ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Methane Recovery and Power Generation Project

Ref. No. 5979-0024
CPA-35 Methane Recovery and Combustion with Renewable Energy Generation from Anaerobic Animal Manure Management Systems under the Land Bank of the Philippines' Carbon Finance Support Facility

June 2019

LIST OF ACRONYMS

BOD	Biological Oxygen Demand
BUSECO	Bukidnon Second Electric Cooperative
CDM	Clean Development Mechanism
CFSF	Carbon Finance Support Facility
CO	Carbon Monoxide
CPA	Component Project Activity
CSR	Corporate Social Responsibility
DENR	Department of Environment and Natural Resources
DNA	Designated National Authority
DO	Dissolved Oxygen
DOE	Designated Operational Entity
DP	Discharge Permit
ECC	Environmental Compliance Certificate
EMB	Environmental Management Bureau
EMF	Environmental Monitoring Fund
ENRO	Environment and Natural Resources Office
EPMD	Environmental Program and Management Department
ERPA	Emissions Reduction Purchase Agreement
ESMP	Environmental and Social Management Plan
ESSF	Environmental and Social Safeguards Framework
HC	Hydrocarbons
LBP	Land Bank of the Philippines
MOA	Memorandum of Agreement
MRF	Methane Recovery Facility
MSDS	Materials Safety Data Sheet
NOx	Nitrogen Oxides
PCO	Pollution Control Officer
P.D.	Presidential Decree
PM	Particulate Matter
PoA	Program of Activity
PPE	Personal Protective Equipment
PTO	Permit to Operate
R.A.	Republic Act
SMR	Self-Monitoring Report
SPA	Subproject Agreement
TSS	Total Suspended Solids
WTF	Water Treatment Facility

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PURPOSE OF THE DOCUMENT

This Environmental and Social Management Plan (ESMP) is prepared as part of the requirements of the Safeguards Framework for Clean Development Mechanism (CDM) projects implemented under the Carbon Finance Support Facility (CFSF) of the Land Bank of the Philippines (LBP). The Environmental and Social Safeguards Framework (ESSF) was developed to ensure the establishment of protection, compliance, and mitigation measures for relevant environmental and social aspects of projects under the CDM program which covers the Methane Recovery and Power Generation Projects of CPA 35.

Scope

Since the Project is a key component of CPA 35's wastewater treatment facility (WWTF), which handles the primary waste the piggery produces (manure), – this ESMP will cover the operations of the entire pig farm described herein, only highlighting the management of impacts attributable to or associated with the Project.

1 PROJECT SUMMARY

The Methane Recovery and Power Generation Project of CPA 35 is an initiative developed under LANDBANK's CFSF. Its goal is to capture greenhouse gases, particularly methane from piggery wastewaters that would otherwise dissipate into the atmosphere, and convert them into electrical energy.

1.1 Proponent Profile

Proponent:	CPA 35
Business Address:	Malaybalay City, Bukidnon, Philippines
Project Site:	Malaybalay City, Bukidnon, Philippines
Project Type:	Livestock Project
Philippine Standard Industrial Classification:	0145 - Hog Farming

Contact Persons

LANDBANK

Lending Programs Management Group:	Emellie V. Tamayo
Designation:	Head / First Vice President
Telephone No.:	(632) 405-7309
Fax No.:	(632) 528-8542
Environmental Program Management Department:	Prudencio E. Calado III
Designation:	Head / Assistant Vice President
Telephone No.:	(632) 405-7339
Fax No.:	(632) 528-8484

1.2 Pig Farm Profile

Farm area:	12.5746 ha
Production:	Grow-Finish
Housing type:	Conventional sheds, open-sided
Actual capacity:	2,800 heads
ECC capacity:	3,840 heads
Average population:	2,700 heads
Start of operation:	August 2010
Number of employees:	14

CPA 35 Farm is a sole proprietorship contract grower of San Miguel Foods, Inc. engaged by the latter to accommodate hogs during the growing to finishing phase of production. It is currently able and licensed (as per its Environmental Compliance Certificate) to house a maximum of 3,840 heads.

The Farm is currently entirely powered by Bukidnon Second Electric Cooperative, Inc. (BUSECO) but will soon utilize electricity from biogas through the Project. A deep well within its premises supplies the Farm's water needs. Treated effluent from its existing treatment facility is also used for flushing pig buildings. Figure 1 shows the layout and basic facilities of the Farm.

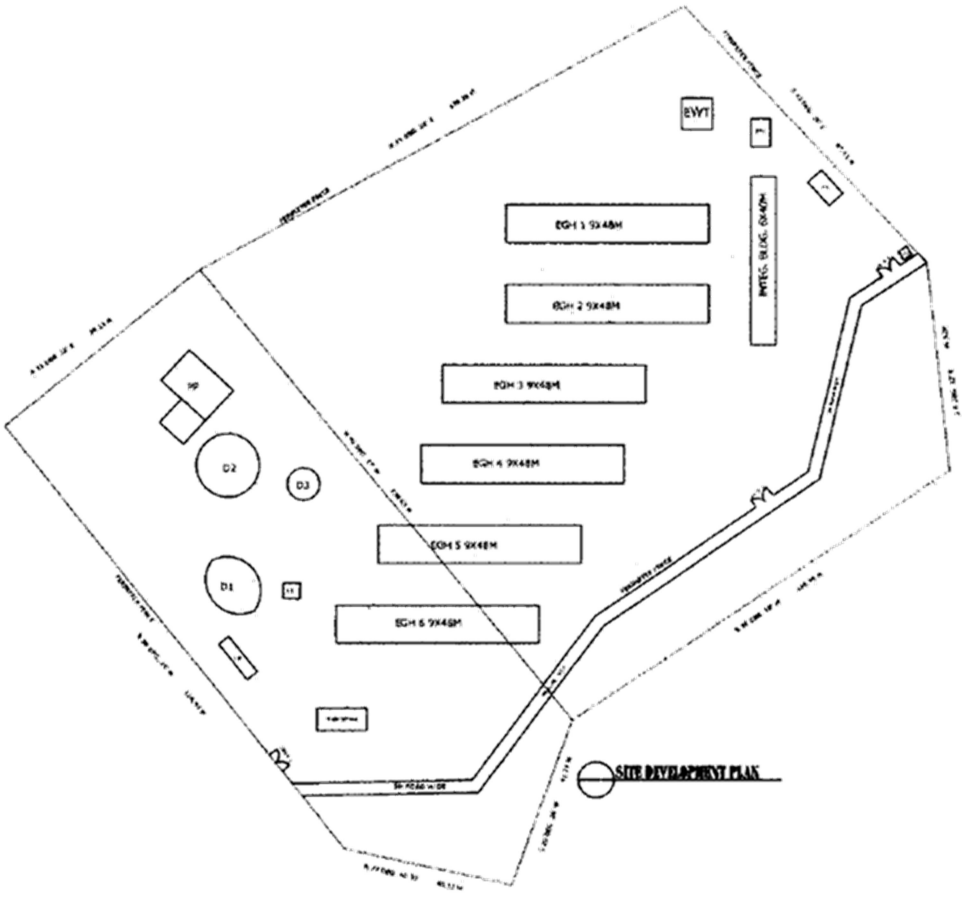

Figure 1. Site layout of CPA 35

1.3 Existing Environmental Conditions

The Project is being built within the premises of CPA 35, a 2.574-ha property 860 masl in Malaybalay City, Bukidnon. Bukidnon is in the island of Mindanao, southern Philippines. A 1-km unpaved road connects the Farm to Sayre Highway which leads to the Malaybalay city proper about 8 km away (see Fig 2).

1.3.1 Land Classification and Use

Malaybalay City is classified as mostly rural, its lands widely used for agricultural purposes. Lands around the Farm are covered with pineapple and corn plantations interspersed with pig and poultry farms. CPA 35' property is classified as agro-industrial.

1.3.2 Climate

The climate in Malaybalay City is Tropical Rainforest according to Köppen-Geiger system[1]. No pronounced dry season is experienced in the area. The city has an average annual temperature of 23.4 °C and receives an average annual precipitation of 2664 mm[1]. The climate in the city is also quite cool owing to its high altitude. Typhoons are barely an occurrence in Bukidnon[2].

1.3.3 Topography and Soil

The subject property gently slopes from west to east and is surrounded by wide, level to slightly undulating terrains. Clay is the general soil type in the Farm and its vicinity.

1.3.4 Water Resources

The Farm sits in between two prominent landforms (Fig 2) – Kitanglad Mountain Range and Mt. Dulong-dulong – and thus enjoys abundant water supply.

The closest bodies of water to the property are a creek that is about 30 m from its northern perimeter and a natural depression roughly 40 m on its southern perimeter. This feature seems to be the source of waters that form the Dila Creek.

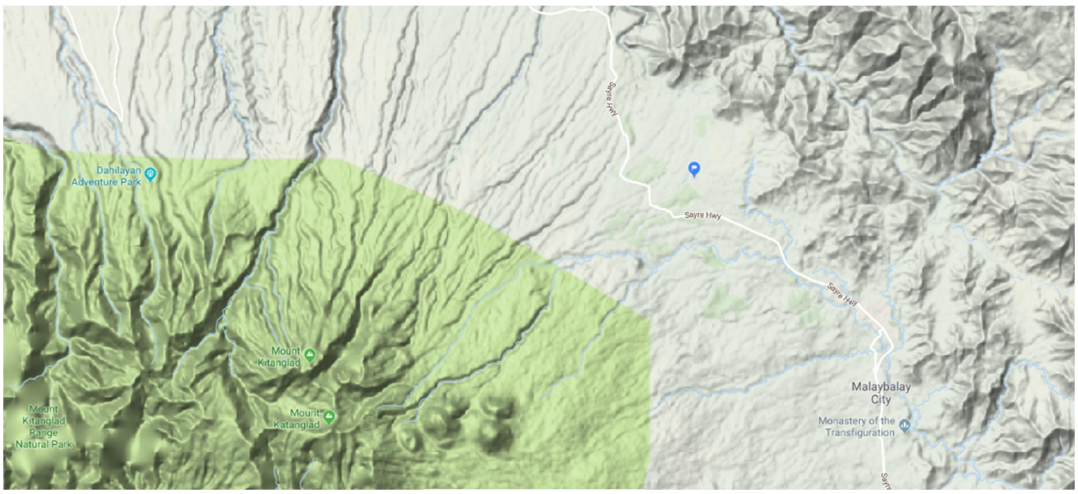

Figure 2. Map showing relative location of CPA 35

1.3.5 **Natural Hazards**

The Farm is not vulnerable to flooding[3] but is in a low-risk earthquake zone. It is not however susceptible to earthquake-induced landslides[2].

1.3.6 **People and Communities**

There are very few, if any, houses situated within the 500-m radius of the Farm. Other livestock farms in the area are located 1 km away from the property, in compliance with local regulations.

1.4 **Project Description**

The Project covers the installation and operation of an anaerobic digester system and its ancillary facilities including post-treatment wastewater lagoons and a biogas-fueled electricity generation system. The biodigester and the power generation unit are collectively referred to herein as methane recovery facility (MRF).

1.4.1 **Components and Design**

CPA 35's wastewater treatment process features three treatment phases:

- *Pre-Treatment*, which involves removal of indigestible materials and relatively large digestible particles in wastewaters prior to entering the reactors;
- *Anaerobic digestion*, or the disintegration of biodegradable materials in the wastewaters through biological processes facilitated by microbes which thrive in the conditions provided by the reactor; and
- *Post-Treatment* of the by-products of anaerobic digestion – biogas, effluent, and sludge.

The WWTF will be consisted of a sand trap, three enclosed (with HDPE sheet), above-ground concrete tanks (biodigesters), and a filtration tank. The power generation unit will basically be a biogas-fueled generator set. Wet digestion will likely be employed. Anaerobic process will likely be mesophilic, occurring at around 30-40 °C. At this temperature range, the ideal retention time is 30-40 days.

Overall, the WWTF was designed to accommodate wastes generated by more than the maximum number of pigs the Farm could house (4,000 heads) and capture enough biogas to run the Project's facilities with a net energy requirement of zero. The design and layout of the WWTF's components are illustrated in the construction plans in Appendix A.

1.4.2 **Operation**

Once completed and operational, wastewaters will be channeled into a collecting tank from which they will be pumped into the series of three fermentation reactors. Stirring inside the reactors and movement of effluent from one reactor to another will be facilitated by hydraulic pressure created by incoming feedstock.

From the biodigesters, partially treated wastewaters will overflow into and be made to flow through a 4-chambered gravitation filtration tank with sand filling. The last filtration pond will also serve as reservoir of treated waters that will be

pumped back into the pig sheds for cleaning, or onto the vegetable and ornamental garden and nearby croplands for irrigation.

Biogas that has collected at the top of the reactors will be propelled using blowers through the gas conditioning equipment and then into a generator set for conversion to electrical energy to be used in the Farm.

Sludge in the biodigesters will be extracted through gravitational pipes (pull-plug system) and directed onto a drying bed using a submersible pump. Dried sludge will be used as fertilizer.

Figure 3 illustrates the wastewater treatment and power generation process of CPA 35.

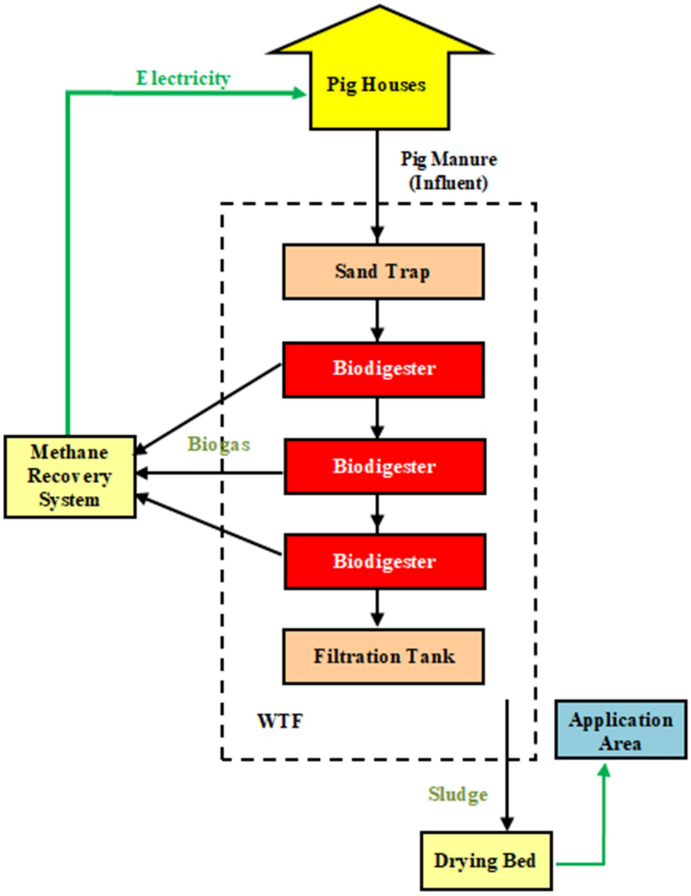

Figure 3. Wastewater treatment and power generation process of CPA 35

2 ENVIRONMENTAL MANAGEMENT

2.1 Impacts

2.1.1 Positive

Environment

The primary treatment of pig wastes of CPA 35 Farm is accomplished mainly through the Project. Anaerobic digestion with the biodigester helps ensure that the Farm's effluents meet regulatory quality standards. Using recycled effluent for irrigation reduces extraction of groundwater and use of synthetic fertilizers on land.

