

Sitio Carbonan Treatment Wetlands

Green-Gray Partnership
Project for Philippine Cities
and Municipalities

Calatagan, Batangas

Ref No: GGI-00-MP-PT-2006

20 December 2021 | V 1.0

With support from:



FONDS FRANÇAIS POUR
L'ENVIRONNEMENT MONDIAL

CONSERVATION
INTERNATIONAL





About the Green-Gray Partnership

Climate change can no longer be ignored. The raging waters of typhoons Ondoy in 2009 and Haiyan 2013 are seared in Philippine collective memory. In the span of three weeks in 2020, three typhoons battered the country, inflicting over a hundred fatalities and at least PHP 25 billion (USD 518 million) worth of damage. The Philippines urgently needs to harness nature to uplift communities not just because it's better for the planet, but because making the most of available resources is an economic necessity.

In the last quarter of 2021, just as the Philippines was reining in the pandemic, Conservation International and AECOM began the Green-Gray Partnership Project with eleven local cities and municipalities to kickstart the adoption of nature-based solutions.

Integrating green natural systems into gray infrastructure provides multi-function and cost-effective solutions. Green-gray combines natural elements with hard infrastructure to protect and restore natural processes and create healthier urban environments. The combination allows the creation of natural habitats or system functionality (green infrastructure) in a resilient and optimized manner (gray infrastructure). Many green-gray solutions incorporate wetland and forest habitats. As with all habitat creation/restoration projects, the success of these initiatives depends on an understanding of the ecological structure and function of the target habitats.

Green-gray infrastructure approaches can apply in coastal, freshwater, and terrestrial settings and accomplish a variety of project goals. The typical infrastructure services such as flood management, coastal protection, and improving water quality are delivered alongside other benefits such as safeguarding biodiversity, providing livelihoods, increasing public space, and even financial returns to local communities through carbon credits.

A key reference for this engagement is the *Practical Guide to Implementing Green-Gray Infrastructure* by the Green-Gray Community of Practice, which is led by Conservation International. The guide, published in 2020, provides green-gray case studies and walks

readers through the process of project preparation, design, and implementation. It also defines the critical elements of the green-gray approach:

1. Using science and engineering to produce operational efficiencies;
2. Using natural processes to maximize benefits (i.e. ecosystem services);
3. Increasing the value provided by projects by including social, environmental, and economic benefits; and
4. Using collaborative processes to organize, engage, and focus interests, stakeholders, and partners.

Conservation International selected the pioneer batch of Green-Gray partner cities and municipalities based on the following criteria:

- **Commitment to a Resilient Future** Good track record and strong interest for pursuing a climate-resilient future for their locality;
- **Drivers of Change** Positioned as municipal leaders for a sustainable future for the Philippines;
- **Rich and Diverse Natural Assets** Representation of the abundant biodiversity of the Philippines; and
- **Vulnerability to Impacts of Climate Change** Exposure to the impacts of climate change.

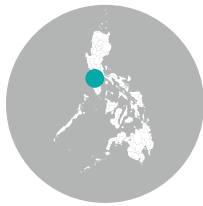
The Green-Gray Partnership Project was meant to equip local governments units (LGUs) with capacities to identify opportunities for the adoption of nature-based solutions and prepare concept notes to rally support for pilots. At the beginning of the project, it was essential to transfer knowledge of green-gray infrastructure through the guide and workshops focusing on case studies. This built a base from which the local governments drew from in order to craft a Statement of Intent and a Concept Design Note (Annex 1), both of which are contained in this document.

This document, containing a high-level design and assessment, may be used by the local governments to seek support for project preparation (in which the concept should be refined with further studies), detailed design, and implementation. Support may be sought from national government, financing institutions, grant giving foundations, and private sector partners.

Municipality of Calatagan, Batangas, Philippines

Sitio Carbonan Treatment Wetlands

Enhancing Mangroves into Treatment Wetlands for Climate Smart Aquaculture in Sitio Carbonan, Calatagan, Batangas



Location
Municipality of Calatagan,
Batangas, Luzon

Proposed Site
Sitio Carbonan, Barangay Balitoc

Key Thematic Area
Coastal

Key Issue
Poor water quality impacting the
fishing community's livelihoods

Green-Gray Solution
Wetlands and Oyster Gabions as
natural filters

Proposed Implementation
Timeframe
1-2 years

Executing Agencies

- Municipal Agriculture Office
- Bureau of Fisheries and Aquatic Resources
- Department of Environment and Natural Resources

Project Aim
A Green-Gray Infrastructure Solution is proposed to address the issue of wastewater discharged from the shrimp farms that will ultimately improve water quality to support seaweed farming in the coastal waters. It also aims to enhance biodiversity through mangrove restoration and reduce the overall cost required to treat wastewater, and to deploy a scalable and replicable solution for cost-effective wastewater treatment across the country.

1,423

Benefiting
Fisherfolk

source:
Municipal Agriculture
Office, 2021

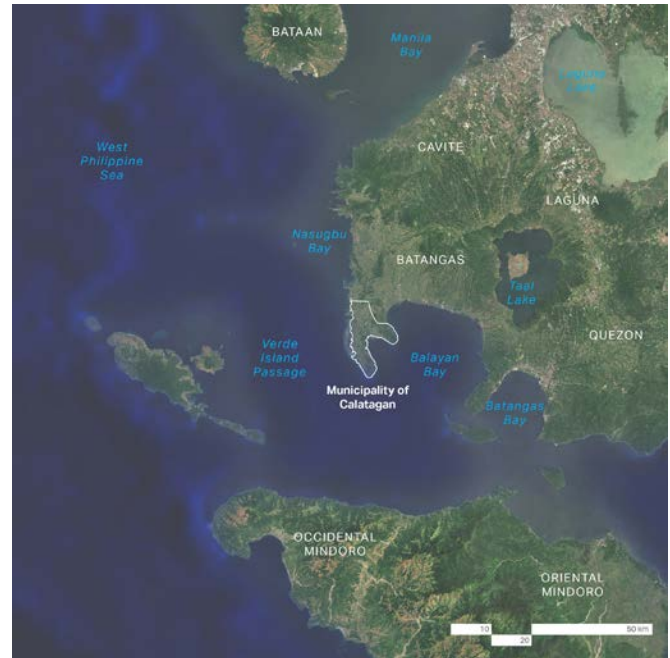
3,108

Metric tons
of CO₂
captured

1,937

Metric tons
of Improved
Aquaculture
Productivity

Based only on assumptions and estimates; for verification in next stage



Calatagan Location Map



Calatagan Green-Gray Partnership Project Location Map



Overview

Seaweed is key to the marine environment in Calatagan, Batangas. It is also major source of livelihood for fisherfolk communities, such as those in Sitio Carbonan, Barangay Balitoc. However, seaweed yields have dropped due to the degradation of water quality. Coastal population is growing so the local government plans to relocate families out of hazard-prone and environmentally critical areas. Also, outflows from the intensive culture practices in the shrimp ponds are disrupting the natural ecosystem.

Wastewater coming from a cluster of shrimp farms along the coast has been identified as a primary cause of the decline of seaweed production in the area. Due to poorly treated wastewater being discharged from the ponds, the fishermen have experienced low quality seaweed harvests and sporadic harvest periods. Mangrove restoration at two locations by the discharge point of the shrimp farms will act as a natural filter to improve water quality.

The proposed green-gray solution enhances the presence of mangroves in the site to improve water quality and ease the tensions between seaweed farming and shrimp raising. A potential outcome of this pilot project is collaboration between the local government and the private companies in the area to eventually adapt climate smart aquaculture practices, hereby making the municipal aquaculture more resilient and synergistic.

Sustainable Development Goals (SDG) Targets

<p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<p>13 CLIMATE ACTION</p>
<p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<p>14 LIFE BELOW WATER</p>
<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	<p>17 PARTNERSHIPS FOR THE GOALS</p>
<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p>	

Rationale

Aquaculture by the coastline and seaweed farming in Sitio Carbonan are currently incongruous. The uncontrolled growth of one will lead to the eventual diminishing of the other. In a place where fishery is a major source of livelihood, it does not have to be a zero-sum game.

Sitio Carbonan

Sitio Carbonan is located in Barangay Balitoc on the west coast of Calatagan, Batangas. In 2010, there were only a few families residing in Sitio Carbonan, but this ballooned to 144 families (population: 692) in 2021. Ten families (population: 54) reside between the two fishponds, but the local government plans to relocate them out of the danger zone and environmentally critical area.

The land is susceptible to moderate coastal flooding, which increases during high tides and to moderate storm surge levels. Mangroves in the buffer hazards and serve as barriers against strong waves. Some of the mangrove species are *Avicennia marina* locally known as Kalapinay, *Sonneratia alba* or Pagatpat, and *Rhizophora sp.* or Bakawan.

Strong local seaweed industry

Located along the Verde Island Passage, hailed as the center of global shore-fish biodiversity, Calatagan hosts rich coastal and marine resources on which most of population depends for food and livelihood. Given its economic value in the market, seaweed farming serves as another source of income for the people of Calatagan. According to Food and Agriculture Organization of the United Nations, the Philippines is a primary producer in the global seaweed trade.

The Philippines' Bureau of Fisheries and Aquatic Resources (BFAR) reports that Seaweed output contributed 33.3 percent to the national fisheries production in 2020. It was second to tuna in terms of fisheries export value in 2019 at USD 250 million, equal to a 22% share to the total export earnings for that year. Meanwhile, Shrimp/Prawn, at fourth place, contributed USD 42 million to the total export value (BFAR Philippine Fisheries Profile, 2019).

