GUINEA CURRENT LARGE MARINE ECOSYSTEM PROJECT

MISSION REPORT ON ELLAH LAKES PLC AQUACULTURE COMPLEX, OBRIKOM, RIVERS STATE, NIGERIA

by

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Executive Summary

Ellah Lake PLC aquaculture complex (ELP) is located at Obrikom, near Omoku in the *ONE* Local Government Area (ONELGA) of Rivers State, in the Federal Republic of Nigeria.

ELP comprise of 100Ha surface area of grow-out aquaculture ponds. It has 1.2 Ha surface area nursery ponds and a well-engineered concrete tanks and raceways hatchery. It also has an intensive care culture unit for rearing fish from the fingerling stages to table size. Other components of the complex are feed mill, a piggery, a poultry and a palm oil palm plantation (POP)

Incorporated as a limited liability fish farm company in 1980 with an authorized share capital of one million shares (valued at N1each), ELP is the only aquaculture company listed on the Nigerian Stock Exchange (NSC) with share capital of over 250,000 shares.

Operating at full capacity, it is estimated that fry production from the approximately 10 MT-capacity hatchery tanks will be about 3,660,000 fish fry per cycle of 8 weeks. The nursery system with a total surface area of 1.15 Ha has a projected potential production of 1,145,000 fingerlings (30 g) per cycle, allowing for mortality rates of 20%. Operating at even 10% survival, fish output per crop from the 100 Ha surface area ponds will be estimated at over 1000 MT per crop for a possible 1.5-times cropping session in a year. Similarly, the intensive care unit, at a proposed stocking density of 200/m^3 is expected to yield about 14.6 MT of 0.5kg fish per cycle.

The feed mill with an installed production capacity of 3 MT of feed per one hour, the piggery, the poultry and the palm oil plantation in the aquaculture complex are other potential sources of revenue for the complex, if properly managed.

There are many constraints that militate against the realization of the full potential of the aquaculture complex. While the genesis of this appears to be the flooding of the facility about 8 years ago, other causal effects may be traced to lack of a good laboratory to provide support services for the hatchery and grow-out facilities, generally low level technical expertise to man the major units, high level of predation and poaching and a possible genetic mix of species resulting from the invasion of ponds by 'wild' species during the flood.

Five important issues have been identified as needing immediate redress if the facility is to realize its huge potential in a systematic and cost effective manner. These issues are: infrastructure development; laboratory support services; upgrade of technical expertise; general improvement in the administration; and recapitalization.

A help-line of between US$200,000-250,000 (two hundred thousand to two hundred and fifty thousand US Dollars) is proposed to get ELP fully rejuvenated and to be able to serve as a spring board from where smaller aquaculture units could reach out for various levels of assistance to produce fish for profit.

1.0 Introduction

1.1 Mission objectives and targets

The objective of this mission was to survey the area of Port Harcourt with regard to its aquaculture potentials; identify possible threats to the development of that sector and to identify possible partners and stakeholders in the aquaculture sector in Port Harcourt. In order to accomplish the set objectives in the long term, the team set out to:

- Do a quick appraisal of Ellah Lakes PLC (ELP) aquaculture complex; the biggest fish farm complex in the Port Harcourt area with a view to gaining insight into the potentials of this facility and the constraints that may be militating against the realization of its optimal potentials.
- Apply the results of this survey as a springboard by which the other small-holder aquaculture set-ups in the Port Harcourt area (Annex 1) could be helped in a systematic manner to rationalize their operations and be able to grow fish for profit.

1.2 Establishment and Geographical Location of Ella Lakes PLC.

The Ellah Lake PLC aquaculture complex comprise of 100Ha surface area of grow-out aquaculture ponds backed by 1.2 Ha surface area nursery ponds and a well-engineered concrete tanks and raceways hatchery. It also has an intensive care culture unit for rearing fish from the fingerling stages to table size. All the fish producing units are serviced by a 3MT/hr production-capacity feed mill. Other components of the complex comprise of a piggery, a poultry and a palm oil palm plantation (POP)

ELP is located at Obrikom, near Omoku in the *ONE* Local Government Area (ONELGA) of the Rivers State in the Federal Republic of Nigeria. Covering an estimated area of 150 Ha, ELP is located in the River Nun (Niger) flood plains. The land is serviced by the Ebiem stream, an arm of the Sombriero River, one of the longest tributaries of the Nun (Figure 1)

1.3 Historical perspectives and business status of the farm

Ellah Lakes PLC was established as a limited liability fish farm company in 1980 with an authorized share capital of one million shares (valued at N1each). In 1992, the company went public with an authorized share capital of 30 million shares and valued at N 1 per share. By 1999, the share capital had increased to 240 million shares valued at 0.5 N per share. The equity was Chief J. W. Ellah, Sons & Company (76.4%) and over 2000 other Nigerians (23.6%). Presently, Ellah Lakes PLC is the only aquaculture company listed on the Nigerian Stock Exchange (NSC) with share capital of 250,000 valued at 50k per share.