Significant reduction of foul odors emanating from stored effluents has been observed since the operation of the biodigester. This has improved the working condition of workers and the general environment in the Farm for its neighboring communities and livestock.

By providing a mechanism to capture methane and using it as a renewable source of energy, the Project is helping lower the Farm's overall carbon footprint – through preventing release of greenhouse gases into the atmosphere and decreasing its consumption of conventional fuels (for power). With inputs coming from 2,800 hogs (current average), through the Project, CPA 35 is estimated to be capable of reducing greenhouse gas emissions equivalent to 1,500 tCO_2e annually.

Economy

Using biogas-generated electricity lessens the Farm's reliance on the grid, translating to savings for the piggery business. Further savings may also be gained from reusing treated effluent for the Farm's operations.

Having been being registered as a component project activity (CPA) in the CDM Program, CPA 35 has an opportunity to earn monetary incentives by selling carbon credits to World Bank. It may also opt to trade its carbon credits in the wider carbon market after the Program.

Lastly, CPA 35 provides employment opportunities to residents of Malaybalay City and of nearby provinces. It also generates revenue for the local government.

2.1.2 Negative

Certain aspects of the Pig Farm's and the Project's operations inevitably result in potential harm to the environment, including generation wastewaters; hazardous and non-hazardous wastes; air pollutants; foul odors, noise, dust and other nuisance; and depletion of natural resources, especially freshwater / groundwater. These pose inherent risks of variable degrees to environmental quality and natural ecosystems and health and safety of workers, communities, and livestock.

A. Wastewater Generation
Wastewaters saturated with dissolved manure and feed materials are primarily generated from raising livestock through intensive farming methods.

B. Solid Wastes Generation

Pig manure, sludge from wastewater treatment, and carcasses make up the bulk of solid wastes generated in the Farm.

C. Hazardous Wastes Generation

Generation of potentially hazardous wastes mainly result from veterinary activities and use of various chemicals for cleaning and for maintenance of machineries. Biological materials from diseased pigs also pose significant risks to the health of workers and livestock.

D. Generation of Air Pollutants

Emissions from diesel- and biogas-fueled generator sets which supplement the grid for the Farm's power requirements are the main sources of air pollutants in the Farm.

E. Risks to Environmental Quality

- Pollution. The inadvertent release to the environment (through breaches and leaks) of the wastes listed above, especially of nutrient-rich meterials, may cause serious damage to the quality of affected soil and aquatic resources.

- Global warming. Large amount of biogas, mostly composed of potent greenhouse gases, are produced during the anaerobic decomposition pig manure and other organic compounds. If allowed to escape to the atmosphere, these gases will contribute to the furthering of the deteriorating effects of global warming. Use of power from the grid consumes non-renewable fuels which generate greenhouse gases when processed for electricity production.

- Resource depletion. Intensive farming demands for significant volume of freshwater. Neglectful sourcing and use of water in the Farm could deplete water resources.

F. Health and Safety (Methane Recovery Facility)

Biogas is a mixture of gases produced during anaerobic digestion. It is mainly composed of methane and carbon dioxide, but other gases (nitrogen, hydrogen, hydrogen sulphide, ammonia, etc.) may also be present at lower concentrations.

- Fire and Explosion. The MRF presents a major fire and explosion hazard in the farm owing to the high concentrations of biogas (primarily consists of methane which is highly flammable and combustible) that it is designed to capture and process. Risk of explosion is elevated in areas where biogas is compressed for storage.

- Asphyxiation and Poisoning. Methane and carbon dioxide are asphyxiants, substances that cause suffocation by displacing oxygen in the ambient air. Furthermore, carbon dioxide and hydrogen sulfide are considered poisonous when inhaled at high concentrations. In the farm, risks of asphyxiation and gas poisoning are high in the areas associated with the MRF and in confined spaces and poorly ventilated areas where fugitive biogas may collect.

- ¬ Infection and Infestation. Handling and processing of manure, wastewaters, and sludge expose workers to various pathogens and parasites.

G. *Health and Safety (General Operations)*
Various elements and situations in the Farm could compromise the health and safety of workers and livestock. The comfort and convenience of surrounding communities may also be affected by impacts not contained by the Farm's boundaries.

- ¬ Odor, Noise, Dust. Foul odors are typically emitted from manure drains and storage and unclean pig houses. Loud noises may be produced by pigs (especially during feeding) and farm machines. Dust is generated from handling feeds and other dusty materials and by movement of vehicles on unsealed roads.

- ¬ Pests and vermin. Pests and vermin are attracted to foul odors and sources of food in the Farm (improperly disposed biodegradable wastes and Inadequately contained food and feed materials).

- ¬ Diseases and Injuries. Livestock, pathological materials, and excretions likely harbor harmful organisms. Various injuries could result from accidents, particularly when handling pigs, operating machineries, and using toxic substances.

2.2 **Due Diligence**

CPA 35 Farm commits to undertake environmental due diligence in its dealings and operations through compliance with relevant regulatory safeguards and implementation of the measures provided in the environmental management and monitoring plan in Table 3 and in the existing and proposed plans presented herein.

2.2.1 **Legal Framework**

The Farm operates in the context of laws prescribing the regulatory safeguards in Tables 1 and 2. Table 1 lists relevant national legal instruments concerned with environmental protection, whereas Table 2 lists permits issued by local government agencies that mainly address health and safety aspects of the Farm and the Project.

Table 1. Environmental documents and statutory requirements regulating the operation of CPA 35

DOCUMENT	PARTICULARS	
Environmental Compliance Certificate (ECC)	Reference No.	ECC-R10-0909-0028
	Issuing Agency	EMB Region 10
	Date of Issuance	October 6, 2009
	Valid Until	- no expiration -
	Conditions	・ area of operation: 2.5746 ha ・ maximum population: 3,840 heads ・ creation of EMF
Discharge Permit (DP) for Water Pollution Source / Control Facilities	Reference No.	2014-DP-G-1013-706
	Issuing Agency	EMB Region 10
	Date of Issuance	July 7, 2014
	Valid Until	July 6, 2019
	Conditions	・ no discharge to any body of water
Permit to Operate (PTO) Air Pollution Source Control Installations	Reference No.	2017-POA-B-1013-1939
	Issuing Agency	EMB Region 10
	Date of Issuance	June 17, 2017
	Valid Until	February 10, 2022
	Conditions	・ For the following equipment: - (1 unit) 400-m^3 anaerobic digester - (1 unit) 25 kVA “KDE 25SS KIPOR” diesel engine stand by generator set
Hazardous Waste Generator ID	Registration No.	For application
	Approving Agency	EMB Region 10
	Date of Approval	- --
	Valid Until	- no expiration -
	Conditions	**- - -**
Water Permit	Reference No.	For application
	Issuing Agency	National Water Resources Board
	Date of Issuance	**-- -**
	Valid Until	- no expiration -
	Conditions	(P.D. 1067 Water Code)
PCO (Pollution Control Officer) Accreditation Certificate	Accreditation No.	2014-PCO-1013-0063
	Issuing Agency	EMB Region 10
	Date of Issuance	**---**
	Valid Until	September 2020

EMB Environmental Management Bureau
EMF Environmental Monitoring Fund

Table 2. Permits ensuring the safety of CPA 35 Farm's facilities and operation

DOCUMENT	PARTICULARS	
Business Permit	Permit No.	2018-1454
	Issuing Agency	Office of the Mayor - Malaybalay City
	Date of Issuance	January 12, 2018
	Valid Until	December 31, 2018
	Prerequisites	compliance with the requirements of the following: ・ Occupancy Permit ・ Locational and Zoning Clearance ・ Fire Safety Inspection Certificate ・ Health and Sanitary Certificate ・ City ENRO Certificate
Occupancy Permit	Reference No.	01-14-007
	Issuing Agency	Office of the Building Official – Malaybalay City
	Date of Issuance	January 30, 2014
	Valid Until	- no expiration -
	Prerequisites	・ compliance with P.D. 1096 (National Building Code)
Fire Clearance	Reference No.	10-0025647
	Issuing Agency	Bureau of Fire Protection Regional Office 10
	Date of Issuance	November 23, 2017
	Valid Until	November 23, 2018
	Prerequisites	・ compliance with R.A. 9514 (Revised Fire Code)
Sanitary Permit	Permit No.	0034
	Issuing Agency	City Health Office - Malaybalay City
	Date of Issuance	January 12, 2018
	Valid Until	December 31, 2018
	Prerequisites	・ compliance with P.D. 522 ('Sanitation Requirements'), P.D. 856 (Code on Sanitation), and pertinent local ordinances

ENRO Environment and Natural Resources Office
P.D. Presidential Decree
R.A. Republic Act

2.2.2 **Environmental Management and Monitoring Plan**

Table 3 summarizes the measures CPA 35 is implementing and intends to implement to address the environmental impacts and risks identified in Section 2.1.2. Adequate training will be given to concerned employees to ensure that the content of this environmental management plan will be properly carried out.

Table 3. Environmental Management Plan of CPA 35

IMPACT	SOURCE / ACTIVITY	MEASURES	STATUS			MONITORING METHOD	FREQUENCY	PARAMETER / INDICATOR	RESPONSIBLE ENTITY	REPORTING TO	Cost^, Php
			Existing / Current Practice	To be Implemented / Under Construction	Adoption Under Review						
A. Wastewater											
a.1 generation of wastewater	pig raising	water conservation strategies	✓			quantify wastewater production	monthly	volume of wastewater produced	Supervisor	Owner > reported in SMR	(Project cost)
		treatment of wastewater in WWTF	✓								
a.2 generation of domestic wastewater	general farm activities	water conservation strategies	✓			check siphoning and hauling records	every 5 years	volume of sewage hauled	Supervisor	Operations Manager > reported in SMR	-
		lined sewage septic tanks	✓								
		sewage disposal to treatment plant		✓							
B. Solid Waste											
b.1 generation of manure, sludge	pig raising, feed wastage, WTF	minimize feed wastage - semi-automated feeding system	✓			quantify (dried) sludge produced	annually	amount of sludge produced	Supervisor	PCO > reported in SMR	(Project cost)
		treatment of manure in WWTF	✓								
b.2 generation of (non-infectious) carcasses, blood	injuries, adverse environmental conditions, etc.	observe sound pig raising practices and biosecurity measures	✓			weigh disposed materials	daily	weight of materials disposed	Supervisor	PCO > reported in SMR	-
		regular inspection and preventive maintenance of equipment regulating pig environment	✓								
		carcass disposal in concrete vault	✓								
		incineration of carcasses and pathological materials			✓						
b.3 generation of general solid wastes	general farm activities	waste segregation	✓			weigh solid wastes disposed of (recyclables and residuals)	every hauling	weight / details on wastes generated, stored, and disposed of	Supervisor	PCO > reported in SMR	(cost of hauling and dumping)
		adequate collection bins, proper storage	✓								
		reuse, recycling / selling of recyclables	✓								
		residuals hauled to the sanitary landfill	✓								
		composting	✓								
C. Hazardous Materials											
c.1 generation of hazardous, toxic wastes	facilities' operation and maintenance	monitors resource usage to avoid expiration of chemicals	✓			quantify each type of hazardous waste produced / stored and disposed of (check hazardous waste manifests)	every hauling and disposal	quantity of each hazardous waste type stored and disposed	Supervisor	PCO > reported in SMR	(cost of disposal through TSD)
		disposal through accredited TSD	✓								
		reusing, recycling (for various construction and maintenance activities)	✓								
c.2 generation of infectious, pathological wastes, carcasses	veterinary activities, infections, outbreaks	disposal in concrete vault	✓								
D. Air Pollution											
d.1 generation of air pollutants	vehicles, stand-by generator sets (fossil fuel combustion)	operates equipent according to manufacturer's instruction	✓			review inspection and maintenance record	quarterly	number and details of machinery issues noted	Supervisor	Owner	(cost of maintenance, including salaries)
		regular inspection and preventive maintenance of equipment	✓								
E. Risk of Environmental Degradation											
e.1 surface water and groundwater quality degradation, disruption of soil properties, contamination	e.1.1 wastewater collection, transport, treatment, disposal	WWTF constructed with durable materials	✓			effluent sampling and testing by an EMB-accredited laboratory	quarterly - more frequently during rainy seasons	effluent quality indicators: BOD, TSS, ammonia, phosphate (must meet standards for Class C effluent)	Supervisor	PCO > reported in SMR	(cost of maintenance, including salaries) 50,000 / yr for effluent testing
		operates WWTF as prescribed	✓								
		regular inspection and preventive maintenance of WWTF	✓								
		raised lagoon walls to prevent ingress of runoff	✓								
		adequate rainwater and wastewater separation	✓								
		adequate groundwater and wastewater separation	✓								
		establish vegetation (filter strips) around lagoons		✓							
		has and implements contingency response plan	✓								
	e.1.2 sludge management, storage, leachate	regular inspection and preventive maintenance of drying bed	✓			review inspection and maintenance record	monthly - more frequent during rainy seasons	number and details of leak / breach incidents	Supervisor	PCO	-
		adequate separation of storage from surface/groundwater	✓								
		establish vegetation (filter strips) around drying bed and storage	✓								
		has and implements contingency response plan	✓								
	e.1.3 pathological wastes, carcass disposal, leachate	disposal in concrete vault	✓			review inspection and maintenance record	monthly - more frequent during rainy season	number and details of leak / breach incidents	Supervisor	PCO	-
		establish vegetation (filter strips) around disposal site	✓								
		has and implements contingency response plan	✓								
	e.1.4 handling, transport, storage, disposal of hazardous and	use materials according to registered use / manufacturer's instruction	✓			review inspection and maintenance record	weekly	number and details of leak / breach incidents	PCO	Owner	(cost of signage cost)