The Calatagan Municipal Agriculture Office (MAO) list of Registered Fisherfolk indicates that there a total of 1,423 registered fisherfolk in the municipality from Barangay 1 (488), Barangay 2 (180), Barangay 4 (239),

Balitoc (282), and Gulod (234); the five barangays are adjacent to each other on the west coast.

Seaweed species in Calatagan are *Kappaphycus alvarezii* or Tambalang, *Kappaphycus striatum* or Sacol, *Eucheuma denticulatum* or Spinosum, and edible seaweeds like *Caulerpa lentillifera* and *Caulerpa racemosa*. Seaweed farms are typically located 2-4 kilometers from the western coastline. Following a 60- day culture period, harvested seaweed is dried for two days through solar, floating and hanging methods until it reaches a moisture content of 36-38%. Most farmers build and use their own seaweed growing equipment.

Calatagan also has numerous fishponds and shrimp farms. In Sitio Carbonan, there are four fishponds: Batangas Aqua Farm Inc, Prawn Farm Project of BMW Realty Inc. / OandB/ Dos Aqua, Cuala Farm, and Alejandro Fishpond. These utilize intensive culture systems. These fishponds have business permits to operate, but no tenurial instruments. The Batangas Aqua Farm Prawn Farm Project face the Seaweed Farming Areas of Sitio Carbonan. There are recurring conflicts between seaweed farming and shrimp raising (*vannamei*). Seaweed needs good water quality while shrimp farms are required to follow good aquaculture practices in raising *vannamei*, considering community health and environmental impacts.

When the ponds dispose wastewater directly to the coast, the seaweed harvests and livelihoods of farmers in the area and adjacent barangays are impacted.

Conserving municipal waters

The Municipal Government, through the Municipal Agriculture Office (MAO) and Municipal Environment and Natural Resources Office (MENRO), is strictly implementing local environmental ordinances. The Municipal Ordinance No. 108 series of 2009 or Municipal Environment Code of Calatagan was formulated to promote the principles of ecologically sustainable development and to ensure that all reasonable and practicable measures are taken by LGUs to protect, restore and enhance the quality of the environment. The Municipal Ordinance No. 83 series of 2006 or Municipal Fisheries Code of Calatagan was formulated and enacted to address the sustainable management, utilization, development and conservation of the municipal waters and its coastal and fishery resources.

Project Proposal

The municipality is currently implementing its Integrated Coastal Management Plan and Municipal Fisheries Development Plan. The Municipal Agriculture Office (MAO) regularly conducts Fishpond Monitoring to ensure the compliance of all shrimp farms with good aquaculture practices.

Operators are required to secure documents like Environment Compliance Certificate (ECC) from the Department of Environment and Natural Resources Office (DENR) and BFAR Certification before establishing a fish/shrimp pond. The documents serve as bases for monitoring. There is strict implementation of the "No ECC, No Mayor's Permit" Policy. In addition, operators are required to establish

Settling Ponds to ensure that wastewater will not directly discharge to the coast. The wastewater should be stocked for 8 to 14 days and disposed through a submergible pump.

The coastal water quality testing conducted in the area by the MAO, with the help of Batangas Provincial Government Environment and Natural Resources Office (PGENRO) on November 3, 2021, shows that some marine samples taken across the farms do not meet the General Effluent Standards (GES) and Water Quality Guideline Value (WQGV) for Class SC and Class SB - standard requirements for seaweed production, tourism activities and primary contact recreation like swimming and bathing. Based on its findings, recommendations were also drawn for compliance of the farms' operators.

Parameter	Laboratory Sample No.				General Effluent Standard (GES) Class SC	General Effluent Standard (GES) Class SB
	WM-21-1934 BMW, Dos Aqua Farm, O&B Outfall @ 1000H	WM-21-1935 Batangas Aqua Farm Outfall @ 1040H	WM-21-1936 Cuala Farm Outfall @ 1114H	WM-21-1937 Alejandro Farm Outfall @ 1203H		
pH	6.975	7.058	7.352	7.234	6.0 - 9.0	6.5-9.0
Temperature, °C	21.8	21.0	21.9	23.0		
Dissolved Oxygen (DO), mg/L	4.0	1.7	7.2	3.9	-	-
Biochemical Oxygen Demand (BOD)	24	13	30	17	100	30
Total Suspended Solids (TSS), mg/L	46	51	96	57	100	70
Phosphate, mg/L	3.5095	0.1169	0.8191	0.1432	4	1
Nitrate, mg/L	1.8026	1.8556	0.7622	3.2933	20	20

Parameter	Laboratory Sample No.				Water Quality Guideline Value (WQGV) Class SC	Water Quality Guideline Value (WQGV) Class SB
	WM-21-1938 Across Alejandro Farm @ 0952H	WM-21-1939 Across Cuala Farm @ 0958H	WM-21-1940 Across BMW; Dos Aqua and OB Farm @ 1005H	WM-21-1941 Across Batangas Aqua Farm @ 1010H		
Dissolved Oxygen (DO), mg/L	4.2	4.1	4.2	5.2	5 (minimum)	5 (minimum)
Total Suspended Solids (TSS), mg/L	46	38	35	57	80	50
Phosphate, mg/L	0.0406	0.0921	0.2109	0.0425	0.2	0.2
Nitrate, mg/L	0.7162	1.0096	0.5814	1.5942	10	10

Results of Water Quality Analysis on existing fish/shrimp farms conducted on November 3, 2021



Water Quality Analysis on existing fish/shrimp farms conducted on November 3, 2021

Pilot treatment wetlands

The proposed green-gray solution is to enhance the existing mangroves in Sitio Carbonan to assist in the treatment of aquaculture wastewater discharge. These treatment wetlands can help improve water quality and mitigate the impacts of shrimp farming on coastal water quality and the seaweed farms.

The pilot site is located within the municipal waters of Calatagan along the west coast. The shrimp farms by the coastline span about 20 hectares. There are two discharge outlets. Meanwhile, the current mangrove area is about 2.7 hectares. Enriching the mangroves can create a wetland buffer zone along the shoreline where discharge outlets of the fishponds are located.

This approach leverages Calatagan’s existing natural resources and capacity for mangrove rehabilitation. Calatagan has five official Marine Protected Areas, of which two of the most recent are located on the west coast and focus on mangroves: Calatagan Mangrove Forest Conservation Park “Ang Pulo” (7.5 ha) and Calatagan Mangrove Rehabilitation and Nursery Project (20 ha).

Scale up to climate smart aquaculture

As the MAO continues to conduct monitoring, some fish/shrimp pond operators may be flagged for non-compliance. These periods of evaluation and improvement are opportunities for the local government and the private companies to collaborate on climate

smart practices, particularly aligning pond effluent systems with natural solutions and shifting to renewable energy. Intensification of shrimp farming can be balanced with restoration to provide biodiversity and community climate adaptation benefits. If a collaboration is agreed upon, the local government will need technical assistance for the design, communication, and negotiation of the climate smart aquaculture system with their partner.

Green-gray infrastructure impact

Improving the coastal water quality in Sitio Carbonan using green-gray infrastructure may unlock multiple benefits including:

- Improve seaweed yield and stabilize the livelihoods of small scale fisherfolk
- Generate supplemental income associated with mangrove rehabilitation
- Improve marine biodiversity
- Reduce the impact of storm surges on the local aquaculture ponds

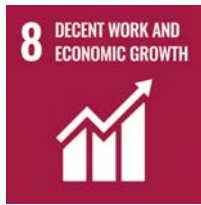
Ultimately, the pilot can make a case for the municipality wide adoption of nature-based strategies in aquaculture to:

- Promote low carbon and inclusive growth of Calatagan fishery sector
- Restore the blue carbon ecosystems along the Verde Island Passage



Seaweed varieties in Calatagan, Batangas:
Kappaphycus alvarezii
Kappaphycus striatum
Euचेuma denticulatum
Caulerpa lentillifera
Caulerpa racemosa

Sustainable Development Goals (SDG) Targets



Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services



Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities



By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

Strengthen efforts to protect and safeguard the world's cultural and natural heritage

By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels



By 2030, achieve the sustainable management and efficient use of natural resources

Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products



Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Integrate climate change measures into national policies, strategies and planning

Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities



By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

Provide access for small-scale artisanal fishers to marine resources and markets



Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

Mobilize additional financial resources for developing countries from multiple sources

Adopt and implement investment promotion regimes for least developed countries

Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation

Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

Indicative Implementation Arrangements

Precise implementation arrangements remain to be determined at the pre-design preparation phase, but it is foreseen that the project shall be led and monitored by the Municipal Agriculture Office.

Support may be sought from the Provincial Government Environment and Natural Resources Office, which has an environmental monitoring laboratory and water quality monitoring program. Partnership with the national government may happen through the Bureau of Fisheries and Aquatic Resources of the Department of Agriculture and the Department of Environment and Natural Resources.