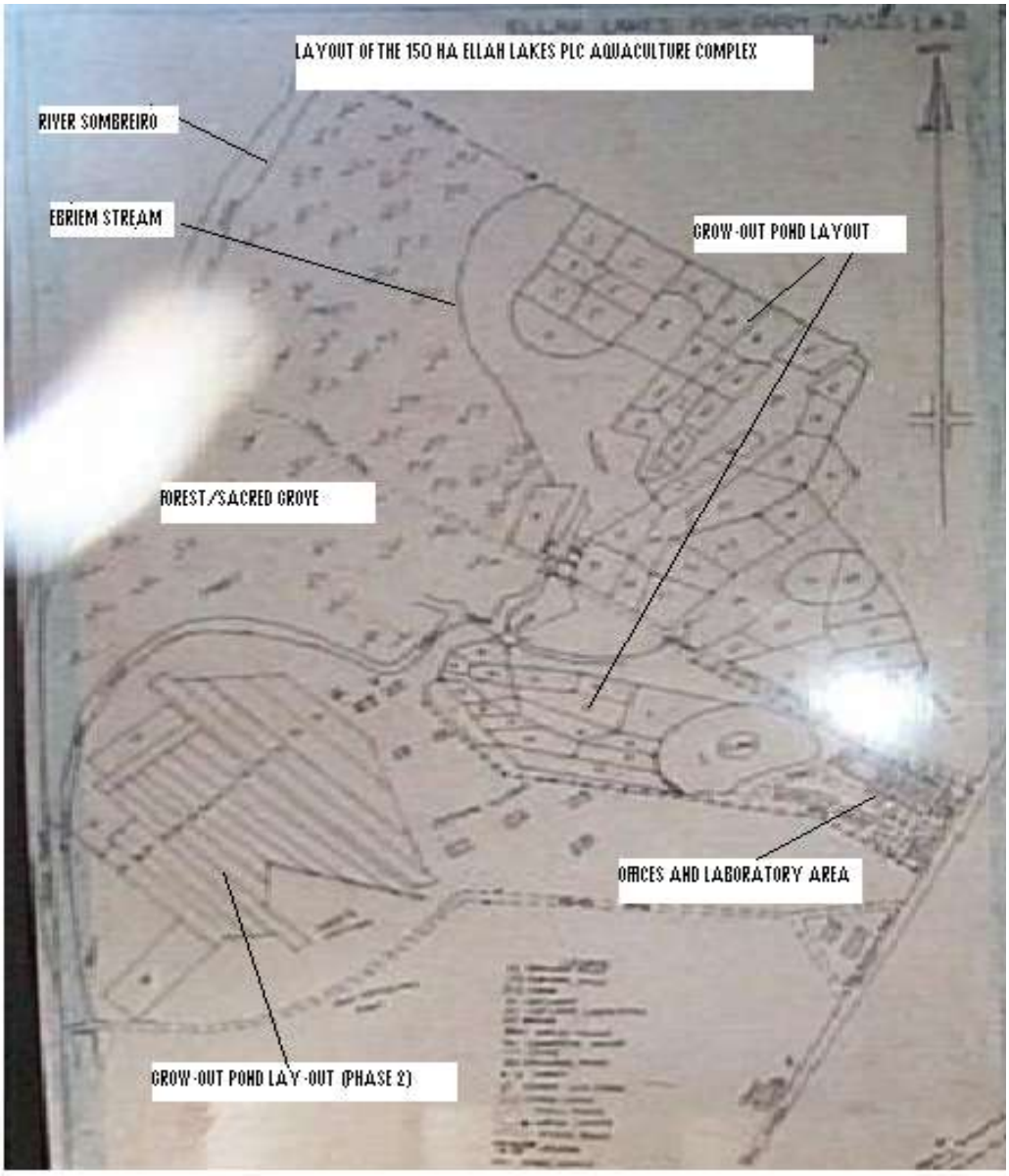


Figure 1. General Lay-out of the 150 Ha Ellah Lakes Aquaculture Complex, Obrikom, Rivers state, Nigeria.