	infectious materials	MSDS available and consulted		✓							(cost for TSD disposal)
		proper and secured storage	✓								
		spill kits available	✓								
		appropriate signage, warnings in place		✓							
		regular inspection of storage, disposal facilities	✓								
		has and implements contingency response plan	✓								
		adequate training on handling hazardous materials		✓							
	e.1.5 natural hazards	raised lagoon walls	✓			review inspection and maintenance record	monthly - more frequently during rainy seasons	details of inspection report	PCO	Owner	(cost of slope protection)
		adequate runoff channels	✓								
		plant / maintain vegetation along / on sloping areas	✓								
e.2 (release of GHGs)	e.2.1 anaerobic digestion, biogas collection and utilization, fugitive biogas	biogas sequestered using biodigester	✓			review inspection and maintenance record	monthly	number and details of leak / breach incidents (odor detection)	Supervisor	Owner	(cost of maintenance, including salaries)
		MRF constructed with durable materials	✓								
		operate MRF as prescribed	✓								
		regular inspection and preventive maintenance of MRF	✓								
		has and implements contingency response plan	✓								
	e.2.2 use of electricity from grid	energy conservation strategies	✓			review billing statement	monthly	kWh consumption	Supervisor	PCO >reported in SMR	-
		uses renewable fuel (biogas from MRF)	✓								
		uses energy-efficient equipment and facilities	✓								
e.3 groundwater depletion	pig raising, general farm activities	water conservation strategies	✓			quantify volume of freshwater consumption	monthly	volume of freshwater consumed	Supervisor	PCO >reported in SMR	(flow meter cost)
		effluent recycling	✓								
		rainwater harvesting		✓							
F. Health and Safety – Anaerobic Digester System											
f.1 explosion, fire hazard	biogas collection, storage, combustion	WWTF-MRF constructed with durable materials	✓			review inspection and maintenance records, incident reports, complaints register	monthly	number and details of explosion, fire incidents	Maintenance	Owner	(signage cost) (cost of fire protection equipment) (cost of maintenance, including salaries)
		operates WWTF-MRF according to design	✓								
		regular monitoring of pressure within the MRF system	✓								
		regular inspection and preventive maintenance of MRF	✓								
		restricts access to MRF		✓							
		prohibits ignition sources near MRF	✓								
		'no smoking' policy / designated smoking area	✓								
		appropriate signage, warnings in place		✓							
		fire protection equipment on site	✓								
		adequate training on biogas safety		✓							
f.2 asphyxiation, poisoning	biogas	appropriate signage, warnings in place		✓		review incident reports	monthly	number and details of asphyxiation, poisoning incidents	Maintenance	Owner	(cost of PPE) (signage cost)
		adequate training on biogas safety		✓							
		pull-plug system for draining and desludging WWTF	✓								
		use of appropriate PPE		✓							
f.3 infection, infestation	wastewater, sludge	appropriate signage, warnings in place		✓		review incident reports review results of health checks	monthly annually	number and details of infection, infestation incidents	Maintenance	Owner	(cost of PPE) (cost of employees' health checks)
		adequate training on handling infectious materials	✓								
		uses appropriate PPE		✓							
G. Health and Safety – General Farm Operations											
g.1 odor - nuisance, discomfort, health issues	g.1.1 pig houses, manure	regular cleaning, disinfection	✓			review complaints register	every two weeks - more frequent during typhoon (windy) season	number and details of odor complaints	Supervisor	Owner	(cost of cleaning materials) (cost of seedlings) (cost of PPE) (cost of maintenance)
		plant / maintain buffer trees / vegetation	✓								
		uses appropriate PPE		✓							
	g.1.2 WTF, effluent, MRF	employs biodigester (traps odor and biogas)	✓								
		adequate retention time of wastewaters in the biodigester	✓								
		regular inspection and preventive maintenance of WWTF-MRF	✓								
		prevent overtopping, spillage	✓								
		plant / maintain buffer trees / vegetation	✓								
		uses appropriate PPE		✓							
	g.1.3 decomposing materials (sludge and organic solids)	sludge pile is well aerated, prevent waterlogging	✓								
		uses appropriate PPE		✓							
	g.1.4 decomposing materials (placental materials and carcasses)	disposal in vault	✓								
		prevent leachate leakage	✓								
		uses of appropriate PPE		✓							
g.2 noise - nuisance, discomfort	g.2.1 pigs	uses appropriate PPE		✓		review complaints register	monthly	number and details of noise complaint	Supervisor	Owner	(cost of PPE) (cost of seedlings)
		adequate spatial buffer from surrounding communities	✓								

		plant / maintain buffer trees / vegetation	✓		✓						
	g.2.2 vehicles, machineries	operates equipment according to manufacturer's instruction	✓								(cost of maintenance)
		limits operation during day time	✓								
		regular inspection and preventive maintenance of machineries	✓								
		noise reduction equipment	✓								
g.3 dust - nuisance, discomfort, health issues	g.2.1 pig houses, feed handling	uses appropriate PPE		✓		review complaints register	quarterly - more frequent during typhoon (windy) season	number and details of dust complaints	Supervisor	Owner	-
	g.2.2 composting areas, dried compost handling	limit dust-generating activities during day time, low wind movement	✓								
		uses of appropriate PPE		✓							
	g.2.3 vehicles, machineries	limits vehiclular speed on unsealed roads	✓								
		limit dust-generating activities during day time	✓								
		uses of appropriate PPE		✓							
g.4 pest and vermin proliferation / infestation - nuisance, health issues	decomposing materials, sources of odors	observes good houskeeping practices	✓			review inspection results records and complaints register	monthly - more frequent during rainy season	number and details of incidents, complaints	Supervisor	Owner	(cost of pest control)
		odor control measures	✓								
		pest, vermin control measures	✓								
g.5 health hazards, (risk of) contracting infectious diseases, sustaining injuries, livestock outbreak	handling, transport, storage of hazardous and infectious materials, movement of carrier pests and vermin, handling of ill pigs	adequate training on handling of hazardous, infectious materials		✓		review incident reports, inspection records and complaints register, results of employees' regular health checks	monthly	number and details of illness, injury incidents, complaints	Supervisor	Owner	(cost of PPE) (cost of supplies for biosecurity)
		uses appropriate equipment (including PPE) for handling, storage of hazardous and infectious materials		✓							
		enforce, observe biosecurity, health and safety protocols	✓								
		pest and vermin control measures	✓								
g.6 drowning hazard	open ponds, lagoons, tanks	restricted access to WWTF		✓		review incident reports	monthly	number and details of drowning incidents	Supervisor	Owner	(cost of signage)
		appropriate signage and warnings		✓							

BOD Biological Oxygen Demand
MSDS Materials Safety Data Sheet
PCO Pollution Control Officer
PPE Personal Protective Equipment
SMR Self-Monitoring Report
TSD Treatment, Storage, Disposal
TSMD Technical Support and Monitoring Department
TSS Total Suspended Solids

^ Indicative cost

2.2.3 **Contingency Response**

The following is an overview of the Farm's current preparation and plan of action in response to certain emergency incidents (see also Appendix B):

a. Fire
– Administration building and employees' dwellings are equipped with fire extinguishers whereas pig sheds have sprinklers and taps from which water for putting out fires can be sourced.

b. Earthquake
- The open grounds in front of the Farm are designated as evacuation area for when an earthquake occurs.

c. Outbreak
- The Farm's animal specialist (provided by the integrator) is immediately notified to assess the situation and give instructions for the workers to carry out.

d. Power outage
- A standby diesel-fueled generator is able to supply the Farm's electricity needs, in addition to the biogas genset.

e. Health emergencies
- A first aid kit is available at the site for minor health issues. Farm personnel have access to vehicles which can be used for transporting cases that may be needing more advanced medical care.

Most emergency services can be accessed in Malaybalay City proper after about a 10 to 15-min drive from the Farm.

In the event that any of the listed emergencies occur, farm personnel are to report to the Farm Administrator and Supervisor who are in charge of alerting the owner and emergency services near the property.

2.2.4 **Occupational Health and Safety**

CPA 35's risk management plan for general occupational health and safety issues associated with work in the Farm is presented in Appendix C. Health complaints and accidents will be recorded in a register and will serve as indicators of the plans effectiveness, together with results of workers' annual health check-ups.

2.3 **Monitoring, Reporting and Auditing**

The Proponent will perform the monitoring plan in Table 3 and conduct regular inspection of its facilities not only for internal purposes but also to satisfy the requirements of the Environmental Management Bureau (EMB) for periodic self-monitoring reports (SMR) and compliance monitoring reports (CMR). Furthermore, assessments will also be initiated during or immediately after incidents that may have compromised the integrity of the Farm's facilities, especially of the MRF and WTF, and caused release of pollutants in the environment. A registry of such incidents and other environmental emergencies and accidents will be maintained in the Farm and its details reported in the SMR.

SMRs and CMRs will contain the results of audits on the Farm's environmental performance in terms of resource utilization, waste management, regulatory compliance, and fulfillment of environmental commitments among others. Copies of these documents will be tendered to EMB quarterly and semi-annually, respectively, as well as to LBP-EPMD (Environmental Program and Management Department) for its reference and review.

The Farm Supervisor and PCO have been tasked to ensure that the Farm is compliant with pertinent environmental regulations, including those listed in Table 3, and is performing its environmental commitments, including the implementation of this ESMP

During the implementation of the CDM Program, LBP-EPMD will conduct monitoring activities in the farm at least twice a year to help the Proponent execute, identify gaps in, and improve and update this management plan.

3 SOCIAL DUE DILIGENCE

3.1 Consultation and Participation

Stakeholders of the Project were identified and invited by the Proponent, together with LBP-EPMD, through letters and notices to the consultative meeting held on February 7, 2016 (2 PM to 4 PM) in Malaybalay, Bukidnon. The meeting was attended by a total of 30 individuals from various institutions, including local officials and residents of communities near the project site.

All relevant information, especially those that pertain to the Project's environmental and social impacts, was communicated during the consultation. The issues and queries raised by the stakeholders were all satisfactorily addressed by the Proponent and other presenters.

3.2 Grievance Redress Mechanism

The Farm's Production Supervisor is hereby designated as the main contact person for grievances, feedbacks, and queries related to the Project. He is to ensure that the details of complaints and the actions made to address the same will be recorded completely and truthfully in a register. Such information shall be part of the regular monitoring report for the Project and will be made available to relevant stakeholders.

The Proponent will make reasonable effort to settle any concern at the Project level. Should its attempts be unsuccessful, issues will be raised to the following third party institutions for arbitration and possible resolution:

- Office of the Barangay Chairman
  Complaints shall be entertained in the *barangay* where the farms are situated. The *barangay* office concerned will facilitate the negotiation process and LBP-EPMD will ensure that the complainant is properly represented.

- Municipal Office
  Should no agreement be reached at the *barangay* level, the matter will be elevated to a municipal government office. Depending on the nature of the complaint, grievances may be addressed to the Municipal Health Office, Agriculturist Office, Environment and Natural Resources Office, or other relevant municipal agencies.

- LBP
  LBP through EPMD will take part on the resolution process only after the aggravated party has gone through the previous levels and finds the decisions rendered there unacceptable. EPMD will coordinate with the Proponent to ensure that issues regarding the latter's project are resolved to the best interest of the complainant.

To further ensure the Proponent's accountability, contact details of the Farm's management and LPB-EPMD shall be provided to stakeholders during consultations and through postings at public notice boards. For the Project of CPA 35, the following individuals will serve as grievance administrators:

- Prudencio E. Calado III
  Head/Assistant Vice President, LBP-EPMD

Telephone No.: (632) 405-7339
Fax No.: (632) 528-8484

3.3 Information Disclosure

This ESMP and other relevant information regarding the Project will be published in LANDBANKS's website where it can be readily accessed by the public. Printed copies of this document will be submitted to EMB Region 10 and will also be available in LANDBANK's library (1598 M.H. Del Pilar cor Dr. J. Quintos St., Malate, Manila, Philippines), and in World Bank's InfoShop.

3.4 Equal Opportunity

CPA 35 Farm is an equal opportunity employer, not regarding gender, age, disability, and ethnicity in evaluating and hiring potential employees. Presently, the Farm's workforce is consisted of 11 males and 3 females with ages ranging from 20 to 40 years old. Most of the male workers take on manual, physically demanding work such as animal handling and facility maintenance. The females are tasked to do administrative and kitchen duties.

3.5 Resettlement

The Project is located inside the premises of CPA 35 Farm, a private property. No individual was displaced for nor were there any indigenous peoples affected by the establishment of the Farm and the Project.

3.6 Others

Employees of CPA 35 Farm receive standard basic salary at the minimum, 13th month pay, and other regular statutory benefits, in addition to free meals and lodging at the Farm.

4 ESMP REVIEW AND UPDATING

This ESMP shall be reviewed annually and will be updated subject to the results of the semiannual monitoring activities conducted by the Proponent and LBP-EPMD. Reviews may be done more frequently or earlier than schedule, especially after events resulting in significant adverse effect to the environment.

5 INSTITUTIONAL ARRANGEMENTS

5.1 The Proponent

CPA 35 will be responsible in all the aspects of the Project, including the implementation of this ESMP. It will shoulder all costs associated with the construction and operation of the Project, internal monitoring activities, and meeting various statutory requirements. Specifically, it shall / it shall cause the accomplishment of the following:

- exercise environmental and social due diligence in implementing the Project
- incorporate sound practices in environmental, health, and safety management
- comply with relevant national and local laws and satisfy regulatory obligations
- perform diligent environmental and system monitoring
- prepare and submit on schedule accurate monitoring reports to EMB and LBP
- cooperate with the LBP and other regulatory agencies by providing assistance and correct and relevant information regarding the Project and its environmental performance for reference, review, and monitoring purposes
- promote transparency by maintaining open lines of communication with project stakeholders and giving them access to relevant information
- initiate resolution of conflicts that may arise as a result of the Project's operation

The Proponent, in close coordination with LBP, shall implement the Project based on LBP's ESSF and on the agreed activities and timelines stipulated in the memorandum of agreement (MOA) and subproject agreement (SPA) between the said entities.

5.2 LANDBANK

LBP shall serve as the financial and technical intermediary for the CDM Program of Activity (PoA) under which the Project of CPA 35 is being implemented. It shall provide the Proponent carbon and investment finance assistance for the installation of an anaerobic wastewater treatment facility equipped with a biodigester and methane-fueled power generator. Moreover, it shall act as the entity in charge of project validation and verification activities, and of collation of relevant information and monitoring data for the undertakings mentioned. Specifically, LANDBANK, through EPMD, shall:

- make available financing facilities to the Proponent, subject to existing lending policies of LBP
- coordinate and facilitate communications and transactions between the Proponent and World Bank or other Carbon Buyers, Designated Operational Entity, and when necessary, with other project partners
- administer the agreements (MOA, SPA) forged between LBP and the Proponent
- provide technical support and relevant trainings to farm owners and personnel in partnership with other institutions
- ensure compliance of the Project and its proponent with the rules governing PoAs and with its commitments in the MOA and SPA
- ensure compliance of the Project and its proponent with relevant standards and regulations and environmental commitments by conducting onsite monitoring and evaluation and desk reviews
- provide assistance to the Proponent in complying with statutory requirements for the Project

- ensure the Project's sustainability by monitoring the long-term implementation of the safeguards specified in this ESMP and its environmental performance in general
- gather, collate, and review pertinent information and documents (including safeguard instruments, reports, and permits and clearances) concerning the Project
- participate in conflict resolution initiated by the Proponent
- prepare and submit monitoring reports to World Bank regularly
- satisfy its obligations under the Emissions Reduction Purchase Agreement between LBP and World Bank

LBP shall assist the Proponent in its implementation of the Project based on LBP's Safeguards Framework and on the agreed activities and timelines stipulated in the MOA and SPA.

5.3 Department of Environment and Natural Resources

The Department of Environment and Natural Resources (DENR) is the primary government institution mandated to manage and protect the Philippines' environment and natural resources. It is also the Designated National Authority (DNA) of the CDM Program in the Philippines. As DNA, its main role is to review and endorse PoAs to the United Nations Framework Convention on Climate Change.

5.3.1 Environmental Management Bureau

Through the EMB, DENR sanctions and regulates the activities of the Project by means of various legal instruments. EMB also leads (whether or not as part of a Multi-partite Monitoring Team) the periodic monitoring of the Project's compliance and impacts, including the fulfillment of the commitments stated in this ESMP. Prior to construction, EMB was the agency tasked to review and evaluate the environmental soundness of the Project and authorize its establishment through the issuance of an Environmental Compliance Certificate.

5.4 Municipal Government

The city government of Malatbalay licenses the operation of CPA 35 through the issuance of a business permit. This permit is only given to businesses after satisfying its prerequisites – building and occupancy permits, zoning clearance, sanitary permit, and fire clearance, among others.