Monitoring and Evaluation Plan

The progress and success of the project can be measured by tracking the following indicators:

- Coastal water quality in Sitio Carbonan, Barangay Balitoc to meet the standards stipulated by the Department of Environment and Natural Resources
- Increased seaweed cultivation production tonnage in the local farms
- Marine biodiversity inventory
- Mangrove growth and survival rate

Due Diligence

This document contains a green-gray infrastructure design concept and high-level assessments. More details are required in order to refine this concept into a robust and detailed proposal; thus, the project preparation phase for this project should include:

- Feasibility Study
- Environmental and social impact assessment or environmental and social management framework
- Stakeholder consultations at national and project level implementation including with indigenous people, if relevant
- Gender assessment and action plan
- Operations and maintenance plan, if relevant
- Loan or grant operation manual, as appropriate
- Co-financing commitment letters

If required, the preparation of this project may include the following studies:

- Diagram of the theory of change
- Economic and financial model with key assumptions and potential stressed scenarios
- Pre-feasibility study
- Evaluation report of previous project
- Results of environmental and social risk screening

Conservation International's Diversity, Equity, and Inclusion (DEI) framework

At Conservation International (CI), we are committed to promoting human rights by reducing equity gaps and facilitating the enhancement of social and environmental sustainability. All of our projects are held to strict social and environmental principles as agreed upon and laid out by internationally accepted standards such as the Community, Biodiversity, and Carbon standard, as well as the Global Environmental Fund (GEF) and Green Climate Fund (GCF) safeguards. However, CI is taking our responsibility to communities and the environment even further with a commitment to tracking and monitoring Diversity, Equity, and Inclusion (DEI) benefits through our Environmental and Social Safeguards System (CISS), a system that exceeds international standards. To achieve maximum socio-environmental and climate benefits plus long-term sustainability of any project, we believe that communities must be at the center and actively participate in the design of any conservation initiative in which we engage. Central to this, CI engages communities in:

1. Developing the project components, including governance, management processes, and distribution mechanisms in a consultative, transparent and participatory manner with relevant stakeholders (Conservation Agreements ensure that all parties are heard and decisions are made jointly).
2. Addressing gender inequality in all of our conservation programming, monitoring, and reporting efforts.
3. Guaranteeing the long-term financial viability of the project through optimizing project implementation while maximizing benefits.
4. Prioritizing non-monetary benefits whenever possible to increase the number of beneficiaries and better guarantee long-term project success.

page intentionally left blank

ANNEX 1: Design Note



Statement of Problem and Thematic Area

The Municipality of Calatagan wants to protect and revitalize their seaweed production through strict monitoring of water quality, implementation of local policies, and creating measures that will ensure that all coastal developments comply with the required standards for wastewater being discharged to the coast. As a pilot project, the municipality will address poor wastewater treatment in Sitio Carbonan to improve the seaweed industry in the area.

Seaweed industry as livelihood of Calatagan residents



Project Aim

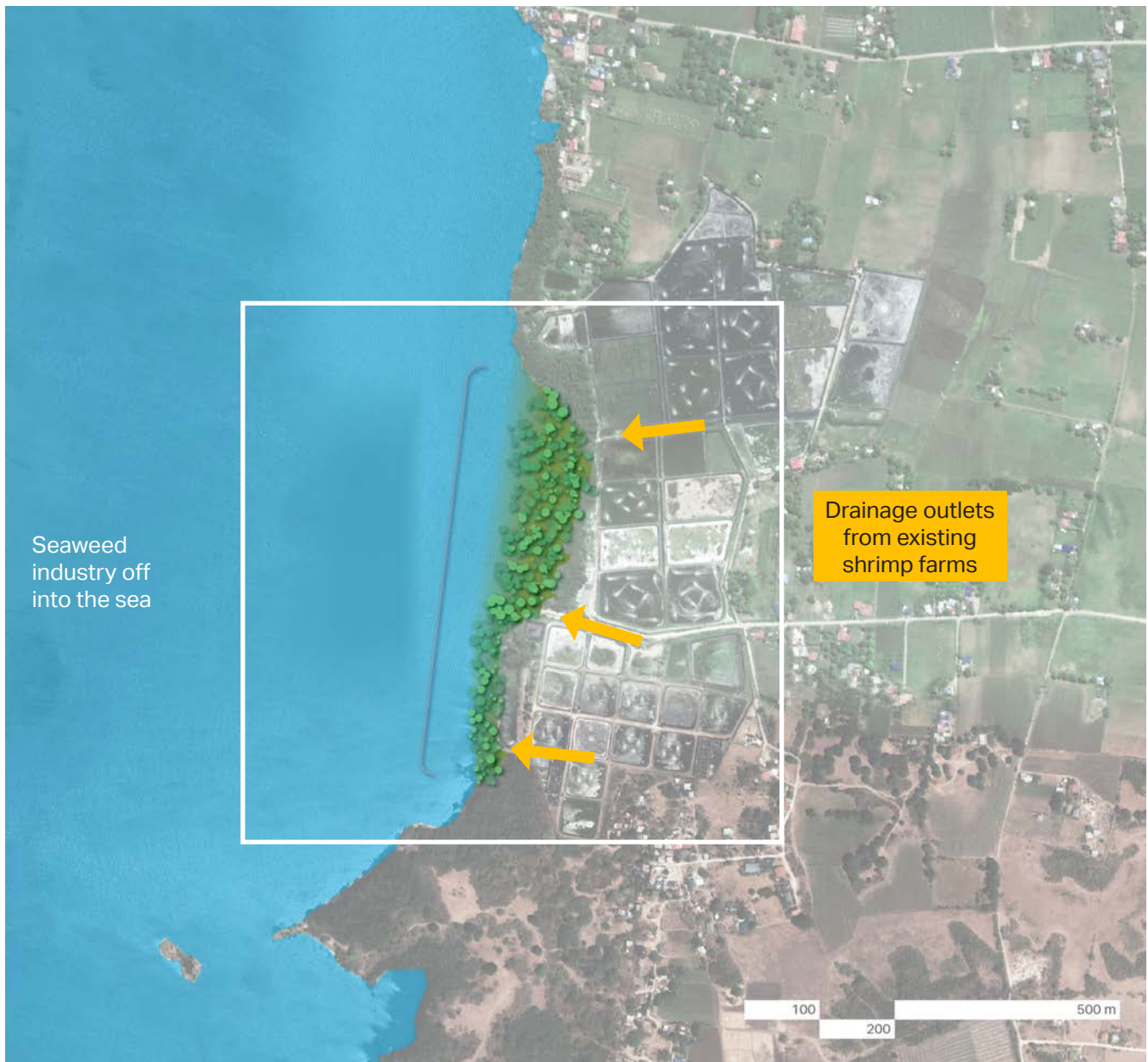
A Green-Gray Infrastructure (GGI) Solution is proposed to address the issue of wastewater discharged from the shrimp farms that will ultimately improve water quality to support seaweed farming in the coastal waters. It also aims to enhance biodiversity through mangrove restoration and reduce the overall cost required to treat wastewater, and to deploy a scalable and replicable solution for cost-effective wastewater treatment across the country.



Existing fish and shrimp farms with wastewater potentially affecting neighboring seaweed industry

Green-Gray Infrastructure Strategy

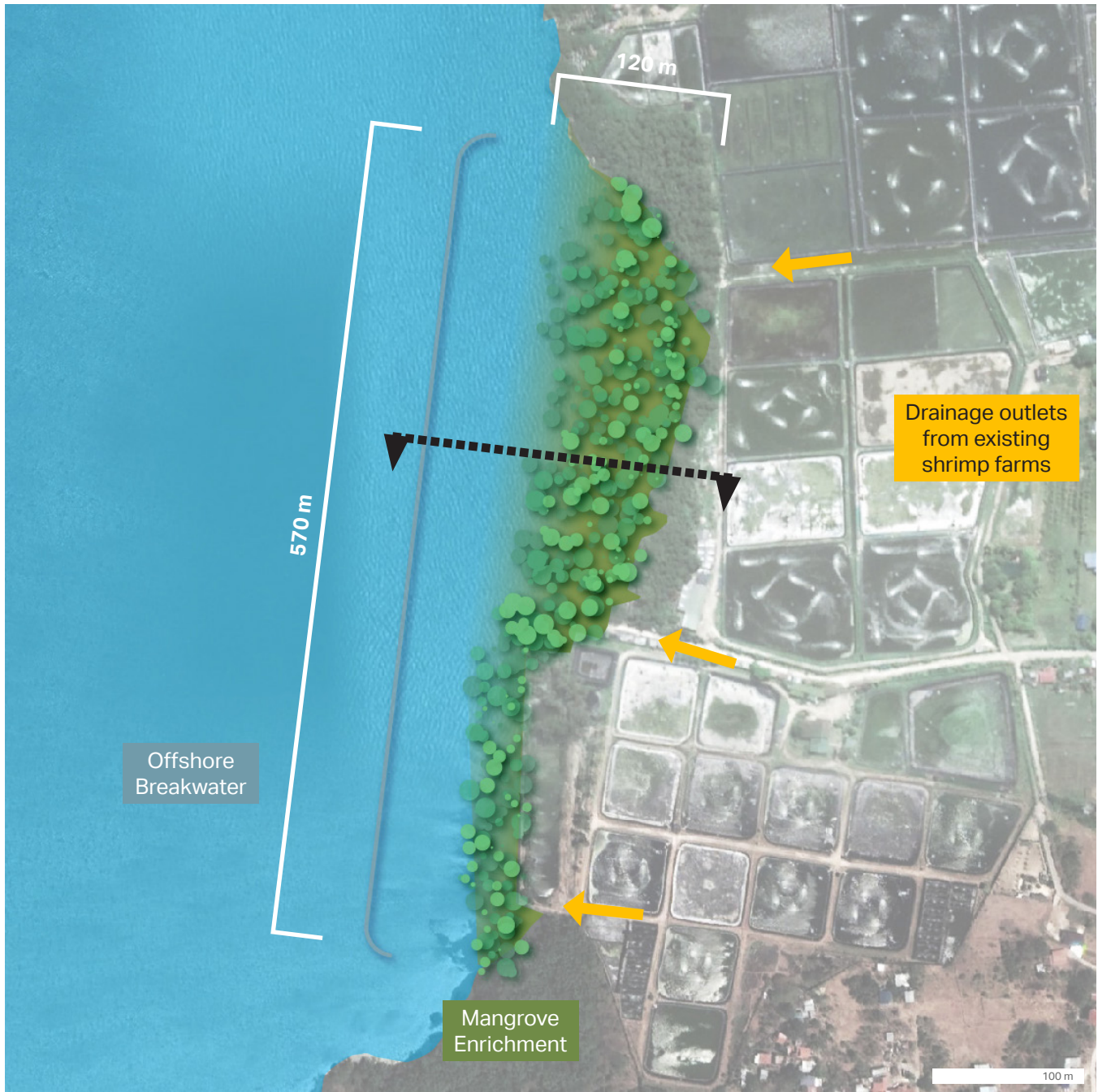
A proposed wetland area shall be created through mangrove restoration at the two (2) identified locations of the discharge point of the shrimp farms. The wetland area will act as a secondary natural filter to further improve the quality of the treated water. An offshore breakwater shall be installed in the form of gabion oyster boxes to protect the seedlings from any wave action and will also serve as another layer of natural filtration system for the wastewater.