1.4 Organizational Structure of the Farm.

Ellah Lakes PLC presently has an establishment of between 54-64 people (including estimated 10-man strong casual labour force. The current distribution of staff in different units of the complex is negatively skewed, if aquaculture is viewed as the main business of the complex. Furthermore, alignment of staff in the 3 major units of hatchery, nursery and grow-out operations is too diffused and do not seem to lend much support to staff being accountable for their respective actions. The personnel staff strength of 13% could also be lower. The breakdown of staff by units is presented as Figure 2. While the Ag. Administrative Manager should have the overall responsibility to managing the

facility, also having direct responsibilities of staff in 4 other may render him ineffective in the long run. The organizational structure, including the command-line is presented in Annex 2. An alternate interim crisis organizational structure is proposed (Annex 3) with corresponding staff strengths (Annex 4).

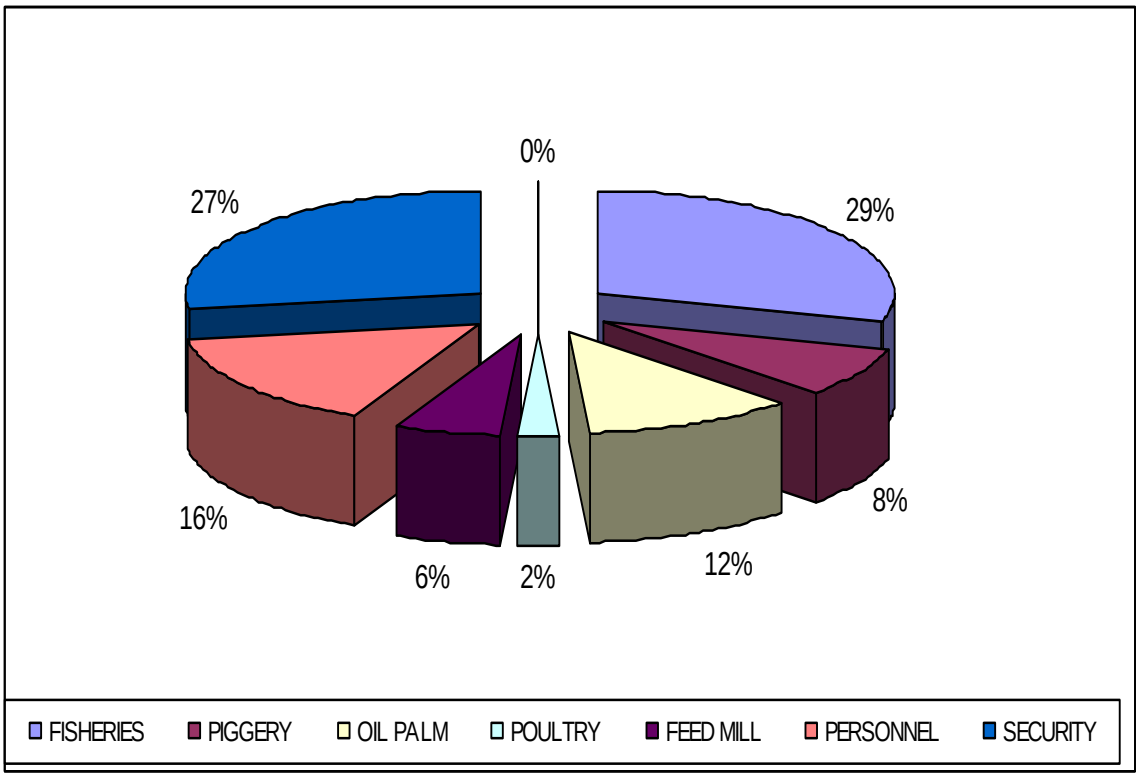


Figure 2. Structure of Staff Strength in Different Units at ELP.

2.0 Potential of Fisheries and Aquaculture Complex

2.1 Hatchery

The hatchery system of Ellah Lake PLC comprise of well-engineered concrete-type units made up of 12 circular tanks, 13 square tanks, 2 rectangular tanks and 12 raceways (Plate 1). On a 5-point grading system ranging from excellent (5) to poor (1), the overall rating of the hatchery (structure and function) is pegged at 3 (good). Operating at full capacity, conservative estimates of fry production from the approximately 10 MT-capacity tank units is put at 3,660,000 fish fry per cycle of 8 weeks.