Agencies and offices of Malaybalay City government will also, if necessary, lead / facilitate the resolution of complaints arising from the farm and the Project's operations.

5.5 World Bank

The World Bank is the main Carbon Buyer of the Project, but will also serve as an advisor to LPB in carrying out the latter's responsibilities as the coordinating and managing entity for CDM projects. The Bank will conduct regular monitoring, audits, and appraisals on the Project's safeguards performance against its

established policies, as well as provide technical guidance to LBP and to the Proponent.

6 SUB-PROJECT ACCOUNTABILITY

In line with Section 3.02 on *Sub-Project Development and Operation by the Sub-Project Entity*, Item (q) of the Sub-Project Purchase Agreement (SPA) signed by the Farm Management, the Sub-Project Entity (Farm Management) agrees and undertakes to:

> (q) implement and operate the Sub-Project in compliance with the World bank Operational Policies, including without limitation and as applicable, the Environmental Management Plan, Resettlement Plan, Indigenous Peoples Plan, and any other requirement resulting from the application of the World Bank Operational Policies.

Having signed the SPA, the Farm Management is accountable to comply with the commitments stated in this document.

LEGEND:

- [illegible]
- [illegible]
- [illegible]
- [illegible]
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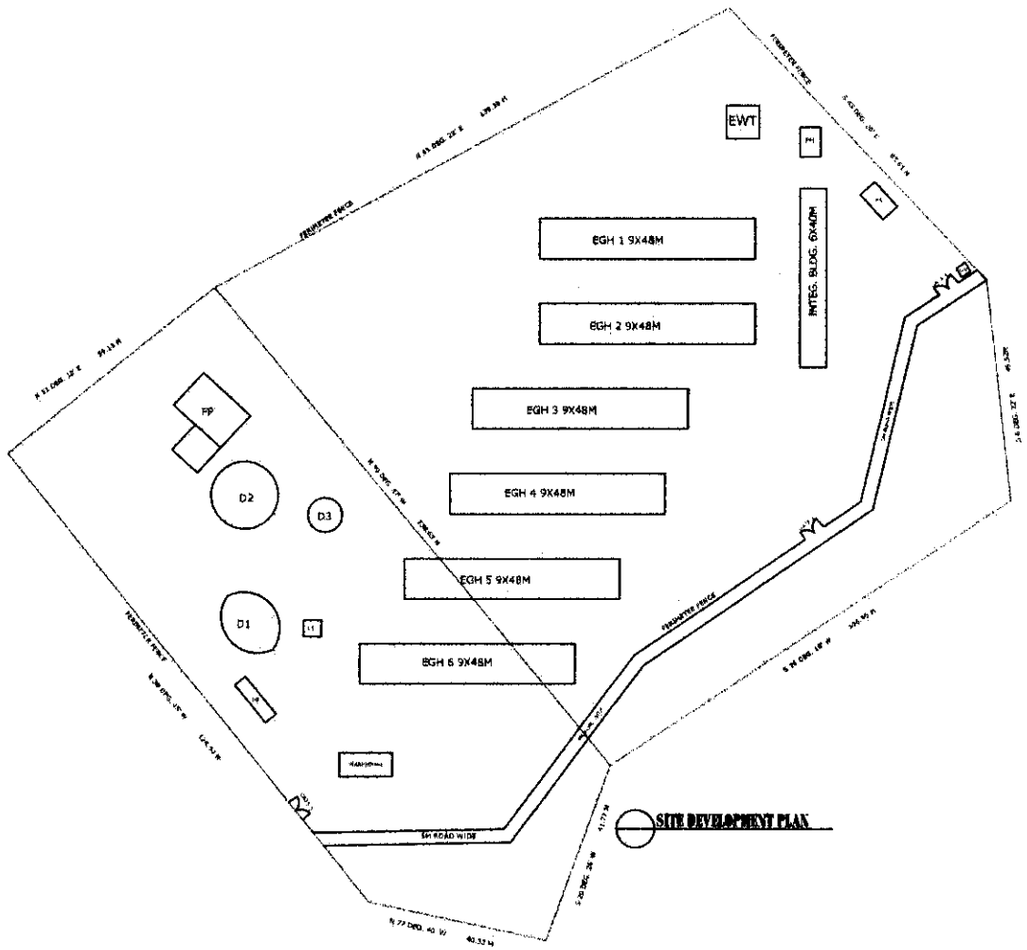
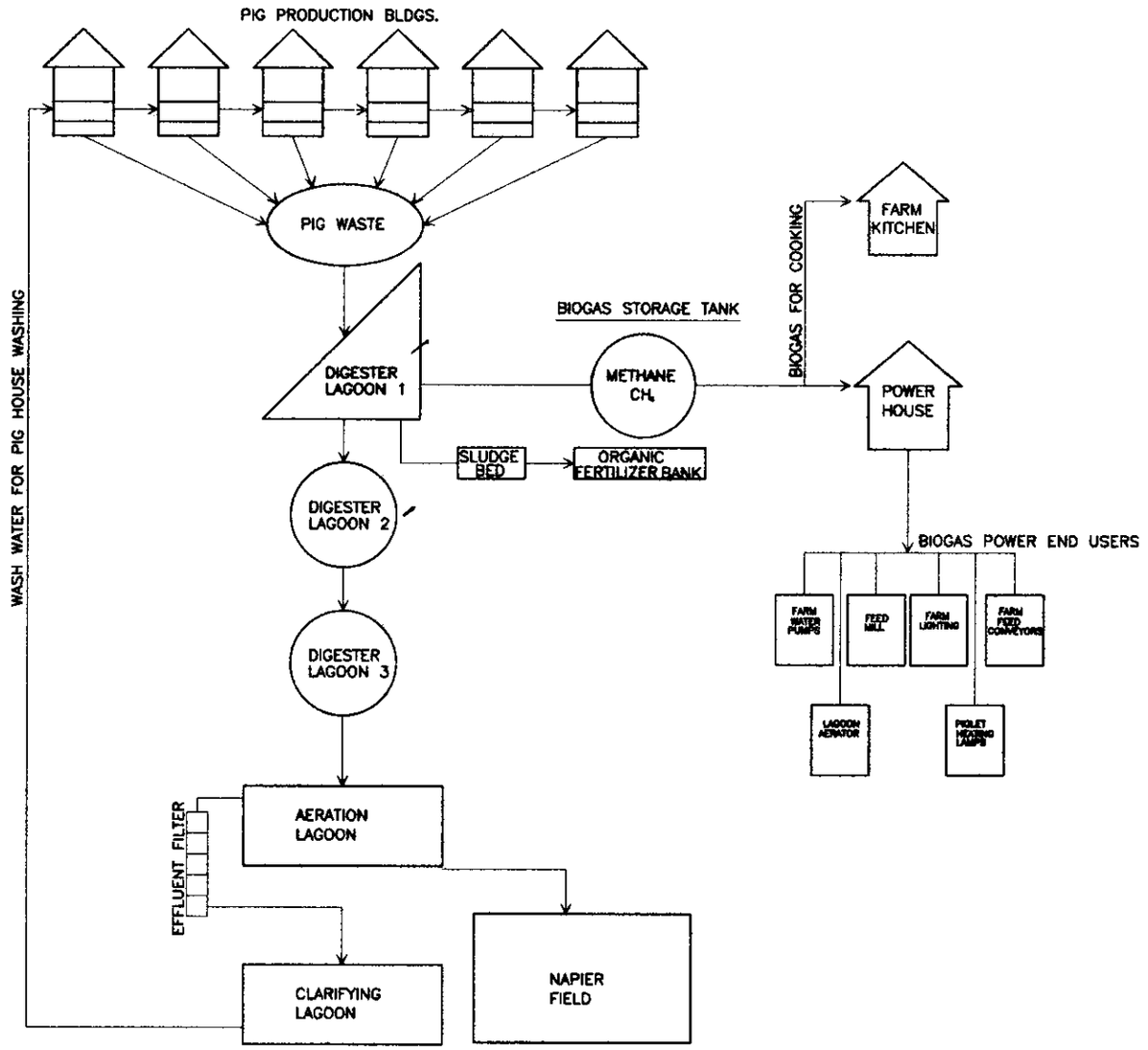


PADERNAL BUILDERS ENGINEERS*ARCHITECTS*DESIGNER*BUILDERS Sayre Highway, Caslang, Malaybalay City Contact nos. 09177250820/088 3140748 E-mail @ padernalbuilders@yahoo.com	Prepared by: ANGELICA P. PADERNAL Civil Engineer	[illegible]	SEAL	PROJECT TITLE: [illegible] FARM SITE DEVELOPMENT PLAN LOCATION: P3 BRGY. PATPAT, MALAYBALAY CITY	Approved by: HARITONI UNABIA-ALBERE Owner	SHEET CONTENTS	SHEET NO.



Shelter Concepts

LIVESTOCK SHELTER CONCEPTS

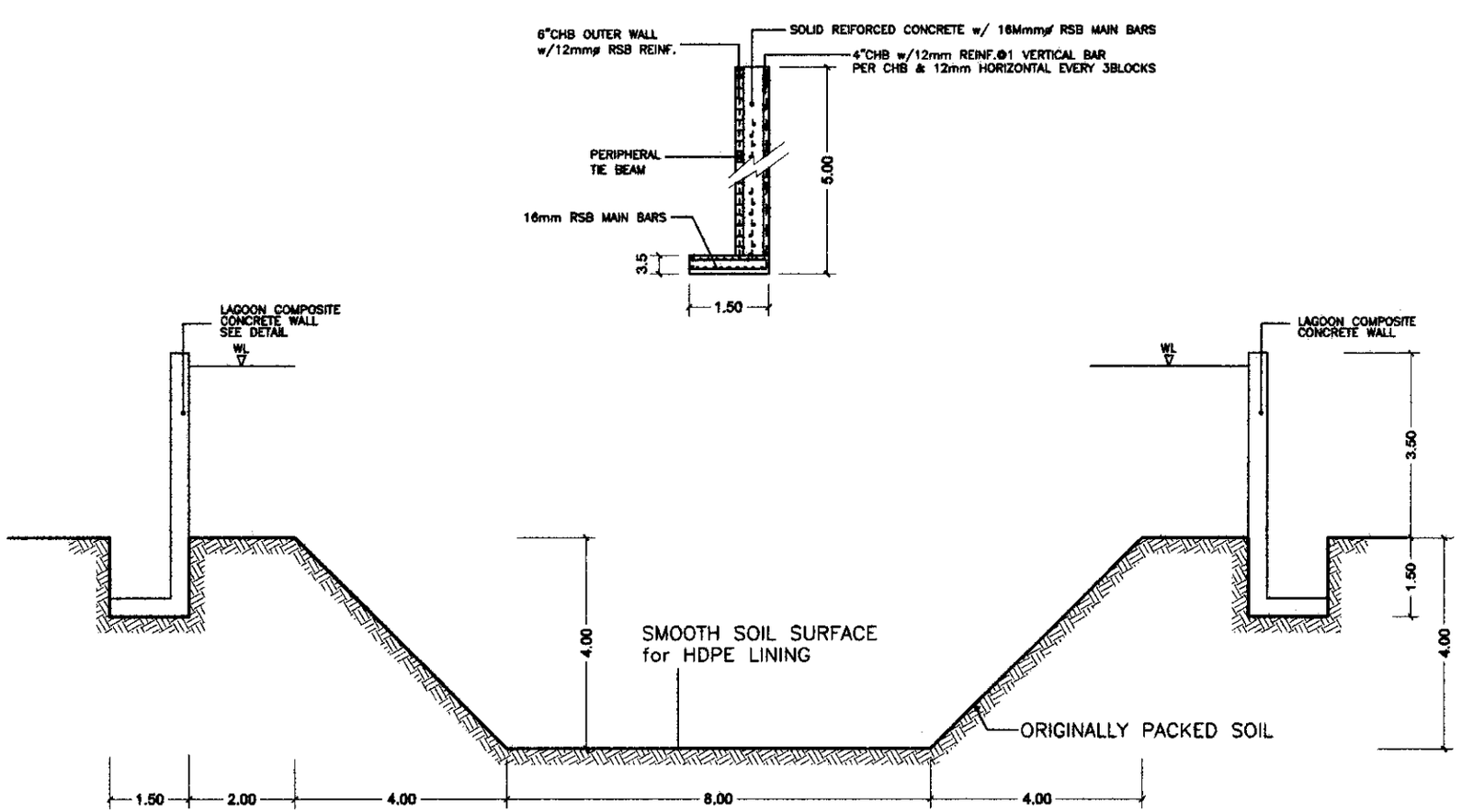
PUROK-3, BRGY. PALPAT, MALAYBALAY CITY

SCHEMATIC DIAGRAM

BMH FARM

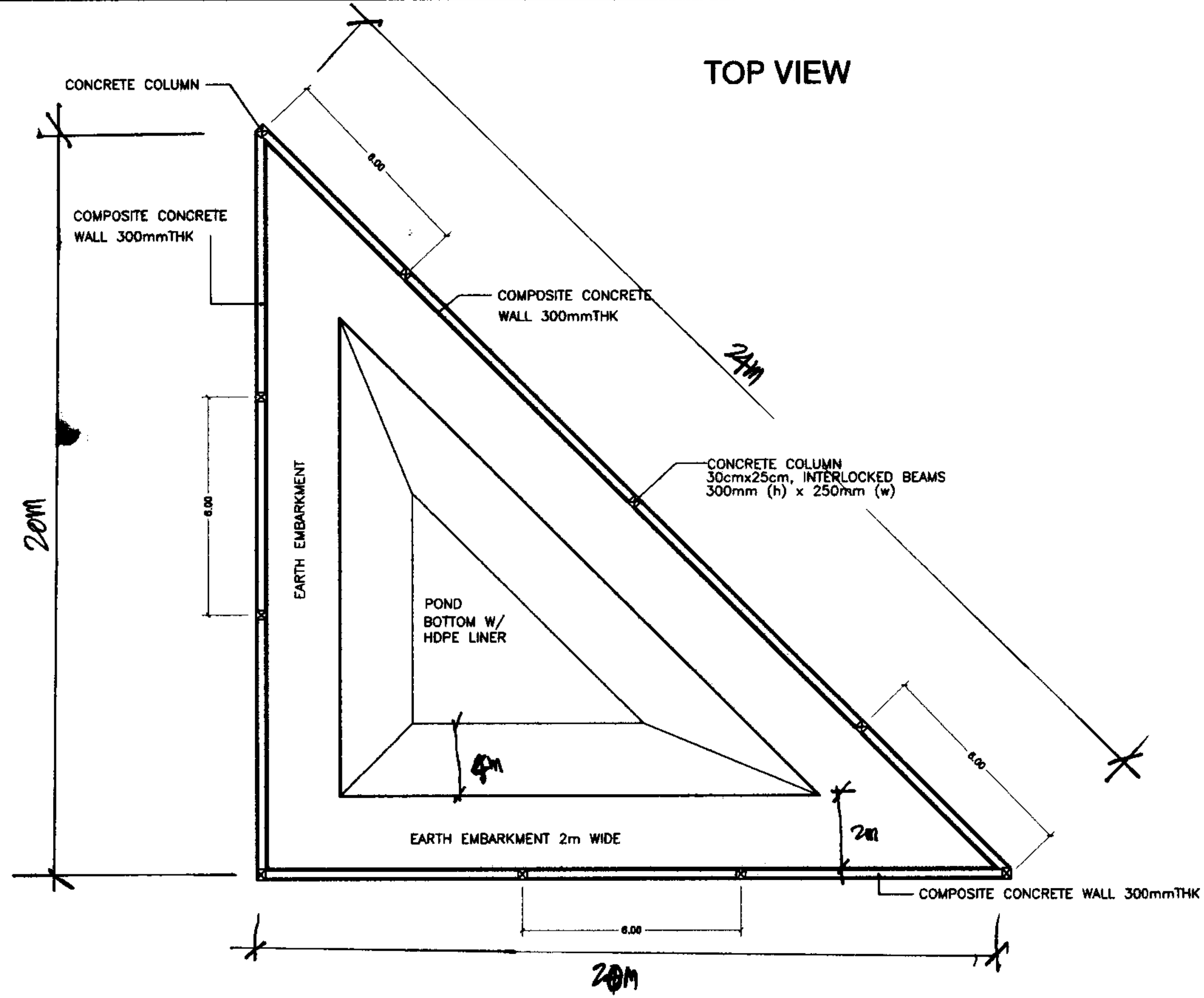
D-7

DETAIL OF LAGOON COMPOSITE CONCRETE WALL



DIGESTER SECTION

Shelter Livestock Concepts — LIVESTOCK SHELTER CONCEPTS, QUEZON CITY, 0933-8814011 0917-6285780	THIS DRAWING AS AN INSTRUMENT OF SERVICE IS THE PROPERTY OF THE ARCHITECT AND MAY NOT BE USED OR REPRODUCED WITHOUT HIS CONSENT. REPUBLIC ACT 544	ARCH. GENEVIEVE M. CARDENAS, Architect	PROJECT/ADDRESS: PUROK-3, BRGY. PALPAT, MALAYBALAY CITY	REMARKS	SHEET CONTENTS: DIGESTER LAGOON SECTION	OWNER: BMH FARM	SHEET NO.: D-1



