.G., R.C. Phillips, and H.P. Calumpong, 1983. Seagrasses from the Philippines. Smithsonian Institution Press. Washington, D.C. 40 pp.

Montebon, A.R. F., 1997. Status of coral reefs in Negros Oriental, Central Philippines. Proc. 8th Int'l. Coral Reef Symp., Panama. 1:295-300.

Mr. E. Applied Environmental Sciences, 2005. A baseline survey on the artificial reef in Subic Bay off sitio Agusuhin, Barangay Cawag, Subic, Zambales, 28-29 April 2005. Prepared for Shell Philippines Exploration (SPEX).

CNG0432W5C/PPA1990309/[20191122-11:27:17]

OCDI-PCI (The Overseas Coastal Area Development Institute of Japan- Pacific Consultants International), 1998. The study on the Subic Bay Port Master Plan in the Republic of the Philippines. Progress Report I.

_____ 1999. The study on the Subic Bay Port Master Plan in the Republic of the Philippines. Progress Report II.

Shannon & Weaver, (1949), 1968. The Mathematical Theory of Communication. Univ. of Illinois Press, Urbana. 117 pp.

Welcomme, R.L., 1983. River Basins. FAO Fisheries Technical Paper 202 FIR/T202. Food and Agricultural Organization of the United Nations. Rome. 60 pp.

_____, 1985. River Fisheries. FAO Fisheries Technical Paper 262. . Food and Agricultural Organization of the United Nations. Rome. 330 pp.

Woodward-Clyde, 1999. Baseline survey of marine biota at dredging and disposal site for Malampaya CGS, off sitio Agusuhin, Barangay Cawag, Subic, Zambales. Final Report. Prepared for Malampaya CGS Alliance.

_____, 2000. Assessment of marine biota at the patch reef south of the dredged channel in front of CGS casting basin. Final Report. Prepared for Malampaya CGS Alliance.

_____, 2001. Resource Inventory, Vol. VII- Plankton, Dinoflagellates and Benthos Study Report (by Ruben A. Estudillo). Subic Bay Protected Areas Management Plan Project. Prepared for Project Management Office-Foreign Assisted Project Office and Ecology Center, SBMA. March 2001.

Woodward-Clyde and Ecology Center-SBMA, 2001. Resource Inventory. Vol. 1- Resource inventory integration report (Final Summary Report). Subic Bay Protected Areas Management Plan Project.

7.9 SOCIO-CULTURAL, ECONOMIC AND POLITICAL ENVIRONMENT

Bases Conversion and Development Act --Republic Act 7227.

Civil Code of the Philippines.

Community-Based Forestry Management Agreement dated February 5, 2003

Comparative Socio-Economic Profile Pilipinas Shell Foundation Inc.

Comprehensive Agrarian Reform Law of 1988.

Comprehensive Land Use Plan of Subic 2000-2010

Digital General Land Use Map, UP PLANADES Subic Team

Memorandum of Agreement (SBMA, Subic and ANA) dated June 13, 2000.

Municipal Trade and Industry Development Plan (1998-2001), prepared by Cynthia F. Valdeconza.

Pilipinas Shell Foundation Inc., Accomplishment Reports.

Provincial Engineer's Office.

Socio-Economic and Perception Survey June 29-July 15 2005, Ecology Center

Socio-Economic Profile of Subic 1999.

Urban Development and Housing Act - Republic At 7279

World Bank Policy 4.12

CNG0432W5C/PPA1990309/[20191122-11:27:17]

7.10 ARCHAEOLOGY

Underwater Archaeology Team- National Museum of the Philippines. 1999. Report on the underwater archaeological inspection of a shipwreck located offshore Subic Bay, Zambales, at the construction site of Shell Philippines Exploration B.V. for the Malampaya Platform Development Project.

Underwater Archaeology Team- National Museum of the Philippines. 2000. Report on the underwater archaelogical re-inspection of LST 1625, a shipwreck located offshore Subic Bay, Zambales, at the construction site of Shell Philippines Exploration B.V. for the Malampaya Platform Development Project.

CNG0432W5C/PPA1990309/[20191122-11:27:17]