Plate 1. Lay-out of the Hatchery at ELP

2.2 The Nursery system.

There nursery system comprise of 8 poorly managed outdoor ponds. Their total surface area is estimated at 1.15 Ha. This has a projected potential production of 1,145,000 fingerlings (30 g) per cycle, allowing for mortality rates of 20%.

2.3 Grow-out

Available records indicate that there are a total of 91grow-out earthen ponds and one reservoir pond in various operational stages in the complex. Pond sizes range from 0.2 Ha to 6.8Ha. About 22 of these ponds are in various stages of construction or disrepair. A further 61 ponds have not been fitted with drainage weirs while the remaining 8 ponds, covering an estimated area of 11.28 Ha, are in complete operational states. A typical grow-out pond at ELP is presented as Plate 2 below.

Plate 2. A typical grow-out pond at ELP

2.4 Intensive care culture unit.

The intensive care culture unit is a recent add-on that is yet to commence production. However, when it becomes fully operational, at a proposed stocking density of 200/m³ it is expected to yield about 14.6 MT of 0.5kg fish for a one cycle/year growth session.

2.5 Feed mill

The feed mill has an installed production capacity of 3 MT of feed per one hour. This translates into feed production levels of 18 MT/day for a six-hour day operation. When all the production ponds are operational, the feed mill has the capacity to produce adequate feed to service all the ponds. It will also be able to support the allied facilities of the piggery and the poultry in the aquaculture complex.

3.0 Potentials of Other Facilities (Piggery, poultry, Oil palm)

The other facilities located in the complex have the potential of producing vital components of the entire fish production system to enhance the overall production level in the farm. Indeed, the piggery and poultry waste can be treated and applied as organic fertilizers to the earthen grow-out ponds. This does not only reduce overhead costs in

purchases of inorganic fertilizers but also creates a more congenial environment for production of 'clean' fish. Similarly, by-products from the oil palm plantation can provide some vital raw materials, of known origin, to the feed mill to reduce the overall costs in the feed stuff procurement and the overall feed production.

4.0 Constraints of the fisheries and aquaculture complex

4.1 Hatchery

The major constraints militating against the optimal operation of the hatchery are identified in three major areas. These are: laboratory support services, technical expertise and general disregard of the fundamental rules of hatchery operation.

i. Laboratory support services.

As observed elsewhere, the engineering design and lay-out of the hatchery tanks and drainage systems cannot be faulted. However, lack of a wet chemistry laboratory to provide levels of the much needed water quality parameters in in-flow waters into the hatchery and in operational hatchery tanks, largely reduces every work done in the hatchery to a status of mere guess work, as far as water quality is concerned. It is acknowledged, though, that a pH meter and some hand gloves for hatchery operations have been recently acquired. While this is highly commendable, it must be emphasised that it is woefully inadequate for the running of the hatchery.

ii. Technical expertise.

The hatchery is manned by a very dedicated group of technicians of varying academic qualifications (MSc to no formal education). While dedication to duty in any hatchery is basic and fundamental to a successful operation, high calibre specialised technical staff often help to maximize the efforts put in by the hard working support staff. The near absence of the former appears to be one of the major contributory factors militating against the optimal running of the hatchery.

iii General observance of the fundamental rules of hatchery operation.

The general sanitary conditions of the hatchery, including the state of the floor, do not seem to lend much support to the efficient running of the facility. There is a need for an immediate remediation of that situation. Furthermore, too many ill-dressed staff make their ways to the hatchery too frequently. This action only promote high incidence of nosocomial diseases in the fish fry.

4.2 Nursery

The constraints militating against normal running of the outdoor nursery ponds may be multifaceted but can largely be traced to three major factors. These include predation, unknown water quality levels and aquatic macrophytes proliferation.

i. Predation is adjudged to be the biggest contributor to mortalities in the nursery ponds. The major predators are birds of prey, amphibians, reptiles and nymphs of dragon flies (liberulidae).

ii. Water quality status of the nursery ponds are largely unknown even though periodically, water samples are sent to the University of Science and Technology at Port Harcourt for analysis. In this respect, mortalities of water quality origin will be difficult to ascertain.

iii. Large mats of the aquatic macrophytes, *Lemna sp.* on the surface of the nursery ponds reduce light penetration into the ponds. Although that biomass may be adding relatively large volumes of oxygen into the system, the net oxygen consumption of decomposing components of the plants may be very large thereby creating a net oxygen deficit in the ponds. The result will be mass mortalities of fingerlings from lack of oxygen.