Calatagan GGI Concept Strategy Plan

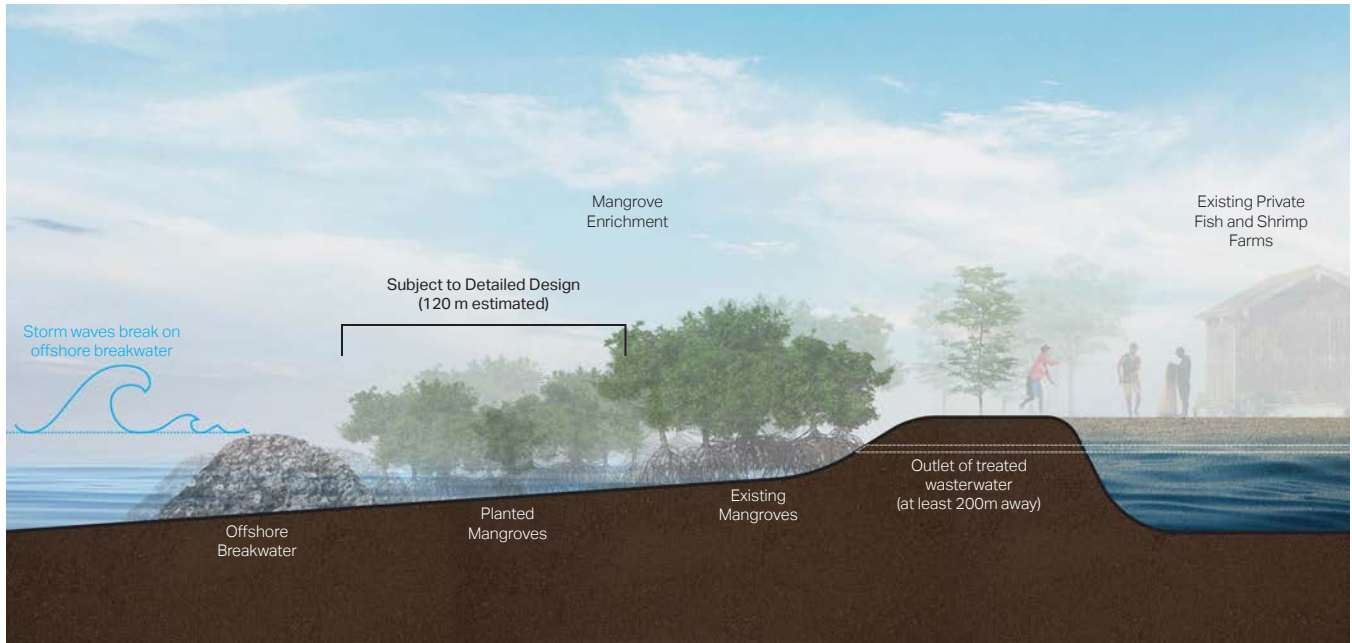
0.6 km
total length of
breakwater

3.7 ha
total land area
for planted
mangrove



Calatagan GGI Concept Strategy Blow-up Plan

Green-Gray Infrastructure Concept Strategy

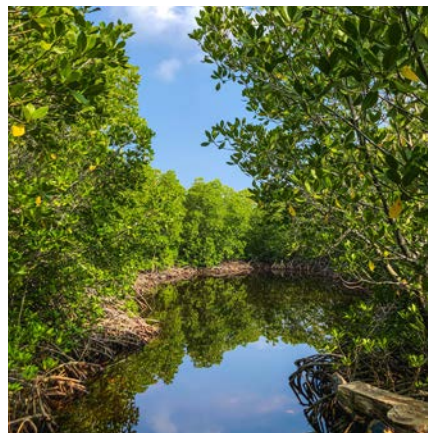


Calatagan GGI Concept Strategy Section



Offshore breakwater

Oyster nets, reef balls, or similar materials to be used for the offshore breakwater to protect mangroves



Mangrove enrichment

Due to their interconnecting roots and branches, mangroves reduce wave energy. In comparison, they only have a minimal impact on storm surge which penetrates the mangroves.



Climate smart shrimp aquaculture

Leverage the aquaculture sector to reduce environmental degradation and restore ecosystems in ways that can access investment capital and scale restoration mangroves.

Benefits of a GGI Solution

Aside from addressing the issue of improving the water quality being discharged to the coast that will improve the livelihood of the fishermen, other benefits from this are: a) enhancement of local biodiversity; b) protection of the shoreline from coastal erosion and such storm surge; and, c) the possibility of carbon sequestration through the mangrove forests.

Integrated Holistic Approach

The proposed GGI Solution is a pilot project that is envisioned to be potentially scaled-up or replicated in the other parts of the country. Whilst, the proposed solution is addressing the key issue at hand, it is important to note that identifying the root cause of the problem is essential to be addressed– in this case, the discharge from intensive culture practices.

Other Approaches

Additional approaches can also be considered to supplement the proposed GGI solution to increase effectiveness in addressing the challenge:

- Strict monitoring of the shrimp farms to comply with regulatory requirements for discharging wastewater.
- Implementation of Climate Smart Shrimp Aquaculture Technology. This can be successfully implemented with the participation of the shrimp farm owners to use abandoned or low-yield ponds for wetland treatment that will further enhance the GGI Solution to improve water quality.

Implementation Period

A timeline of 1-2 years is estimated to prepare, implement, and construct this GGI solution. Due to lack of data and information readily available, additional studies and scoping work shall be required to validate and collect more information regarding the key issues identified by the LGU and the assumptions that have provided during the concept design stage. The proposed project timeline shall cover the following phases:

1. Pre-design Phase

3-5 months;

This will include all the necessary study, scoping and data collection needed to establish, verify, and gather information required to proceed with a detailed engineering design.

2. Design Phase

2-4 months

A detailed engineering design shall be required to fully develop the conceptual design after using the verified data to accurately design the infrastructure according to the required specifications to address the key issue.

3. Implementation Phase

12-24 months

This will include the compliance to the required regulations/standards, seeking of approval of concerned agencies, and observance of due diligence. Upon obtaining the necessary approval and permits, the construction of the infrastructure or implementation of the prescribed program shall be done.

4. Operation, Maintenance and Adaptive Management

periodical

This shall include periodic monitoring of the infrastructure, maintenance and repair if required, evaluation of the impacts to surrounding communities, rehabilitation and retrofitting if required.

ANNEX 2:

Opportunities for Women Empowerment in Calatagan, Batangas

Seaweed farming is one of the major business ventures of women in Calatagan, particularly in Barangay 1, 2, 4, Balitoc, Gulod. It provides opportunities and livelihoods to women. Family is a best feature of a business entrepreneur, wherein, the father is the leader of the farming, while the mother is the one involved in tying and seedling preparation. Setting up is an easy process for the farmers. It does not require a lot of investment, since materials only includes bamboos, kulatay, tulos, soft straw, floaters and seedlings. Maintenance requires minimal time only. This includes replacement of each stick and strings every two to three times of use and the bamboos every year. There is really no need for other daily inputs. Planting and harvesting are the most time consuming activities for seaweed farming. Drying takes time as well.

Women's active participation is a great factor in seaweed farming. In seaweed farming, major decisions on establishing the farm, management and operation and input procurement were done by the husband. There were a number of women who decides on the selling and allocating the harvest and in the input procurement. There were also instances where both husband and wife decide together (i.e. management and operation of the seaweed farm and sell and allocation of seaweed). Very few of them record their expenses on the operation of seaweed and on household expenses. It is usually the wives who recall the amount of harvest and prices of seaweeds during the harvest months. Through seaweed farming, women were given chances to raise their voice and earn income from their own fruit of labor.