Shelter Livestock CONCEPTS | LIVESTOCK SHELTER CONCEPTS

REPUBLIC ACT

PUROK-3, BRGY. PALPAT, MALAYBALAY CITY

DIGESTER LAGOON
TOP VIEW

BMH FARM

D-2

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City
Cellphone No. [illegible]

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (DIGESTER 1)**

ITEM NO.	WORK DESCRIPTION		QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**					
	2x2x8 lumber		80	pcs	75	6,000.00
	CWN 4		5	kgs	80	400.00
	CWN 1		2	kgs	80	160.00
					Material Cost:	6,560.00
					Labor Cost:	1,968.00
					Sub-total:	**8,528.00**
2.0	**EARTHWORKS**					
2.1	Excavation for POND		384	cu.m.	120	**46,080.00**
2.2	Excavation for PERIMETER wall footing		153	cu.m.	120	**18,360.00**
2.3	Backfill/Embankment		100	cu.m.	100	**10,000.00**
3.0	**CONCRETE WORKS**					
3.1	COLUMN FOOTING	10 units	7.875	cu.m.		
	Cement		71	bags	250	17,750.00
	Sand		6	cu.m	900	5,400.00
	Gravel		15	cu.m	900	13,500.00
	16mm diam. RSB		40	lgths	220	8,800.00
	Tie wire # 16		2	kgs	80	160.00
					Material Cost:	45,610.00
					Labor Cost:	13,683.00
					Sub-total:	**59,293.00**
3.2	COLUMN	10 units	4.375	cu.m.		
	Cement		75	bags	250	18,750.00
	Sand		8	cu.m.	900	7,200.00
	Gravel		16	cu.m.	900	14,400.00
	10mm diam. RSB		95	lgths	125	11,875.00
	16mm diam. RSB		80	lgths	320	25,600.00
	Tie wire # 16		20	kgs	80	1,600.00
	2X2X8 lumber		200	pcs	75	15,000.00
	1/4 opw		5	shts	350	1,750.00
	CWN # 4		10	kgs	65	650.00
	CWN # 2 1/2		10	kgs	65	650.00
	CWN # 1		1	kgs	65	65.00
					Material Cost:	97,540.00
					Labor Cost:	29,262.00
					Sub-total:	**126,802.00**
3.3	WALL FOOTING & REINF. CONC. WALL		62	cu.m.		

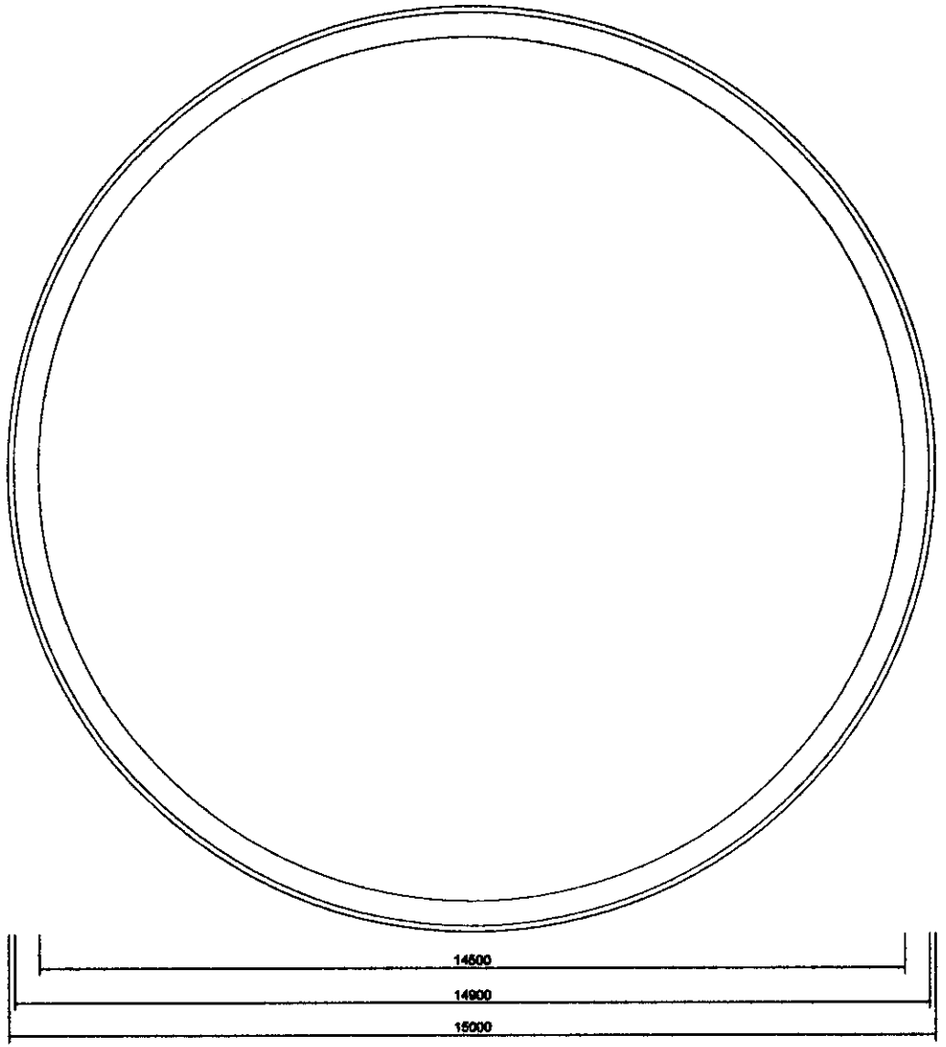
	Cement	580	bags	250	145,000.00
	Sand	35	cu.m.	900	31,500.00
	Gravel	70	cu.m.	900	63,000.00
	16mm diam.x 6m RSB	630	lgths	320	201,600.00
	Tie wire # 16	150	kgs	80	12,000.00
				Material Cost:	453,100.00
				Labor Cost:	135,930.00
				Sub-total:	**589,030.00**
3.4	LINTEL BEAMS	5.44	cu.m.		
	Cement	50	bags	250	12,500.00
	Sand	3	cu.m.	900	2,700.00
	Gravel	6	cu.m.	900	5,400.00
	10mm diam. RSB	400	lgths	125	50,000.00
	Tie wire # 16	50	kgs	80	4,000.00
	2X2X8 lumber	100	pcs	75	7,500.00
	1/4 opw	10	shts	350	3,500.00
	CWN # 4	10	kgs	65	650.00
	CWN # 2 1/2	10	kgs	65	650.00
	CWN # 1	1	kgs	65	65.00
				Material Cost:	74,600.00
				Labor Cost:	26,110.00
				Sub-total:	**100,710.00**
4.0	**MASONRY WORKS**				
4.1	**CHB LAYING OUTER AND INNER WALLS**	680	sq.m		
	4CHB	8500	pcs	10	85,000.00
	Cement	380	bags	250	95,000.00
	Sand	38	cu.m	900	34,200.00
	10mm diam. RSB	580	lgths	125	72,500.00
	Tie wire # 16	30	kgs	80	2,400.00
				Material Cost:	204,100.00
				Labor Cost:	61,230.00
				Sub-total:	**265,330.00**
4.2	**PLASTERING/FINISHING**	680	sq.m.		
	Cement	220	bags	250	55,000.00
	Sand	15	cu.m	900	13,500.00
				Material Cost:	68,500.00
				Labor Cost:	50,000.00
				Sub-total:	**118,500.00**
				TOTAL MATERIAL & LABOR COST:	1,342,633.00
				OVERHEAD, CONTINGENCIES & MISC.	268,526.60
				TOTAL ESTIMATED COST:	**1,611,159.60**

PREPARED BY:

RONILO G. PADERNAL
Project Manager

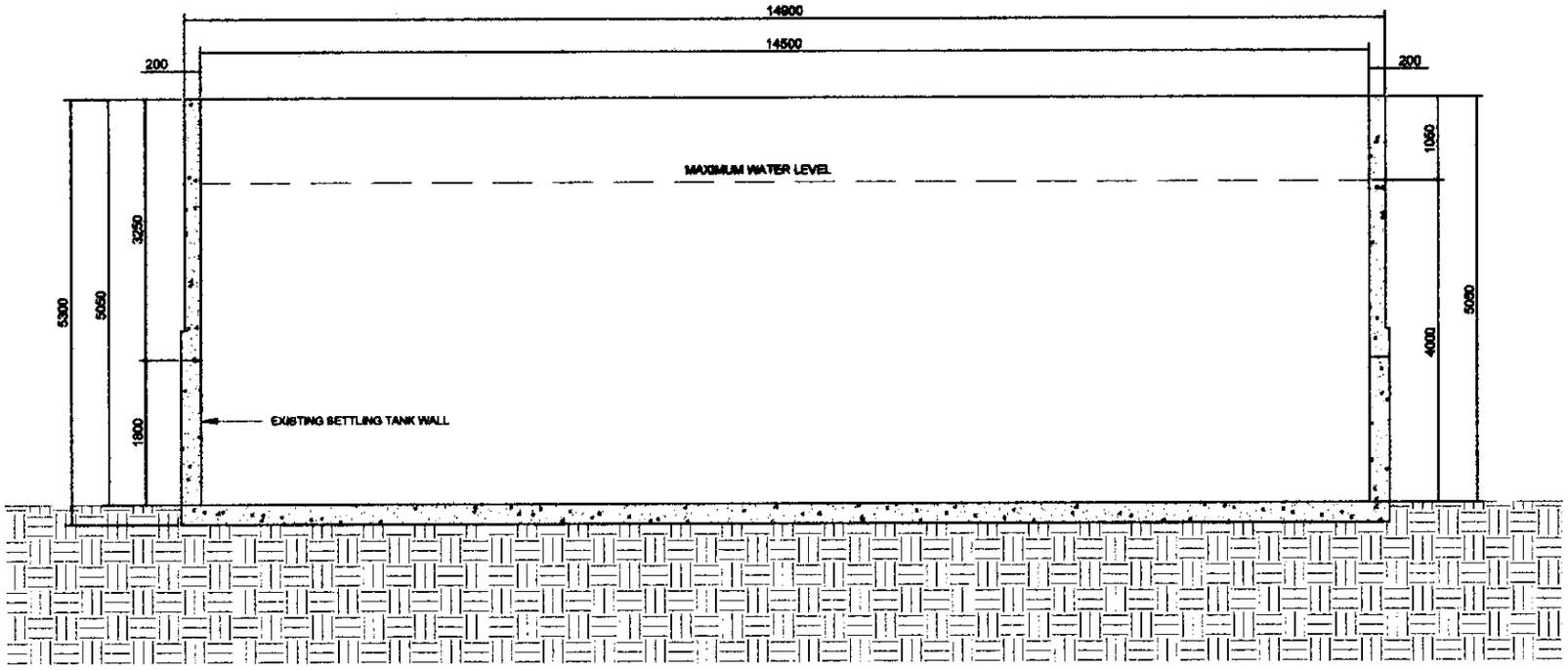
Approved by:

MARITONI C. UNABIA-ALEGRE
Owner



UPGRADED DIGESTER 2
TOP VIEW PLAN
SCALE 1:80 m

PADERNAL BUILDERS ENGINEERS*ARCHITECTS*DESIGNER*BUILDERS Sayre Highway, Coalsong, Malaybalay City Contact nos. 09177250820/09177077009 E-mail @ ronilopadernal@yahoo.com	Prepared by: ANGELICA P. PADERNAL CIVIL ENGINEER	PRC NO. 72710 PTR NO. 5425047A DATE ISS: 1/3/17 PLACE ISS: MALAYBALAY T.I.N. 191-204-987	SEAL	PROJECT TITLE: 60kW RENEWABLE ORGANICS MANAGEMENT SYSTEM LOCATION: PATPAT, MALAYBALAY CITY, BUKIDNON	Approved by: BHH FARM Owner	SHEET CONTENTS UPGRADED DIGESTER 2: TOP VIEW PLAN	SHEET NO.



UPGRADED DIGESTER 2
CROSS SECTION
SCALE 1:60 m

PADERNAL BUILDERS ENGINEERS*ARCHITECTS*DESIGNER*BUILDERS Soyre Highway, Cosisang, Malaybalay City Contact nos. 09177250820/09177077009 E-mail @ ronilopadernal@yahoo.com	Prepared by: ANGELICA P. PADERNAL CIVIL ENGINEER	PRC NO. 72710 PTR NO. 5428047A DATE ISS: 1/3/17 PLACE ISS: MALAYBALAY T.I.N. 191-204-987	SEAL	PROJECT TITLE: 60kW RENEWABLE ORGANICS MANAGEMENT SYSTEM LOCATION: PATPAT, MALAYBALAY CITY, BUKIDNON	Approved by: BMH FARM Owner	SHEET CONTENTS UPGRADED DIGESTER 2: CROSS SECTION	SHEET NO.