Active participation of women in seaweed farming:

Most of the women also were engaged in seaweeds processing such as pickles, jam and crackers. On 2014 through the Municipal Agriculture Office (MAO), the women from Batangas Seaweeds Farmers Association (BASEFA) and Layon Carbonan Chapter Seaweed Farmers (LCCSF) received materials and utensils for Seaweed Processing (pickles) under Bottom-up-Budgeting (BUB) Project. The project helped to uplift the status of women in the society. It generated income and alternative livelihood for the women. They were also given chances to showcase their local products during Formal Launching of Pasalubong Center in Calatagan, Batangas.

Prepared by:
Marvin M. Lumayor
Agricultural Technologist - Fisheries



Photos taken during the Distribution of Seaweeds Processing Materials and Utensils to Batangas Seaweeds Farmers Association (BASEFA)



Photos taken during the Distribution of Seaweeds Processing Materials and Utensils to Layon Carbonan Chapter Seaweed Farmers (LCCSF)



Photo taken during the Fromal Launching of Pasalubong Center in Calatagan, Batangas

List of Seaweed Farmers in Calatagan, Batangas:

Number of Male: 101

Number Female: 43

Total: **144**

Barangay 1

1. Abdon Brucal
2. Alex De Vera
3. Allan De Vera
4. Alvin Furaque
5. Analiza Diño
6. Angelita Medenilla
7. Armando Austria
8. Baby Genoveva Perado
9. Bibiana Perado
10. Calixto Sumanting
11. Catherine Refuerzo
12. Charibel Perado
13. Cristina Daluz
14. Dante Sanchez
15. Dolores Dacillo
16. Edgardo Daluz
17. Edson Daluz
18. Elsa Austria
19. Emmanuel Perado
20. Eusebio De Vera Jr.
21. Eusebio De Vera Sr.
22. Ezperanza Perado
23. Francisco Jose
24. Francisco M. Perado
25. Francisco S. Perado
26. Freddie Sumanting
27. Geraldine Paquibot
28. Jacklyn Jose
29. Jefferson Perado
30. Jericho Sumanting
31. John Paul Medenilla
32. Josephine Daluz
33. Juanito Perado
34. Lida Velarde
35. Luisito Gongon
36. Ma. Victoria Mercado
37. Magno Perado
38. Marcelo De Vera
39. Maribel Isidro
40. Marlon Perado
41. Michael Medenilla
42. Narciso Perado
43. Nelia Paderes
44. Nestor Paderes
45. Orlando Perado
46. Patrick Terrano

47. Paulino Daluz
48. Pedro Daluz
49. Ramon Hernandez
50. Randy Taroza
51. Ricardo Perado
52. Roberto Hernandez
53. Rolando Gordon
54. Romel Encarnacion
55. Rosendo Sumanting
56. Russel Medenilla
57. Russiler Medenilla
58. Sabino Perado
59. Tadio Perado
60. Teodoro Mercado
61. Tom Joshua Perad
62. Virgilio Aborquez

Barangay 2

1. Aldrich Limoico
2. Angeline Catalan
3. Anthony Ricablanca III
4. Antonio Ricablanca Jr.
5. Aurora Sembrana
6. Carmen Catalan
7. Danilo Aquino
8. Edgar Jhon Carlo Limoico
9. Edgar Limoico
10. Edgar Rhian Limoico
11. Ella Bañez
12. Fe Mendoza
13. Felito Sembrana Jr.
14. Fernando Austria
15. Flora Limoico
16. Francisco Catalan
17. Gemma Aquino
18. Gerald Mendoza
19. Grace Mendoza
20. Harvey Mendoza
21. Jaime Sembrana
22. Jayson Catalan
23. Jestoni Ricablanca
24. Laila Ricablanca
25. Lauro Mendoza
26. Manuel Aquino
27. Marilou Leonar
28. Mark Anthony Ricablanca
29. Melinda Aquino
30. Niel Ricablanca
31. Nita Ricablanca
32. Olivar Aquino
33. Rebecca Leonar
34. Rowena Sembrana
35. Sherwin Mendoza
36. Susan Aquino

37. Teresa Noquera
38. Timoteo Aquino
39. Venus Klaudine Limoico

Barangay 4

1. Geovanny Lozano
2. Renato Ansioco
3. Romy Austria

Barangay Balitoc

1. Abeta Fernandez
2. Adona Perran
3. Alvin Salanguit
4. Arnulfo Salanguit
5. Bienvenido Brucal
6. Brandon Zoreta
7. Daniel Brucal
8. Eddie Villaruz
9. Elmer Dimaala
10. Eugenia Villaruz
11. Florentino Fernandez
12. Gerardo Brucal
13. Leonida Mella
14. Leonilo Villaruz
15. Lito Beltran
16. Mamerto Iyahin
17. Marcelo Bulasag
18. Marcelo Fernandez
19. Marivic Villaruz
20. Mark Renzo Iyahin
21. Nelson Salanguit
22. Nicanor Brucal
23. Pedro Brucal
24. Precentacion Velarde
25. Richard Flordeliz
26. Roberto Brucal
27. Roberto Masusi
28. Rogelio Catoblas
29. Romnick Caballero
30. Ronel Velarde
31. Rosana Salanguit
32. Rowena Salanguit
33. Sony Ramirez
34. Susana Fernandez
35. Virgilio Salanguit

Barangay Gulod

1. Ariel Secondez
2. Guillermo Delos Reyes
3. Isabel Gonzales
4. Orlando Andulan
5. Roberto Beltran

ANNEX 3:

Results of Water Quality Analysis

*Republic of the Philippines*

PROVINCE OF BATANGAS

PROVINCIAL GOVERNMENT ENVIRONMENT AND NATURAL RESOURCES OFFICE

Provincial Capitol Compound, Kumintang Ibaba, Batangas City 4200

☎ : (043) 724-6553; 786-1245 | 📠 : (043) 724-6553

✉ : pg_enrobatangas@yahoo.com | 📘 : Pg-enro Batangas

November 23, 2021

HON. PETER OLIVER M. PALACIO

Municipal Mayor

Municipality of Calatagan, Batangas

Dear Mayor Palacio:

We are submitting the attached Investigation Report in relation to the complaint of Brgy. Balitoc against the alleged wastewater discharging activities from aqua culture farms which was assumed to affect the water quality and thus, their seaweed production. This office, together with MENRO LGU Calatagan and Barangay Balitoc conducted an on-site inspection and water sampling November 3, 2021, for this matter.

Please be informed that results of analysis of water samples taken from the outfall of aquaculture farms in Barangay Balitoc and marine water samples tested for Biochemical Oxygen Demand, Total Suspended Solids, phosphate and nitrate were compared with General Effluent Standards (GES) and Water Quality Guideline Values (WQGV) both for Class SC and SB Waters since in addition to the seaweed production, the marine water is intended for tourism activities and primary contact recreation such as swimming and bathing. With the foregoing, recommendations for the proponent, for MENRO Calatagan and to the community were drawn to address the issue.

For your information, reference and appropriate action. Thank you very much and best regards.

Very truly yours,


LUIS A. AWITAN
PG-ENR Officer



Republic of the Philippines
PROVINCE OF BATANGAS
PROVINCIAL GOVERNMENT ENVIRONMENT AND NATURAL RESOURCES OFFICE

Provincial Capitol Compound, Kumintang Ibaba, Batangas City 4200
 ☎ : (043) 724-6553; 786-1245 | 📠 : (043) 724-6553
 📧 : pg_enrobatangas@yahoo.com | 📘 : Pg-enro Batangas

INSPECTION REPORT

SUBJECT : Investigation Report regarding Alleged Wastewater Discharge at Calatagan, Batangas

DATE OF ACTIVITY : November 3, 2021

PERSONS INVOLVED : Gina Rowena O. Medenilla, SEMS, PGENRO
 Dianne Coleen Perez, EMS I
 Robert A. Andal, Lab Tech II
 Marvin M. Lumayor, Fishery Technician, LGU Calatagan

BACKGROUND

LGU Calatagan sought the help of PGENRO to conduct on-site inspection and water sampling in relation to the complaint of Brgy. Balitoc against the alleged wastewater discharging activities from aqua culture farms. They believe that the wastewater discharge affects the growth of the seaweed because it changes the water quality of the marine environment where their seaweeds are grown. A joint inspection with MENRO LGU Calatagan, Barangay Balitoc in Calatagan and this office was conducted on November 3, 2021 for this matter.

In a brief meeting before the conduct of sampling, Mr. Lumayor said that Brgy. Balitoc, made a petition to the Mayor's Office to permanently stop the operation of aquaculture which they believe affects the productivity of their seaweeds. Results of analysis will be used as basis for closure of the aquaculture if found non-compliant.

FINDINGS/ISSUES:

On-Site inspection and Observations

- Two teams simultaneously conducted water sampling and on-site inspection. Inspection was conducted at around 1000H in each of the four (4) aquaculture farms and following were observed:

Table 1. On-site observation on the complained aquaculture farms

AQUAFARM	Date and Time of Inspection	Findings	Remarks
BMW; O&M and Dos Aqua Farm	November 3, 2021@1000H	<ul style="list-style-type: none"> ❖ BMW has 6 fishponds: 5 for O&M and 6 for Dos Aqua Farm ❖ There are three (3) settling ponds inside ❖ Use of probiotics is done for water treatment prior to discharge to Calatagan Bay 	<ul style="list-style-type: none"> ❖ With ECC and all other permits are updated ❖ Solid waste management is in place. Solid wastes are being hauled.
Batangas Aqua Farm	November 3, 2021@1040H	<ul style="list-style-type: none"> ❖ There are 13 fishponds inside ❖ There is a sedimentation pond ❖ Use of probiotics is done for water treatment prior to discharge to Calatagan Bay 	<ul style="list-style-type: none"> ❖ With ECC and all other permits are updated ❖ No production during the conduct of on-site inspection

Cuala Farm	November 3, 2021@1114H	<ul style="list-style-type: none"> ❖ There are 5 fishponds inside ❖ There is a settling pond to separate the water and sludge. The separated water layer is further treated with chlorine prior to its discharge through a submersible pump to Calatagan Bay. No test is done to check the residual chlorine but water is discharged after seven days and if it has turned green. 	<ul style="list-style-type: none"> ❖ With ECC and all other permits are updated ❖ No production during the conduct of on site inspection ❖ Solid wastes i.e. drums, sacks, pet bottles are not properly contained
Alejandro Farm	November 3, 2021@1203H	<ul style="list-style-type: none"> ❖ There are 8 fishponds inside ❖ There is no settling pond to separate the water and sludge. The separated water layer is directly discharged without chlorination. According to the owner/manager the sludge is retained in the middle part of the pond since their pond has no liner unlike to other fishponds nearby 	<ul style="list-style-type: none"> ❖ With ECC and all other permits are updated

Table 2. Water Sampling Stations and Onsite Observation

Laboratory Sample Number	Date and Time of Sampling	Type of Sample/Sample Identification	Remarks
WM-21-1934	November 3, 2021@1000H	Wastewater/BMW, Dos Aqua Farm, O&B Outfall	Sampling conducted under fair weather condition, water sample is greenish in color, foul odor inside is noticeable
WM-21-1935	November3, 2021@1040H	Wastewater/Batangas Aqua Farm Outfall	Sampling conducted under fair weather condition; water sample is greenish in color
WM-21-1936	November3, 2021@1114H	Wastewater/Cuala Farm Outfall	Sampling conducted under fair weather condition; water sample is clear
WM-21-1937	November3, 2021@1203H	Wastewater/Alejandro Farm Outfall	Sampling conducted under fair weather condition; water sample is clear
WM-21-1938	November3, 2021@0952H	Marine Water/Across Alejandro Farm	Sampling conducted under fair weather condition, water sample is slightly turbid in color , taken less than 500m away from Alejandro Farm; mangrove area
WM-21-1939	November3, 2021@0958H	Marine Water/Across Cuala Farm	Sampling conducted under fair weather condition, water sample is slightly turbid , taken less than 500m away from Cuala Farm; mangrove area; solid wastes i.e. plastic cups; plastic bottles attached in the mangroves
WM-21-1940	November3, 2021@1005H	Marine Water/Across BMW, Dos Aqua and OB Farm	Sampling conducted under fair weather condition, water sample is slightly brown in color , taken less than 500m away from Alejandro Farm; mangrove area; 'stale' odor was observed during sampling
WM-21-1941	November3, 2021@1010H	Marine Water/Across Batangas Aqua Farm	Sampling conducted under fair weather condition, water sample is slightly turbid /brown in color , taken less than 500m away from Alejandro Farm; mangrove area; with greenish water coming out from the outfall area observed during sampling

Table 3. Result of Analysis of Water Sampling on November 3, 2021

PARAMETER	Laboratory Sample No.				General Effluent Standard (GES) Class SC	General Effluent Standard (GES) Class SB
	WM-21-1934 BMW, Dos Aqua Farm, O&B Outfall @1000H	WM-21-1935 Batangas Aqua Farm Outfall 1040H	WM-21-1936 Cuala Farm Outfall @1114H	WM-21-1937 Alejandro Farm Outfall @1203H		
pH	6.975	7.058	7.352	7.234	6.0-9.0	6.5-9.0
Temperature, °C (Laboratory Reading)	21.8	21	21.9	23.0		
Dissolved Oxygen (DO), mg/L	4.0	1.7	7.2	3.9	-	-
BOD	24	13	30	17	100	30
Total Suspended Solids (TSS), mg/L	46	51	96	57	100	70
Phosphate, mg/L	3.5095	0.1169	0.8191	0.1432	4	1
Nitrate, mg/L	1.8026	1.8556	0.7622	3.2933	20	20

PARAMETER	Laboratory Sample No.				Water Quality Guideline Value (WQGV) Class SC	Water Quality Guideline Value (WQGV) Class SB
	WM-21-1938 Across Alejandro Farm @0952H	WM-21-1939 Across Cuala Farm @0958H	WM-21-1940 Across BMW; Dos Aqua and OB Farm @1005H	WM-21-1941 Across Batangas Aqua Farm @1010H		
Dissolved Oxygen, mg/L	4.2	4.1	4.2	5.2	5 (minimum)	5 (minimum)
Total Suspended Solids, mg/L	46	38	35	57	80	50
Phosphate, mg/L	0.0406	0.0921	0.2109	0.0425	0.2	0.2
Nitrate, mg/L	0.7162	1.0096	0.5814	1.5942	10	10

INTERPRETATION OF RESULTS

Since the intended use of the water body in Calatagan includes tourism activities and primary contact recreation such as swimming and bathing, we also compared it with WQGV for Class SB in addition to Class SC of DAO 2016-08.

The results of analysis of water samples taken from the outfall of aquaculture farms at Barangay Balitoc tested for BOD, TSS, phosphate and nitrate conform to the General Effluent Standard for Class SC Waters. Even if there is no GES (Class SC & Class SB) for DO, the results of analysis of DO for BMW-Dos Aqua, Alejandro Aqua and Batangas Aqua Farm are relatively low, with respective values of 4.0, 1.7 and 3.9 mg/L/. The 97 mg/L result of TSS analysis of Cuala Farm Outfall exceeded the 100mg/L GES for Class SB for the said parameter. BOD analysis result of Cuala Farm Outfall is borderline the GES for Class SB water with a result of 30mg/L.

On the other hand, for the marine samples, DO analysis results of samples taken across the Alejandro Farm, Cuala Farm and across BMW-Dos Aqua and OB Farm did not meet the WQGV 5mg/L (minimum) with values of 4.2, 4.1 and 4.2 mg/L, respectively. Also, TSS analysis results for Across Batangas Aqua Farm exceeded the 57 mg/L WQGV for class SB water. Lastly, the sample taken across BMW-Dos Aqua, and OB Farm exceeded the 0.2 mg/L WQGV for phosphate for Class SB Waters with a result of 0.2109 mg/L.

RECOMMENDATIONS:

Based on the findings above, the following recommendations were drawn:

1. For the aquaculture farms to monitor the efficiency of the water treatment procedure that they use by first checking the activity of the probiotics and testing the water quality per stage of treatment, i.e., with and without treatment. This will help them decide if the water needs further treatment prior to discharge. Also, it is recommended to seek the assistance of water treatment providers for advice on how to effectively treat their wastewater for a more specific treatment procedures and solutions.
2. For MENRO Calatagan to thoroughly investigate and identify the problem on what other factors affect the productivity/growth seaweed through the help of experts (or conduct benchmarking) in seaweed production. This will address the root cause of the problem and from there plan for a sustainable solution and help local community in their livelihood.
3. For MENRO Calatagan to include the monitoring of the discharge from these farms to their water quality monitoring activities for baselining that may later help in policy

formulation and water pollution control management. Also it will be beneficial to enter into a MOA with DENR EMB for their recreational water quality monitoring program.


4. To implement the Integrated Coastal and Marine Spatial Use Zone Plan in Balayan Bay, specifically in the Culture Zone which identify the functional areas such as mariculture and fishpond. These two zones should not interfere with each other because of the potential adverse impact of partially treated wastewater into the seaweed farm.
5. To mobilize the community and conduct a continuous coastal clean-up drive specifically in the mangrove area since solid wastes are visibly attached to the roots and branches of mangroves.

Prepared by:



GINA ROWENA O. MEDENILLA
Senior Environmental Management Specialist

Reviewed by:



BEVERLY F. BALAHIBO
Su.EMS

Approved by:



MARIVIC P. ESMAS
PGADH

Noted by:



LUIS A. AWITAN
PG-ENR Officer



Republic of the Philippines
PROVINCE OF BATANGAS
ENVIRONMENT AND NATURAL RESOURCES OFFICE
 NATURAL RESOURCES UTILIZATION & ENVIRONMENTAL QUALITY MANAGEMENT DIVISION (NRUEQMD)
BATANGAS ENVIRONMENT LABORATORY

Capitol Site, Batangas City, Philippines 4200
 Email Address: pgenrobel@gmail.com
 Telephone Numbers: (+63 43) 786-1245

Customer : Complaint- Calatagan
 Address : Calatagan, Batangas
 Date Sampled : November 3, 2021
 Sampled by : BEL Staff

Date Received : November 3, 2021
 Time Received : 1540H
 Date of Analysis : November 3-16, 2021
 Date Reported : November 17, 2021
 Test Report No. : 21-861M

TEST REPORT

Laboratory Sample No.	Sample Type	Date / Time Sampled	Identification
WM-21-1934	Brackish Water	11/03/2021 @1000H	BMW, O&B, DOS Aquafarm
WM-21-1935	Brackish Water	11/03/2021 @1040H	Batangas Aquafarm
WM-21-1936	Brackish Water	11/03/2021 @1114H	Cuala Farm
WM-21-1937	Brackish Water	11/03/2021 @1203H	Alejandro Farm

PHYSICO-CHEMICAL ANALYSIS

PARAMETER	UNIT	Laboratory Sample No.				Date and Time of Analysis
		WM-21-1934	WM-21-1935	WM-21-1936	WM-21-1937	
Dissolved Oxygen ⁴	mg/L	4.0	1.7	7.2	3.9	11/03/2021 1545H
Biochemical Oxygen Demand ⁵	mg/L	24	13	30	17	11/03/2021 1545H
Total Suspended Solids ⁶	mg/L	46	51	96	57	11/08/2021 0900H
Phosphate as Phosphorus ⁸	mg/L	3.5095	0.1169	0.8411	0.1432	11/16/2021 1030H
Nitrate as Nitrogen ⁹	mg/L	1.8126	1.8556	0.7662	3.2933	11/05/2021 1404H

Remarks:

- (a) Samples shall be taken between 9:00AM and 2:00 PM
- (b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is up to 10% & that it will not cause any risk to human health and the environment.