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Contact Nos. 0917-72[illegible]0620 / 088 [illegible]

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (DIGESTER 2 RETRO)**

ITEM NO.		WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**DEMOLITION/CHIPPING OF EXISTING CONCRETE WALLS**		1	lot		**15,000.00**
2.0	**CONCRETE WORKS**					
	2.1	COLUMN extension 20 units	3.3	cu.m.		
		Cement	30	bags	250	7,500.00
		Sand	2	cu.m.	900	1,800.00
		Gravel	4	cu.m.	900	3,600.00
		10mm diam. RSB	75	lgths	125	9,375.00
		16mm diam. RSB	80	lgths	320	25,600.00
		Tie wire # 16	20	kgs	80	1,600.00
		2X2X8 lumber	200	pcs	75	15,000.00
		1/4 opw	15	shts	350	5,250.00
		CWN # 4	20	kgs	65	1,300.00
		CWN # 2 1/2	10	kgs	65	650.00
		CWN # 1	1	kgs	65	65.00
					Material Cost:	71,740.00
					Labor Cost:	21,522.00
					Sub-total:	**93,262.00**
	2.2	LINTEL BEAMS	9	cu.m.		
		Cement	81	bags	250	20,250.00
		Sand	5	cu.m.	900	4,500.00
		Gravel	10	cu.m.	900	9,000.00
		10mm diam. RSB	150	lgths	125	18,750.00
		16mm diam. RSB	130	lgths	320	41,600.00
		Tie wire # 16	80	kgs	80	6,400.00
		2X2X8 lumber	150	pcs	75	11,250.00
		1/4 opw	10	shts	350	3,500.00
		CWN # 4	10	kgs	65	650.00
		CWN # 2 1/2	10	kgs	65	650.00
		CWN # 1	1	kgs	65	65.00
					Material Cost:	100,500.00
					Labor Cost:	35,175.00

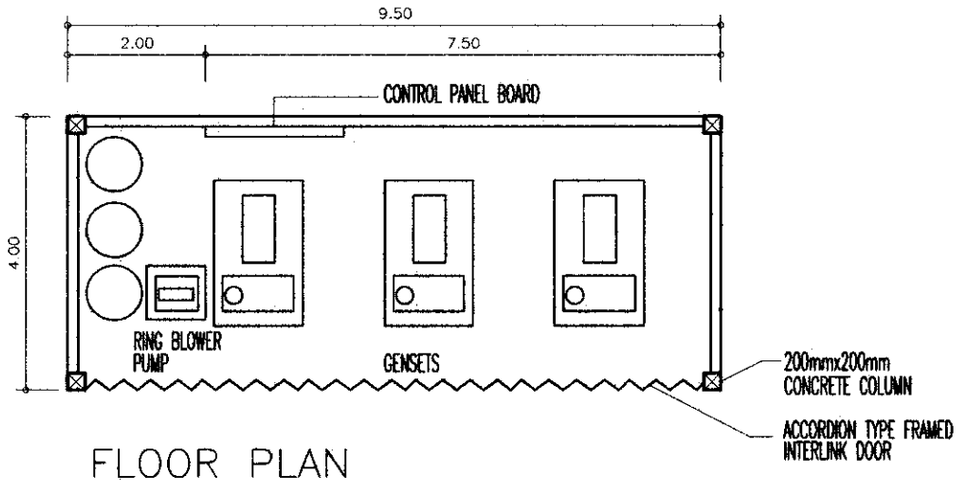
				Sub-total:	**135,675.00**
3.0	**MASONRY WORKS**				
3.1	**CHB LAYING OUTER AND INNER WALLS**	137.5	sq.m		
	6CHB	1800	pcs	18	32,400.00
	Cement	120	bags	250	30,000.00
	Sand	12	cu.m	900	10,800.00
	12mm diam. RSB	120	lgths	220	26,400.00
	Tie wire # 16	30	kgs	80	2,400.00
				Material Cost:	69,600.00
				Labor Cost:	20,880.00
				Sub-total:	**90,480.00**
3.2	**PLASTERING/FINISHING**	300	sq.m.		
	Cement	120	bags	250	30,000.00
	Sand	8	cu.m	900	7,200.00
	sahara	120	bags	50	6,000.00
	power mix	20	gals	750	15,000.00
	Paint brush # 4	4	pcs	80	320.00
				Material Cost:	58,520.00
				Labor Cost:	25,000.00
				Sub-total:	**83,520.00**
				TOTAL MATERIALS & LABOR COST:	417,937.00
				OVERHEAD, CONTINGIES & MISCELLANEOUS:	83,587.40
				TOTAL ESTIMATED COST:	**501,524.40**

PREPARED BY:

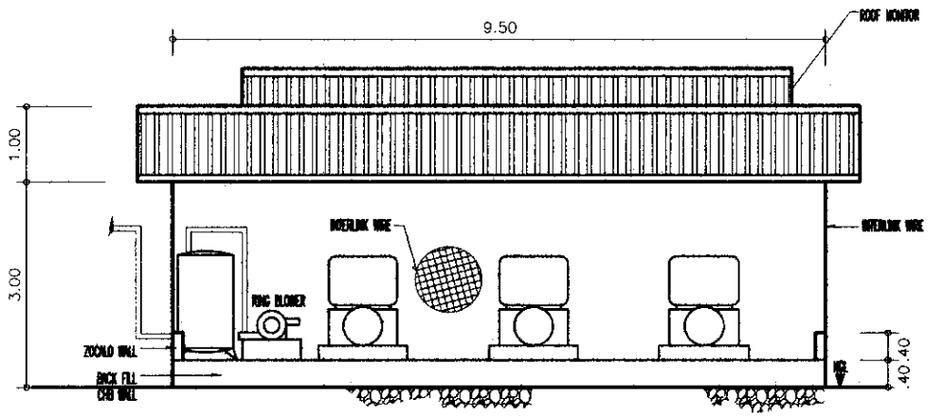
RONILO G. PADERNAL
Project Manager

Approved by:

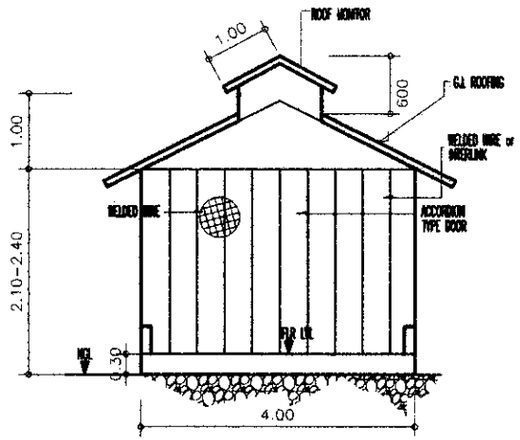
MARITONI C. UNABIA-ALEGRE
Owner



FLOOR PLAN



LONGITUDINAL SECTION



CROSS SECTION

Shelter Livestock CONCEPTS LIVESTOCK SHELTER CONCEPTS NOVALICHES QUEZON CITY 0932-8814011 8817-5285780	THIS DRAWING AS AN INSTRUMENT OF SERVICE IS THE PROPERTY OF THE ARCHITECT AND MAY NOT BE USED OR REPRODUCED WITHOUT HIS CONSENT. REPUBLIC ACT 9485	ARCHITECT PRC NO : DATE ISSUED : PLACE ISSUED :	PROJECT/ADDRESS PUROK-3, BRGY. PALPAT, MALAYBALAY CITY	REVISIONS	TITLE OF DRAWING POWER HOUSE FLOOR PLAN & DETAILS	OWNER BMH FARM	SHEET NO. D-5

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (GENSET HOUSE)**

ITEM NO.	WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**				
	2x2x8 lumber	50	pcs	75	3,750.00
	CWN 4	2	kgs	80	160.00
	CWN 1	1	kgs	80	80.00
				Material Cost:	3,990.00
				Labor Cost:	1,197.00
				Sub-total:	**5,187.00**
2.0	**EARTHWORKS**				
2.1	Excavation for column footing	1.78	cu.m.	250	**445.00**
3.0	**CONCRETE WORKS**				
3.1	COLUMN FOOTING 6units	0.4	cu.m.		
	Cement	5	bags	250	1,250.00
	Sand	0.5	cu.m	900	450.00
	Gravel	1.5	cu.m	900	1,350.00
	10mm diam. RSB	36	lgths	125	4,500.00
	16mm diam. RSB	35	lgths	220	7,700.00
	Tie wire # 16	5	kgs	80	400.00
				Material Cost:	15,650.00
				Labor Cost:	4,695.00
				Sub-total:	**20,345.00**
3.2	COLUMN 6units	1.2	cu.m.		
	Cement	15	bags	250	3,750.00
	Sand	1	cu.m.	900	900.00
	Gravel	2	cu.m.	900	1,800.00
	10mm diam. RSB	95	lgths	125	11,875.00
	16mm diam. RSB	80	lgths	320	25,600.00
	Tie wire # 16	20	kgs	80	1,600.00
	2X2X8 lumber	100	pcs	75	7,500.00
	1/4 opw	6	shts	350	2,100.00
	CWN # 4	10	kgs	65	650.00
	CWN # 2 1/2	5	kgs	65	325.00
	CWN # 1	1	kgs	65	65.00
				Material Cost:	56,165.00
				Labor Cost:	16,849.50
				Sub-total:	**73,014.50**
3.3	WALL FOOTING	1.05	cu.m.		
	Cement	12	bags	250	3,000.00
	Sand	0.5	cu.m.	900	450.00
	Gravel	2	cu.m.	900	1,800.00
	10mm diam.x 6m RSB	10	lgths	125	1,250.00
	Tie wire # 16	2	kgs	80	160.00
				Material Cost:	6,660.00
				Labor Cost:	1,998.00
				Sub-total:	**8,658.00**
3.4	ROOF BEAMS	1.62	cu.m.		
	Cement	20	bags	250	5,000.00
	Sand	2	cu.m.	900	1,800.00
	Gravel	4	cu.m.	900	3,600.00
	10mm diam. RSB	25	lgths	125	3,125.00
	16mm diam. RSB	25	lgths	320	8,000.00
	Tie wire # 16	5	kgs	80	400.00
	2X2X8 lumber	100	pcs	75	7,500.00
	1/4 opw	8	shts	350	2,800.00

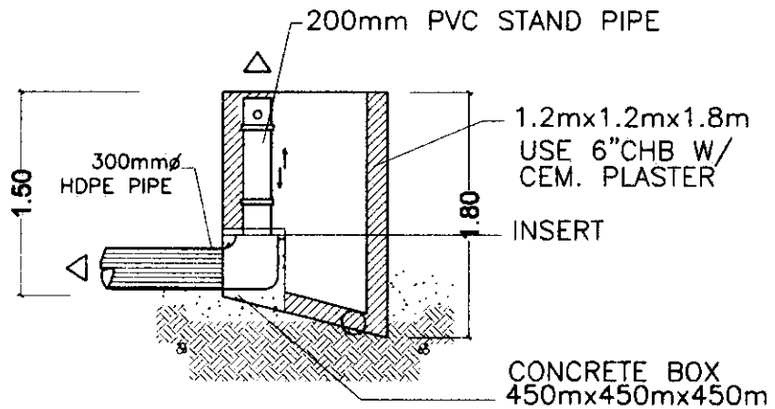
	CWN # 4	5	kgs	65	325.00
	CWN # 2 1/2	5	kgs	65	325.00
	CWN # 1	1	kgs	65	65.00
				Material Cost:	32,940.00
				Labor Cost:	11,529.00
				Sub-total:	**44,469.00**
4.0	**MASONRY WORKS**				
4.1	**CHB LAYING**	87.5	sq.m		
	4CHB	1100	pcs	10	11,000.00
	Cement	55	bags	250	13,750.00
	Sand	6	cu.m	900	5,400.00
	10mm diam. RSB	75	lgths	125	9,375.00
	Tie wire # 16	8	kgs	80	640.00
				Material Cost:	29,165.00
				Labor Cost:	8,749.50
				Sub-total:	**37,914.50**
4.2	**PLASTERING/FINISHING**	170	sq.m.		
	Cement	80	bags	250	20,000.00
	Sand	5	cu.m	900	4,500.00
				Material Cost:	24,500.00
				Labor Cost:	12,000.00
				Sub-total:	**36,500.00**
5.0	**ROOF FRAMING WORKS**				
5.1	**RAFTERS, PURLINS, SAGRODS & FACIA**				
	1 1/2 G.I PIPE SCH. 40	8	lgths	950	7,600.00
	1.2mmx2x3 G.I C-purlins	20	lgths	500	10,000.00
	10mm rsb	8	lgths	130	1,040.00
	1/8x1 angle bar	8	lgths	350	2,800.00
				Material Cost:	13,840.00
				Labor Cost:	4,844.00
				Consumables:	8,000.00
				Sub-total:	**26,684.00**
6.0	**ROOFING AND TINSMITHRY WORKS**				
	0.4mmx1mxl.s color roofing pre-painted	78	l.m.	230	17,940.00
	0.4mmx24x2.44m RR	7	pcs	650	4,550.00
	Tekscrew 2 1/2	800	pcs	3	2,400.00
	Blind rivets	1	box	500	500.00
	Vulcaseal	1	qrt	550	550.00
				Material Cost:	25,940.00
				Labor Cost:	7,782.00
				Trucking cost:	5,000.00
				Sub-total:	**38,722.00**
7.0	**DOORS**				
	7.1 Doors and accessories				
	1 1/2 G.I PIPE SCH. 40	20	lgths	950	19,000.00
	INTERLINK 2"X 4FTx6m	8	rolls	1500	12,000.00
	1/8x1 angle bar	25	lgths	350	8,750.00
	Hinges	12	sets	500	6,000.00
				Material Cost:	45,750.00
				Labor Cost:	13,725.00
				Consumables:	5,000.00
				Sub-total:	**59,475.00**
				TOTAL MATERIALS & LABOR COST:	351,414.00
				OVERHEAD, CONTENGINCIES & MISCELLANEOUS:	70,282.80
				TOTAL ESTIMATED COST:	**421,696.80**

PREPARED BY:

RONILO G. PADERNAL
Project Manager

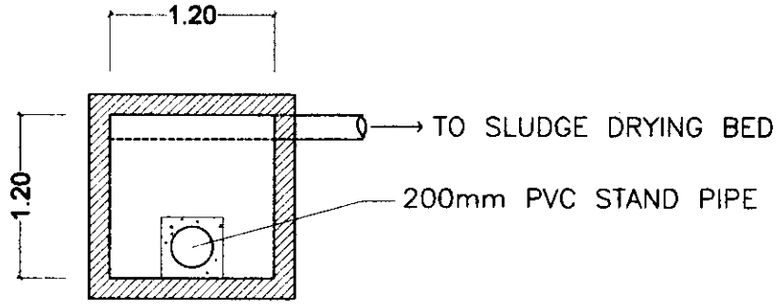
Approved by:

MARITONI C. UNABIA-ALEGRE
Owner



SECTION

SLUDGE BOX/MAN HOLE



TOP VIEW

SLUDGE DRAIN
CONTROL STANDPIPE

Shelter Livestock CONCEPTS

LIVESTOCK SHELTER CONCEPTS
NOVALICHES QUEZON CITY
0932-8914041 0917-8288780

REPUBLIC ACT 545

ARCH. GENEVIEVE M. GARDENAS

PUROK-3, BRGY. PALPAT, MALAYBALAY CITY

SLUDGE WELL
TOP VIEW

BMH FARM

D-3

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (SLUDGE DRAIN PIPE)**

ITEM NO.	WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**				
	2x2x8 lumber	20	pcs	75	1,500.00
	CWN 4	0.5	kgs	80	40.00
	CWN 1	1	kgs	80	80.00
				Material Cost:	1,620.00
				Labor Cost:	486.00
				Sub-total:	**2,106.00**
2.0	**EARTHWORKS**				
	2.1 Excavation for column footing	2.6	cu.m.	250	**650.00**
3.0	**CONCRETE WORKS**				
	Cement	2	bags	250	500.00
	Sand	0.5	cu.m	900	450.00
	Gravel	1	cu.m	900	900.00
	10mm diam. RSB	8	lgths	125	1,000.00
	Tie wire # 16	1	kgs	80	80.00
				Material Cost:	2,930.00
				Labor Cost:	879.00
				Sub-total:	**3,809.00**
4.0	**MASONRY WORKS**				
	4.1 **CHB LAYING**		sq.m		
	6CHB	120	pcs	10	1,200.00
	Cement	4	bags	250	1,000.00
	Sand	1	cu.m	900	900.00
	10mm diam. RSB	10	lgths	125	1,250.00
	Tie wire # 16	1	kgs	80	80.00
				Material Cost:	3,230.00
				Labor Cost:	969.00
				Sub-total:	**4,199.00**
	4.2 **PLASTERING/FINISHING**		sq.m.		
	Cement	3	bags	250	750.00
	Sand	1	cu.m	900	900.00
				Material Cost:	1,650.00
				Labor Cost:	2,500.00
				Sub-total:	**4,150.00**

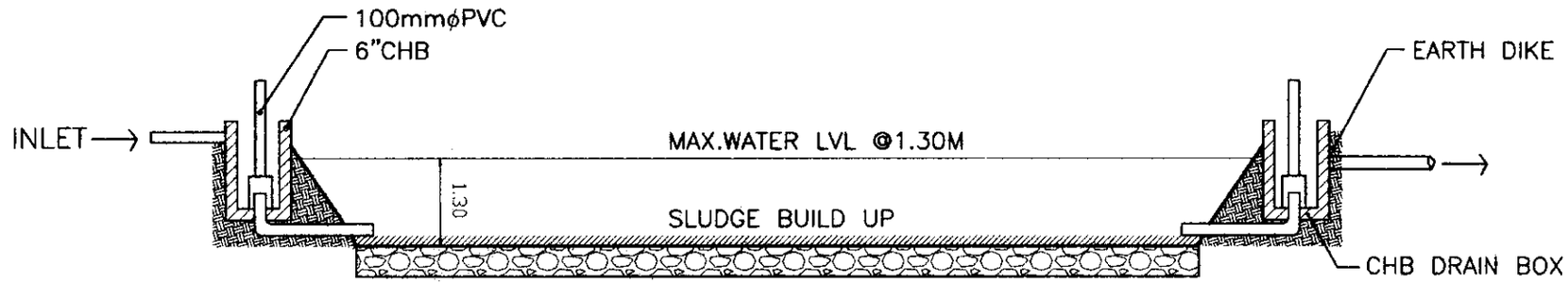
TOTAL MATERIALS & LABOR COST:	14,914.00
OVERHEAD, CONTENGINCIES & MISCELLANEOUS:	2,982.80
TOTAL ESTIMATED COST:	**17,896.80**
	x6
x 6 WELLS	**107,380.80**

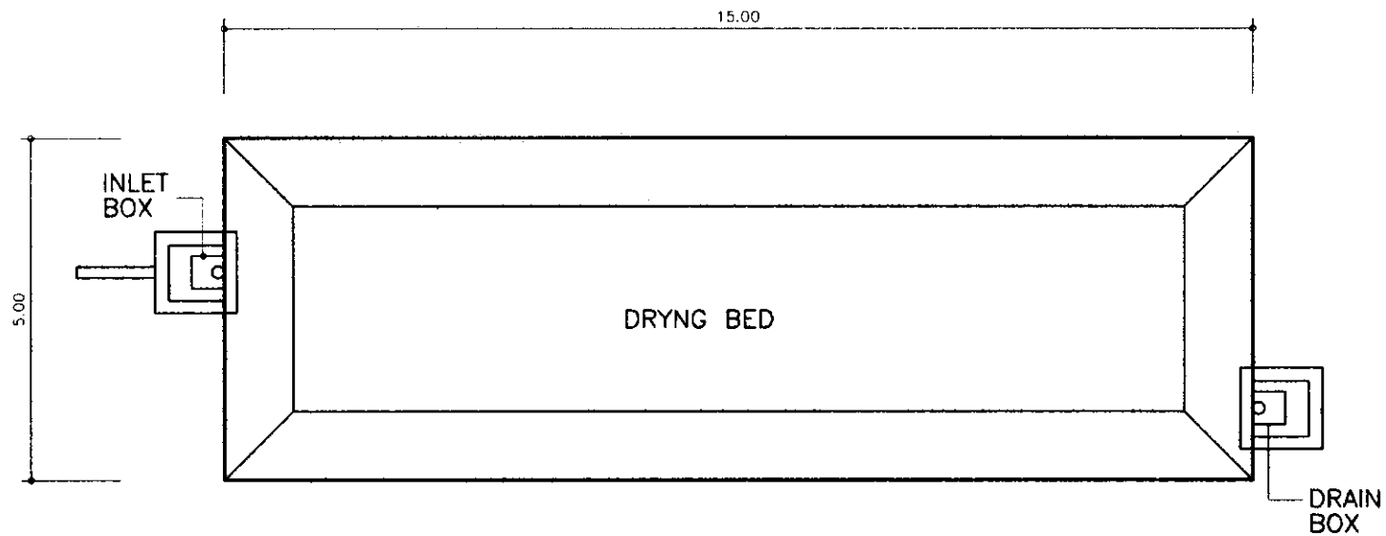
PREPARED BY:

RONILO G. PADERNAL
Project Manager

Approved by:

MARITONI C. UNABIA-ALEGRE
Owner





Shelter Livestock Concepts

LIVESTOCK SHELTER CONCEPTS

PUROK-3, BRGY. PALPAT, MALAYBALAY CITY

DRYING BED DETAILS
PLAN & SECTION

BMH FARM

D-6

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Contact Nos. 0917-2500620 / 088-3140748

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (DRYING BED)**

ITEM NO.		WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**					
		2x2x8 lumber	50	pcs	75	3,750.00
		CWN 4	2	kgs	80	160.00
		CWN 1	1	kgs	80	80.00
					Material Cost:	3,990.00
					Labor Cost:	1,197.00
					Sub-total:	**5,187.00**
2.0	**EARTHWORKS**					
	2.1	Excavation for drying pond	97.5	cu.m.	120	**11,700.00**
3.0	**CONCRETE WORKS**		7.5	cu.m.		
		Cement	75	bags	250	18,750.00
		Sand	4	cu.m.	900	3,600.00
		Gravel	10	cu.m.	900	9,000.00
		10mm diam. RSB	60	lgths	125	7,500.00
		Tie wire # 16	5	kgs	80	400.00
					Material Cost:	39,250.00
					Labor Cost:	11,775.00
					Sub-total:	**51,025.00**
4.0	**MASONRY WORKS**					
	4.1	**CHB LAYING**		sq.m		
		6CHB	50	pcs	10	500.00
		Cement	15	bags	250	3,750.00
		Sand	2	cu.m	900	1,800.00
		10mm diam. RSB	8	lgths	125	1,000.00
		Tie wire # 16	1	kgs	80	80.00
					Material Cost:	6,630.00
					Labor Cost:	1,989.00
					Sub-total:	**8,619.00**
	4.2	**PLASTERING/FINISHING**		sq.m.		

	Cement	8	bags	250	2,000.00
	Sand	0.5	cu.m	900	450.00
				Material Cost:	2,450.00
				Labor Cost:	2,000.00
				Sub-total:	**4,450.00**
5.0	**ROOF FRAMING WORKS**				
5.1	**RAFTERS, PURLINS, SAGRODS & FACIA**				
	1 1/2 G.I PIPE SCH. 40	14	lgths	950	13,300.00
	1.2mmx2x3 G.I C-purlins	30	lgths	500	15,000.00
	10mm rsb	8	lgths	130	1,040.00
	1/8x1 angle bar	10	lgths	350	3,500.00
				Material Cost:	19,540.00
				Labor Cost:	6,839.00
				Consumables:	8,000.00
				Sub-total:	**34,379.00**
6.0	**ROOFING AND TINSMITHRY WORKS**				
	0.4mmx1mxl.s color roofing pre-painted	180	l.m.	350	63,000.00
	0.4mmx24x2.44m RR	8	pcs	650	5,200.00
	Tekscrew 2 1/2	1700	pcs	3	5,100.00
	Blind rivets	2	box	500	1,000.00
	Vulcaseal	1	qrt	550	550.00
				Material Cost:	74,850.00
				Labor Cost:	22,455.00
				Trucking cost:	5,000.00
				Sub-total:	**102,305.00**
				TOTAL MATERIALS & LABOR COST:	217,665.00
				OVERHEAD, CONTINGENCIES & MISCELLANEOUS:	43,533.00
				TOTAL ESTIMATED COST:	**261,198.00**

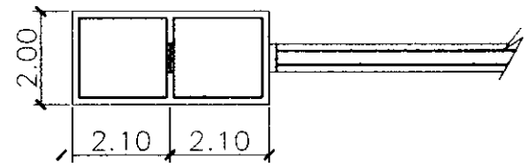
PREPARED BY:

RONILO G. PADERNAL
Project Manager

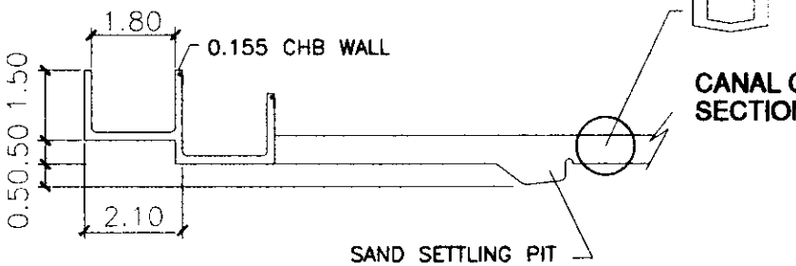
Approved by:

MARITONI C. UNABIA-ALEGRE
Owner

DOUBLE MANURE PIT WITH LABYRINTH TYPE CALCIUM TRAP USING 6"CHB



PLAN



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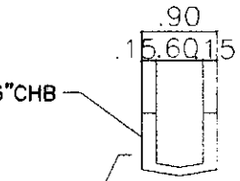

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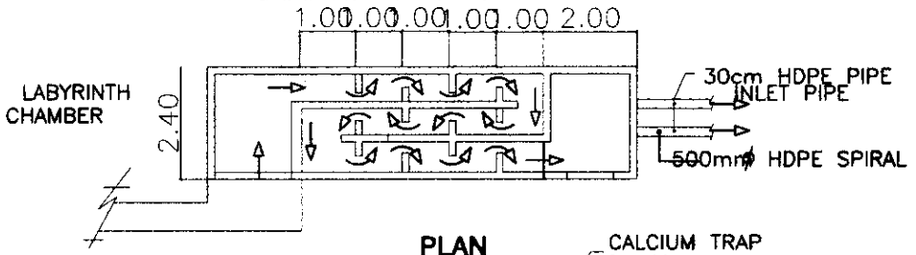
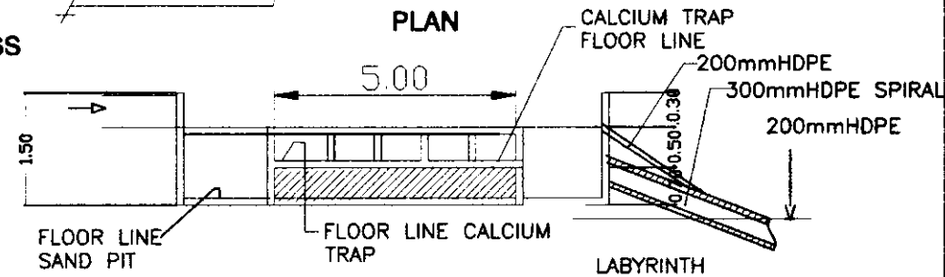


PLAN



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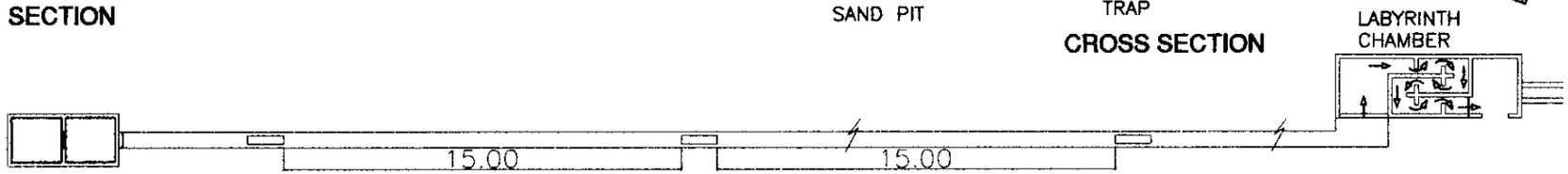
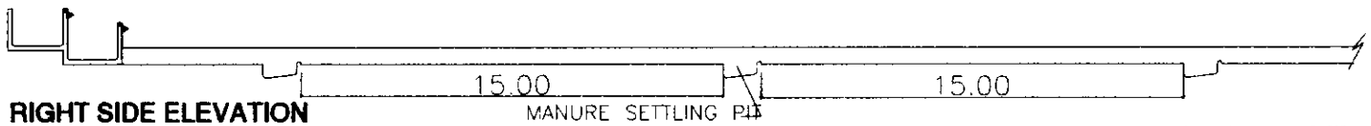


PLAN - MIXING TANK & CONNECTING CANAL



RIGHT SIDE ELEVATION

NOTE: USE CHB FOR
CALCIUM TRAP WALLS
4"CHB/PLASTER-INNER WALLS
6"CHB/PLASTER-OUTER WALLS

Shelter Concepts — LIVESTOCK SHELTER CONCEPTS			PUROK-3, BRGY. PALPAT, MALAYBALAY CITY		CALCIUM TRAP DETAILS	BMH FARM	D-4

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Contact Nos. 0917-7250620 088 31407 18

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (CALCIUM TRAP)**

ITEM NO.	WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**				
	2x2x8 lumber	50	pcs	75	3,750.00
	CWN 4	2	kgs	80	160.00
	CWN 1	1	kgs	80	80.00
				Material Cost:	3,990.00
				Labor Cost:	1,197.00
				Sub-total:	**5,187.00**
2.0	**EARTHWORKS**				
2.1	Excavation for MIXING TANK	9.6	cu.m.	200	**1,920.00**
2.2	Excavation for CONNECTING CANAL	45	cu.m.	200	**9,000.00**
2.3	Excavation for calcium trap	32.4	cu.m.	120	**3,888.00**
3.0	**CONCRETE WORKS**	7			
	Cement	65	bags	250	16,250.00
	Sand	4	cu.m.	900	3,600.00
	Gravel	10	cu.m.	900	9,000.00
	10mm diam. RSB	60	lgths	125	7,500.00
	Tie wire # 16	10	kgs	80	800.00
	2X2X8 lumber	30	pcs	75	2,250.00
	1/4 opw	4	shts	350	1,400.00
	CWN # 4	2	kgs	65	130.00
	CWN # 2 1/2	2	kgs	65	130.00
	CWN # 1	1	kgs	65	65.00
				Material Cost:	41,125.00
				Labor Cost:	12,337.50
				Sub-total:	**53,462.50**
4.0	**MASONRY WORKS**				
4.1	**CHB LAYING**	115	sq.m		
	6CHB	1250	pcs	10	12,500.00
	4CHB	200	pcs	10	2,000.00
	Cement	120	bags	250	30,000.00
	Sand	8	cu.m	900	7,200.00
	10mm diam. RSB	130	lgths	125	16,250.00