Methods

- ¹ Electrometric (Laboratory)
- ² Laboratory & Field Methods
- ³ Visual Comparison (with filtration)
- ⁴ Iodometric
- ⁵ 5-day BOD Test
- ⁶ Gravimetric dried at 103-105°C
- ⁷ Liquid-Liquid, Partition-Gravimetric
- ⁸ Stannous Chloride
- ⁹ Brucine Sulphanilic
- ¹⁰ Atomic Absorption Spectrometric
- ¹¹ HVG – Atomic Absorption Spectrometric
- ¹² Closed Reflux
- ¹³ Turbidity Meter
- ¹⁴ Salinity Meter
- ¹⁵ Gravimetric dried at 120°C

*Results of analysis are those obtained at the time of examination and relate only to the sample/s tested. Sample/s will be kept for a week from the date of analysis.

Method References:

- DENR Administrative Order No. 2016-08
- Standard Methods for the Examination of Water and Wastewater. 22nd ed. Maryland: United Book Press, Inc.

Analyzed by:

CHARYL LORRAINE H. ALORIA, RCh.
 Environmental Management Specialist II
 License No.: 0012869
 Valid Until: 04/01/2022

Checked by:

GINA ROWENA M. MEDENILLA, RCh.
 Senior Environmental Management Specialist
 License No.: 0010399
 Valid Until: 01/24/2023

Approved by:

BEVERLY F. BALAHIBO, RCh.
 Supvg. Environmental Management Specialist
 License No.: 009917
 Valid Until: 08/12/2024

Noted by:

MARIYIC P. ESMAS, RCh.
 Assistant Department Head
 License No.: 7468
 Valid Until: 01/28/2023



Republic of the Philippines
PROVINCE OF BATANGAS
ENVIRONMENT AND NATURAL RESOURCES OFFICE
 NATURAL RESOURCES UTILIZATION & ENVIRONMENTAL QUALITY MANAGEMENT DIVISION (NRUEQMD)
BATANGAS ENVIRONMENT LABORATORY

Capitol Site, Batangas City, Philippines 4200
 Email Address: pgenrobel@gmail.com
 Telephone Numbers: (+63 43) 786-1245

Customer : Complaint- Calatagan	Date Received : November 3, 2021
Address : Calatagan, Batangas	Time Received : 1540H
Date Sampled : November 3, 2021	Date of Analysis : November 3-16, 2021
Sampled by : BEL Staff	Date Reported : November 17, 2021
	Test Report No. : 21-861M

TEST REPORT

Laboratory Sample No.	Sample Type	Date / Time Sampled	Identification
WM-21-1938	Marine Water	11/03/2021 @0952H	Alejandro Farm
WM-21-1939	Marine Water	11/03/2021 @0958H	Cuala Farm
WM-21-1940	Marine Water	11/03/2021 @1005H	BMW, O&B, DOS Aquafarm
WM-21-1941	Marine Water	11/03/2021 @1010H	Batangas Aquafarm

PHYSICO-CHEMICAL ANALYSIS						
PARAMETER	UNIT	Laboratory Sample No.				Date and Time of Analysis
		WM-21-1938	WM-21-1939	WM-21-1940	WM-21-1941	
Dissolved Oxygen ⁴	mg/L	4.2	4.1	4.2	5.2	11/03/2021 1545H
Total Suspended Solids ⁶	mg/L	46	38	35	57	11/08/2021 0900H
Phosphate as Phosphorus ⁸	mg/L	0.0406	0.0921	0.2109	0.0425	11/16/2021 1030H
Nitrate as Nitrogen ⁹	mg/L	0.7162	1.0096	0.5814	1.5942	11/05/2021 1404H

Remarks:

- (a) Samples shall be taken between 9:00AM and 2:00 PM
- (b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is up to 10% & that it will not cause any risk to human health and the environment.

Methods

- | | | |
|---|---|--|
| ¹ Electrometric (Laboratory) | ² Laboratory & Field Methods | ³ Visual Comparison (with filtration) |
| ⁴ Iodometric | ⁵ 5-day BOD Test | ⁶ Gravimetric dried at 103-105°C |
| ⁷ Liquid-Liquid, Partition-Gravimetric | ⁸ Stannous Chloride | ⁹ Brucine Sulphanilic |
| ¹⁰ Atomic Absorption Spectrometric | ¹¹ HVG – Atomic Absorption Spectrometric | ¹² Closed Reflux |
| ¹³ Turbidity Meter | ¹⁴ Salinity Meter | ¹⁵ Gravimetric dried at 120°C |

*Results of analysis are those obtained at the time of examination and relate only to the sample/s tested. Sample/s will be kept for a week from the date of analysis.

Method References:

- DENR Administrative Order No. 2016-08
- Standard Methods for the Examination of Water and Wastewater. 22nd ed. Maryland: United Book Press, Inc.

Analyzed by:


CHARYL LORRAINE H. ALORIA, RCh.
 Environmental Management Specialist II
 License No.: 0012869
 Valid Until: 04/01/2022

Checked by:


GINA ROWENA C. MEDENILLA, RCh.
 Senior Environmental Management Specialist
 License No.: 0010399
 Valid Until: 01/24/2023

Approved by:


BEVERLY F. BALAHIBO, RCh.
 Supvg. Environmental Management Specialist
 License No.: 009917
 Valid Until: 08/12/2024

Noted by:


MARIVIC P. ESMAS, RCh.
 Assistant Department Head
 License No.: 7468
 Valid Until: 01/28/2023



Republic of the Philippines
PROVINCE OF BATANGAS
ENVIRONMENT AND NATURAL RESOURCES OFFICE
 NATURAL RESOURCES UTILIZATION & ENVIRONMENTAL QUALITY MANAGEMENT DIVISION (NRUEQMD)
BATANGAS ENVIRONMENT LABORATORY

Capitol Site, Batangas City, Philippines 4200
 Email Address: pganobel@gmail.com
 Telephone Numbers: (+63 43) 786-1245

Customer : Complaint- Calatagan
 Address : Calatagan, Batangas
 Date Sampled : November 3, 2021
 Sampled by : BEL Staff

Date Received : November 3, 2021
 Time Received : 1540H
 Date of Analysis : November 3-16, 2021
 Date Reported : November 17, 2021
 Test Report No. : 21-861M

TEST REPORT

Laboratory Sample No.	Sample Type	Date / Time Sampled	Identification
WM-21-1934	Brackish Water	11/03/2021 @1000H	BMW, O&B, DOS Aquafarm
WM-21-1935	Brackish Water	11/03/2021 @1040H	Batangas Aquafarm
WM-21-1936	Brackish Water	11/03/2021 @1114H	Cuala Farm
WM-21-1937	Brackish Water	11/03/2021 @1203H	Alejandro Farm

PHYSICO-CHEMICAL ANALYSIS						
PARAMETER	UNIT	Laboratory Sample No.				Date and Time of Analysis
		WM-21-1934	WM-21-1935	WM-21-1936	WM-21-1937	
Dissolved Oxygen ⁴	mg/L	4.0	1.7	7.2	3.9	11/03/2021 1545H
Biochemical Oxygen Demand ⁵	mg/L	24	13	30	17	11/03/2021 1545H
Total Suspended Solids ⁶	mg/L	46	51	96	57	11/08/2021 0900H
Phosphate as Phosphorus ⁸	mg/L	3.5095	0.1169	0.8411	0.1432	11/16/2021 1030H
Nitrate as Nitrogen ⁹	mg/L	1.8126	1.8556	0.7662	3.2933	11/05/2021 1404H

Remarks:

- (a) Samples shall be taken between 9:00AM and 2:00 PM
 (b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is up to 10% & that it will not cause any risk to human health and the environment.

Methods

- | | | |
|---|---|--|
| ¹ Electrometric (Laboratory) | ² Laboratory & Field Methods | ³ Visual Comparison (with filtration) |
| ⁴ Iodometric | ⁵ 5-day BOD Test | ⁶ Gravimetric dried at 103-105°C |
| ⁷ Liquid-Liquid, Partition-Gravimetric | ⁸ Stannous Chloride | ⁹ Brucine Sulphanilic |
| ¹⁰ Atomic Absorption Spectrometric | ¹¹ HVG – Atomic Absorption Spectrometric | ¹² Closed Reflux |
| ¹³ Turbidity Meter | ¹⁴ Salinity Meter | ¹⁵ Gravimetric dried at 120°C |

*Results of analysis are those obtained at the time of examination and relate only to the sample/s tested. Sample/s will be kept for a week from the date of analysis.

Method References:

- DENR Administrative Order No. 2016-08
 Standard Methods for the Examination of Water and Wastewater, 22nd ed. Maryland: United Book Press, Inc.

Analyzed by:

CHARYL LORRAINE H. ALORIA, RCh.
 Environmental Management Specialist II
 License No.: 0012869
 Valid Until: 04/01/2022

Checked by:

GINA ROWENA C. MEDENILLA, RCh.
 Senior Environmental Management Specialist
 License No.: 0010399
 Valid Until: 01/24/2023

Approved by:

BEVERLY F. BALAHIBO, RCh.
 Supvg. Environmental Management Specialist
 License No.: 009917
 Valid Until: 08/12/2024

Noted by:

MARIVIC P. ESMAS, RCh.
 Assistant Department Head
 License No.: 7468
 Valid Until: 01/28/2023



Republic of the Philippines
PROVINCE OF BATANGAS
ENVIRONMENT AND NATURAL RESOURCES OFFICE
 NATURAL RESOURCES UTILIZATION & ENVIRONMENTAL QUALITY MANAGEMENT DIVISION (NRUEQMD)
BATANGAS ENVIRONMENT LABORATORY

Capitol Site, Batangas City, Philippines 4200
 Email Address: ppenrobel@gmail.com
 Telephone Numbers: (+63 43) 786-1245

Customer : Complaint- Calatagan
 Address : Calatagan, Batangas
 Date Sampled : November 3, 2021
 Sampled by : BEL Staff

Date Received : November 3, 2021
 Time Received : 1540H
 Date of Analysis : November 3-16, 2021
 Date Reported : November 17, 2021
 Test Report No. : 21-861M

TEST REPORT

Laboratory Sample No.	Sample Type	Date / Time Sampled	Identification
WM-21-1938	Marine Water	11/03/2021 @0952H	Alejandro Farm
WM-21-1939	Marine Water	11/03/2021 @0958H	Cuala Farm
WM-21-1940	Marine Water	11/03/2021 @1005H	BMW, O&B, DOS Aquafarm
WM-21-1941	Marine Water	11/03/2021 @1010H	Batangas Aquafarm

PHYSICO-CHEMICAL ANALYSIS						
PARAMETER	UNIT	Laboratory Sample No.				Date and Time of Analysis
		WM-21-1938	WM-21-1939	WM-21-1940	WM-21-1941	
Dissolved Oxygen ⁴	mg/L	4.2	4.1	4.2	5.2	11/03/2021 1545H
Total Suspended Solids ⁶	mg/L	46	38	35	57	11/08/2021 0900H
Phosphate as Phosphorus ⁸	mg/L	0.0406	0.0921	0.2109	0.0425	11/16/2021 1030H
Nitrate as Nitrogen ⁹	mg/L	0.7162	1.0096	0.5814	1.5942	11/05/2021 1404H

Remarks:

(a) Samples shall be taken between 9:00AM and 2:00 PM

(b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is up to 10% & that it will not cause any risk to human health and the environment.

Methods

¹ Electrometric (Laboratory)

² Laboratory & Field Methods

³ Visual Comparison (with filtration)

⁴ Iodometric

⁵ 5-day BOD Test

⁶ Gravimetric dried at 103-105°C

⁷ Liquid-Liquid, Partition-Gravimetric

⁸ Stannous Chloride

⁹ Brucine Sulphanilic

¹⁰ Atomic Absorption Spectrometric

¹¹ HVG – Atomic Absorption Spectrometric

¹² Closed Reflux

¹³ Turbidity Meter

¹⁴ Salinity Meter

¹⁵ Gravimetric dried at 120°C

*Results of analysis are those obtained at the time of examination and relate only to the sample/s tested. Sample/s will be kept for a week from the date of analysis.

Method References:

DENR Administrative Order No. 2016-08

Standard Methods for the Examination of Water and Wastewater, 22nd ed. Maryland: United Book Press, Inc.

Analyzed by:

CHARYL LORRAINE H. ALORIA, RCh.

Environmental Management Specialist II

License No.: 0012869

Valid Until: 04/01/2022

Checked by:

GINA ROWENA O. MEDENILLA, RCh.

Senior Environmental Management Specialist

License No.: 0010399

Valid Until: 01/24/2023

Approved by:

BEVERLY F. BALAHIBO, RCh.

Supvg. Environmental Management Specialist

License No.: 009917

Valid Until: 08/12/2024

Noted by:

MARIVIC B. ESMAS, RCh.

Assistant Department Head

License No.: 7468

Valid Until: 01/28/2023

PHOTO DOCUMENTATION



Meeting with the Barangay Officials of Brgy. Balitoc together with Mr. Marvin Lumayor from MENRO Calatagan last November 03, 2021



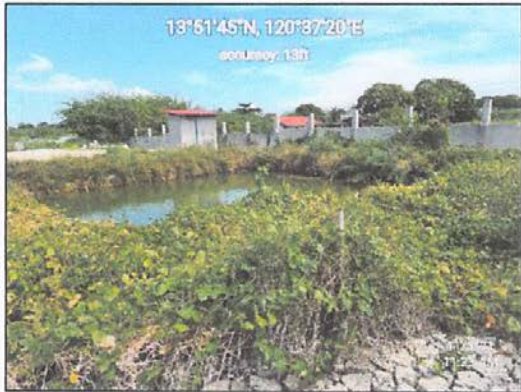
One sampling team obtain water sample where the effluent of the aquaculture flows to the sea / marine water



Effluent of BMW, O&M and Dos Aquafarm



Outfall from settling pond of Cuala Farm



Settling pond of Cuala Farm



Oufall of Alejandro Farm



Solid waste is piled up in a corner / area



Outlet of the fishpens to settling pond and outlet to drain for BMW, O&B and Dos Aquafarm



Outfall from settling pond of Batangas Aquafarm

Facts and figures

1.

AECOM launched when a handful of employees from design and engineering companies shared a dream of creating an industry-leading firm dedicated to making the world a better place.

2.

AECOM became an independent company formed by the merger of five entities. While our official founding was in 1990, many of our predecessor firms had distinguished histories dating back more than 120 years.

3.

Since then, more than 50 companies have joined AECOM and, in 2007, we became a publicly traded company on the New York Stock Exchange.

4.

As the world's trusted infrastructure consulting firm with an unrivaled heritage delivering design, planning, engineering, consulting and construction management solutions.

AECOM in the Philippines

Established in 1996, AECOM in the Philippines has grown into a 200+ strong team of planners, engineers, environmental scientists, geologists, landscape architects and technical management specialists driven by a common purpose to deliver a better world.

Creating Sustainable Legacies

We are leading the change towards a more sustainable and equitable future by partnering with our clients to provide solutions that help them achieve their environmental and social value ambitions and advancing sustainable business operations to help prevent the worst impacts of climate change.



47,000 people



Fortune 500 #163



Work across seven continents



2 Million Work Hours Awards



Revenue \$13.2 billion in fiscal year 2020



100% Rating on Corporate Equality Index / Best Places to Work for LGBT Equality 2021

Accolades

- ENR rankings No 1
- Environment Firm
- Transportation Design Firm
- Facilities Design Firm
- Mixed-Used Buildings
- Education Buildings
- Aviation
- Highways
- Chemical Remediation
- Top 10 Military Friendly company 2020
- Military Friendly® Top 10 Company
- Military Friendly® Top 10 Supplier
- Diversity Program
- Military Friendly® Top 10 Employer
- Military Friendly® Top 10 Spouse Employer
- National safety council: 155 Perfect Record Awards
- Achieved a minimum of 12 consecutive months without a recordable injury or illness.
- For each award, achieved a minimum of one million consecutive hours without an injury or illness that resulted in days away from work and zero fatalities.



Bogota, Colombia (C) Conservation International

Since 1987, Conservation International (CI) has worked to spotlight and secure the critical benefits that nature provides to humanity.

Combining fieldwork with innovations in science, policy and finance, we’ve helped protect more than 6 million square kilometers (2.3 million square miles) of land and sea across more than 70 countries. Today, with offices in more than two dozen countries and a worldwide network of thousands of partners, our reach is truly global. But we couldn’t have made it this far without you. Your contributions support our work to protect nature for the benefit of us all.

CI’s work in Asia-Pacific began in 1989 with a pledge to protect some three dozen of the Earth’s biodiversity hotspots, including the Philippine archipelago and the Sundaland rainforests of Southeast Asia.

Since then, our focus in Asia-Pacific has expanded across the region to include other ocean and forest areas considered critical to human well-being. We help improve food security, support innovative financing for conservation projects and establish protected area networks that encompass essential ecosystems.

CI’s unique combination of experience with ecosystem conservation and restoration, community co-design, and stakeholder leadership allows us to advise and lead [green-gray initiatives](#) around the world in collaboration with local, regional and national governments and engineering partners.

Priorities

- **Stabilizing our climate by protecting and restoring nature**
- **Doubling ocean protection**
- **Expanding planet-positive economies**

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle — from planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical expertise and innovation, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a *Fortune 500* firm and its Professional Services business had revenue of \$13.2 billion in fiscal year 2020. See how we are delivering sustainable legacies for generations to come at [aecom.com](https://www.aecom.com) and [@AECOM](https://twitter.com/AECOM).