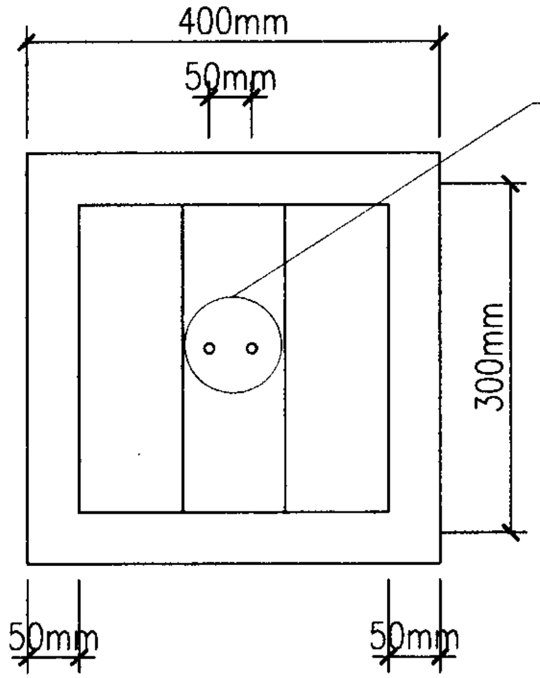
	Tie wire # 16	20	kgs	80	1,600.00
				Material Cost:	55,050.00
				Labor Cost:	16,515.00
				Sub-total:	**71,565.00**
4.2	**PLASTERING/FINISHING**	230	sq.m.		
	Cement	80	bags	250	20,000.00
	Sand	5	cu.m	900	4,500.00
				Material Cost:	24,500.00
				Labor Cost:	16,100.00
				Sub-total:	**40,600.00**
				TOTAL MATERIAL & LABOR COST:	185,622.50
				OVERHEAD, CONTINGENCIES & MISCELLANEOUS:	37,124.50
				TOTAL ESTIMATED COST:	**222,747.00**

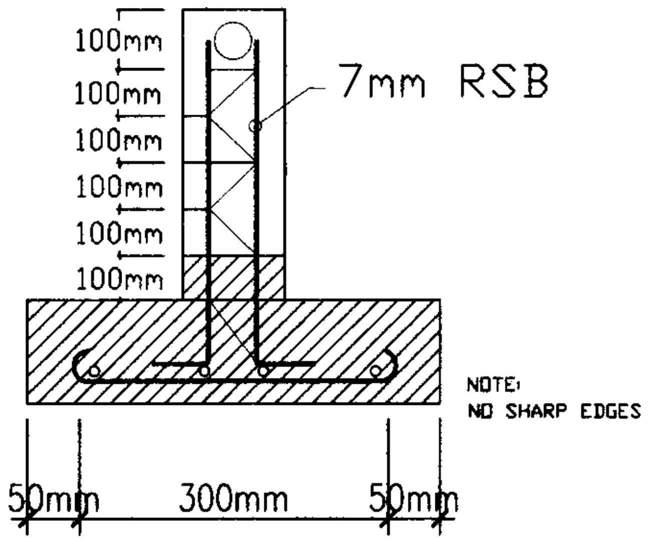
PREPARED BY:

RONILO G. PADERNAL
Project Manager

Approved by:

MARITONI C. UNABIA-ALEGRE
Owner





NOTE:
ALL REINFORCING STEEL BARS ARE 7mm dia.

LIVESTOCK SHELTER CONCEPTS QUEZON CITY	REPUBLIC ACT	PUROK-3, BRGY.PALPAT,MALAYBALAY CITY	BUBBLER PEDESTAL DETAIL	BMH FARM	A-5

PADERNAL BUILDERS

ENGINEERS * ARCHITECTS * PLANNER * BUILDERS

Blk 16 Lot 25 Carmenville Subd., Casisang, Malaybalay City

Project : **PROPOSED BMH BIOGAS FACILITIES IMPROVEMENTS**
Location : **P3 PATPAT, MALAYBALAY CITY**
Owner: **MARITONI C. UNABIA-ALEGRE**
Subject : **Bill of Materials and Cost Estimates (PEDESTAL FOR BLOWERS)**

ITEM NO.	WORK DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1.0	**LAY-OUT AND STAKING**				
	2x2x8 lumber	10	pcs	75	750.00
	CWN 4	0.5	kgs	80	40.00
	CWN 1	1	kgs	80	80.00
				Material Cost:	870.00
				Labor Cost:	261.00
				Sub-total:	**1,131.00**
2.0	**EARTHWORKS**				
	2.1 Excavation for column footing	1	cu.m.	250	**250.00**
3.0	**CONCRETE WORKS**				
	Cement	2	bags	250	500.00
	Sand	0.5	cu.m	900	450.00
	Gravel	0.3	cu.m	900	270.00
	7mm diam. RSB	4	lgths	90	360.00
	Tie wire # 16	0.5	kgs	80	40.00
				Material Cost:	1,620.00
				Labor Cost:	486.00
				Sub-total:	**2,106.00**
4.0	**MASONRY WORKS**				
	4.1 **CHB LAYING**		sq.m		
	6CHB	15	pcs	10	150.00
	Cement	2	bags	250	500.00
	Sand	0.5	cu.m	900	450.00
	7mm diam. RSB	5	lgths	125	625.00
	Tie wire # 16	0.5	kgs	80	40.00
				Material Cost:	1,615.00
				Labor Cost:	484.50
				Sub-total:	**2,099.50**
	4.2 **PLASTERING/FINISHING**		sq.m.		
	Cement	1	bags	250	250.00
	Sand	0.2	cu.m	900	180.00
				Material Cost:	430.00
				Labor Cost:	500.00
				Sub-total:	**930.00**
				TOTAL MATERIALS & LABOR COST:	6,516.50
				OVERHEAD, CONTENGINCIES & MISCELLANEOUS:	325.83
				TOTAL ESTIMATED COST:	**6,842.33**
					x2
			2 Blowers		**13,684.65**

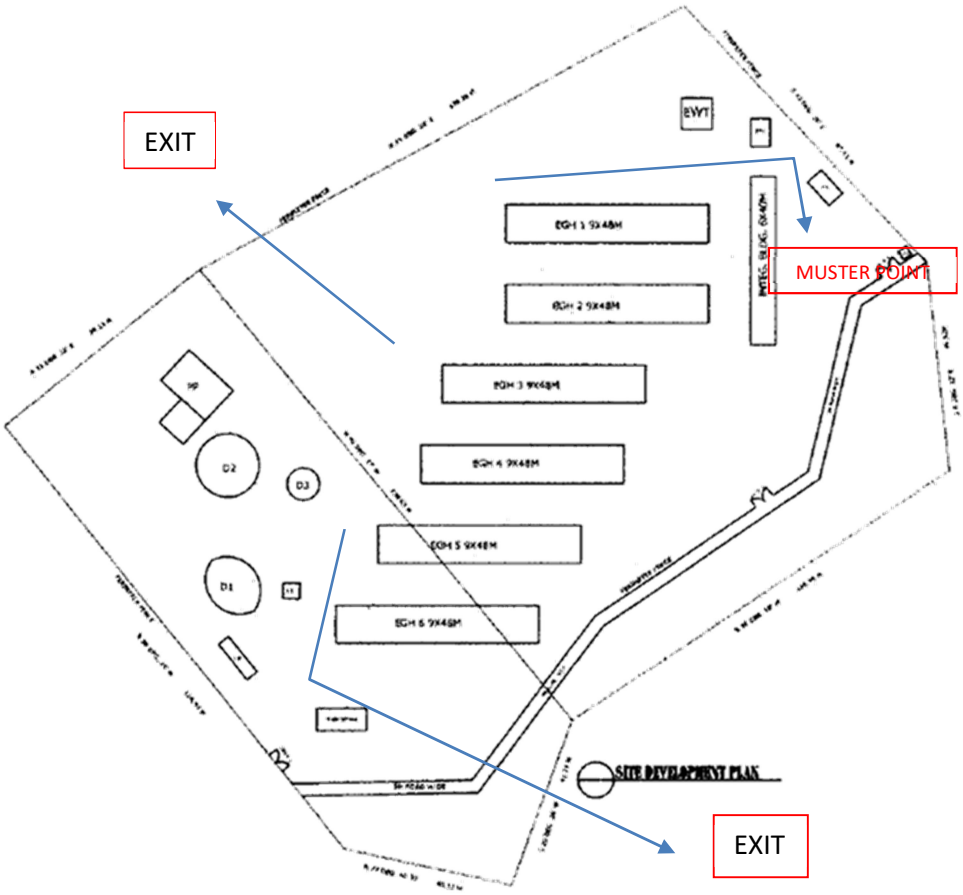
PREPARED BY:

RONILO G. PADERNAL
Project Manager

Approved by:

MARITONI C. UNABIA-ALEGRE
Owner

APPENDIX B. Site Evacuation Plan



CPA 35 Point Persons:

Owner: <name> <contact details>
Farm Supervisor: <name> <contact details>
Biodigester / Genset Maintenance: <name><contact details>

Local Emergency Contact Details:

City Disaster Risk Reduction and Management Office – **813-3611**

Malaybalay City Bureau of Fire Department – **813-5449**
Malaybalay Police Station – **0926-821-8803**

APPENDIX C.

Health and Safety Risks Management Plan of CPA 35

Hazard	Possible Harm	Source / Cause	Prevention / Minimization*	Person/s Responsible
physical				
noise	discomfort, hearing damage	pig squeals	- wear appropriate PPE (ear protection)	Farm Personnel
		running machineries and vehicles	- install noise-control devices when applicable - regular equipment inspection and maintenance - equipment housed in enclosed structure, if applicable - schedule shifting duties - install signage and warnings - wear appropriate PPE (ear protection)	Supervisor Farm Personnel
vibration	discomfort, ergonomic and nerve injuries, fatigue	running machineries	- ensure all loose equipment are securely placed - perform regular equipment inspection and maintenance - install signage and warnings	Supervisor Farm Personnel
electricity	shock, electrocution, burns	faulty machineries and power lines	- get services of a licensed electrician - consult equipment manual - perform regular equipment inspection and maintenance	Maintenance Farm Personnel
		improper use (or servicing) of electrical equipment	- restrict access to equipment - install signage and warnings - train staff (consult equipment manual) - wear appropriate PPE	
heat	burns	running machineries (hot surfaces, vapors, liquids)	- use insulation where possible - install machine guards - install signage and warnings - wear appropriate PPE (such as long sleeved shirts)	Maintenance Farm Personnel
	discomfort, heat exhaustion, heat stroke	working in enclosed spaces with limited ventilation	- adequate hydration and rest breaks	Supervisor
dust	irritation, respiratory distress / diseases	feeds, ambient dust	- calm work pacing to avoid exciting the pigs - thorough cleaning of indoor spaces - PPEs (mask)	Farm Personnel
poor lighting	eye strain, can't see hazards	unlit / inadequately lit areas	- install light sources - carry portable light sources - work during daytime whenever possible	Supervisor Farm Personnel
chemical				
harmful gases, dust, vapors (inhalation)	discomfort (odor), asphyxiation, poisoning, respiratory distress / diseases	degrading organic wastes hazardous substances (cleaning and pest control chemicals, veterinary medicines, fuels, hazardous wastes, etc.)	- observe measures for odor control - install signage and warning labels - train staff (on handling hazardous substances and wastes and working in confined spaces; review MSDS / product information sheets) - wear appropriate PPE (mask) - ensure first aid kits are readily available	Owner Supervisor Farm Personnel
		fuel burning (machineries, vehicles)	- perform regular equipment inspection and maintenance	Maintenance
		fugitive gases	- perform regular inspection and maintenance of biogas system	Maintenance
hazardous substances (contact, ingestion)	irritation, burns, poisoning, skin problems	hazardous substances (cleaning and pest control chemicals, veterinary medicines, fuels, hazardous wastes, etc.)	- use proper labeling, containers, and storage - restrict access to chemical and hazardous waste storage - train staff (handling hazardous substances and wastes; review MSDS / product information sheets) - only competent staff should administer veterinary medicines - ensure first aid kits are readily available - PPEs (gloves, eye glasses)	Owner Supervisor
biological				
pathogens / infectious agents, toxins and other products	various infectious diseases, parasites, irritation	pathological materials / tissues sick animals animal excretions and fluids manure (wastewaters) sludge veterinary wastes (especially sharps) potential disease carriers (objects, people, dust)	- observe proper disposal of animal and veterinary wastes - implement quarantine measures - good housekeeping practices (disinfection) - practice hygienic practices (especially hand hygiene) - perform workers' regular health examination - train staff (on animal handling, proper waste handling and disposal) - wear appropriate PPE (gloves, mask, goggles)	Owner Veterinarians Supervisor
		insects, pests, vermin	- proper disposal of odorous wastes - good housekeeping practices - implement pest control measures	Farm Personnel
ergonomic				
ergonomic stress	ergonomic injuries	repetitive actions, forceful exertions, sustained awkward posture	- use aid of appropriate equipment for lifting/moving heavy objects - use of proper lifting techniques - implement buddy system at work - ensure job rotation / adequate rest (in between tasks)	Supervisor Farm Personnel
		improper use of equipment	- train staff (consult manuals)	Supervisor Farm Personnel
		use of faulty equipment	- repair or replace equipment	Supervisor
other accidents and contingencies				
slips, trips, falls	injuries, wounds, contusions	spills (slips) various objects, debris (trips) heights, slips (falls)	- maintenance of walkways - daily safety briefings and regular trainings - barricading of work areas - wearing of appropriate PPE	Supervisor Farm Personnel
entanglement	injuries, wounds, strangulation	machineries	- install machine guards - tie back long hair - wear long sleeve shirts - avoid wearing loose-fitting clothes and personal accessories - regular equipment inspection and maintenance	Farm Personnel
blows, punctures	injuries, wounds, contusions	pig handling	- use animal restraints - ensure enough space to maneuver - train staff (animal handling techniques) - wear appropriate PPE (boots, gloves, etc.)	Supervisor Farm Personnel
sharps	sharps injuries,	veterinary activities, waste	- ensure only trained personnel conduct veterinary	Supervisor

	wounds	handling	activities - wear appropriate PPE (gloves, goggles)	Farm Personnel
fires	burns	faulty electrical systems, explosions, fugitive gases, accidental ignition	- comply with requirements and regulations of fire authorities - provide adequate and proper (multipurpose) fire protection equipment - designate smoking areas away from digester, gas tanks, and electrical equipment and storage of combustible materials (compost, sludge, chemicals) - regular clearing of vegetation near farm structures - install signage and warnings - train staff (on contingency plan and proper equipment use) - perform regular inspection and maintenance of electrical systems and equipment	Owner Maintenance
blast	blast injuries	excessive pressure in biodigester, fugitive gases, contained gases in confined spaces, fires	- keep sources of heat, including machineries, at a safe distance from biogas facility - prohibit smoking and use of cellphones around biogas system and gas storage facilities - perform regular inspection and maintenance of MRF - install signage and warnings	Lead Man Maintenance

* Shaded rows / items applicable for Anaerobic Digestion System