4.3 Grow-out ponds

A substantial number of the grow-out ponds are not equipped with drainage canals. An equally large numbers of ponds are currently overgrown with weeds and shrubs while the operating ponds are badly infested with all kinds of wild fish species, possibly resulting from the periodic flooding of the facility. Water quality parameters and bottom conditions also remain largely unknown. The physical and chemical problems aside, poaching of both human and animal origin also do militate strongly against the projected production levels of the ponds.

4.4 Intensive care culture unit.

The intensive care culture unit is yet to begin operation. However, given the good engineering work done in the laying of the facility, the only problems that can be envisaged presently, at commencement of operations, will be availability of high level technical expertise to run the facility very efficiently.

4.5 Feed mill

The feed mill with an installed capacity of about 18 metric tonnes of processed feed in a day operates at below 50% capacity presently. Major constraints are listed as lack of spare parts, irregular supply of feed stuff and at times low quality feed stuff. The low production levels are also

attributable to low demands from the end product users within the complex.

5.0 Constraints of Other Facilities

The other facilities comprising of the piggery, poultry and the palm oil plantation (POP) appear to have little constraints but all can do with some level of capital infusion and better health-care needs. Furthermore the POP, appears to have high labour cost in slashing weeds around the 8,000 trees and harvesting of fruits as additional constraints. Lack of effective management of the labour force responsible for that unit may be an additional constraint, though on a small scale.

6.0 Current Production Levels of Facilities in the Aquaculture Complex.

6.1 Hatchery

Current productions levels from the hatchery are estimated at 4,392,000 fry per cycle. This represents approximately 60% of the total production capacity of the hatchery per year.

6.2 Nursery

Current production levels is estimated at 451,200 fingerlings per cycle of 8 weeks. Mortalities are pegged at about 25.4%.

6.3 Grow-out ponds.

Fish production outputs for the period of June 2004 to June 2005 are estimated at 1.125 MT for the 11.8 Ha total surface area grow-out facility.

6.4 Intensive care culture units.

This unit is yet to commence production.

6.5 Feed mill

Currently, the feed mill produces 1 MT of feed per cycle. Operating at this level, the machine is able to accomplish 4 cycles in one month. However, the effective number of cycles performed in a month is determined by the demand of the consuming units within the complex

7.0 Current production levels of other facilities

The piggery currently turns out about 100 litters per cycle for about 6-8 months. This figure represents approximately 60% of its installed capacity.

The poultry has an installed capacity of 3000 broilers/ cycle of 7-10 weeks. Current production lines stand at 500 birds/cycle and represents 16.7% of its installed capacity. Mortalities stand at about 3-5%/cycle.

The palm oil plantation produces about 90 bunches per cycle of 6 months. Out of this, 85 litres of palm oil is extracted.

8.0 General Observations

There is no dispute about the fact that Ellah Lakes PLC aquaculture complex has such an enormous potential that could make it play a lead role in demonstrating the viability of aquaculture practice as a profitable business venture in the Niger delta of Nigeria. There are, however, many issues that need to be tackled in a businesslike manner, if the enormous potential of this facility is to be unearthed in a scientific, systematic and cost effective manner. Five most important issues that need immediate attention are identified as infrastructure development; laboratory support services; technical expertise; general administration; and recapitalization. Brief comments are provided on these issues to justify the recommendations that follow.

i. Infrastructure development.

The general infrastructural development in the aquaculture complex is good. However, it appears that most of them have far exceeded their normal amortized period and therefore need replacement. Other areas of concern will be access to the facility, security fences and perimeter dykes.

ii. Laboratory support services.

Laboratory support services in aquaculture ventures play such an important role that the overall profitability of the operations of the farm can be attributed to the competence of the laboratory operations. Where such facilities are non-existent in a complex system like Ellah Lakes PLC, optimal operations of the various water-related units will be almost impossible to attain.

iii. General administration and supervision.

The administrative structure of the facility (annex 2) appears too diffused with command structures not emphasising the main purpose of the facility; fish production. Similarly, the staffing in the various units of the complex is too skewed and appears to be wrongly weighted for a typical aquaculture facility. The consequence of all these is that members of the various units do not see themselves as independent operable entities whose existence depends on the output from their units. Thus outputs from any unit can be accounted for anyhow and in complete negation of the quantum of the inputs. A typical example from the grow-out facility is cited to buttress this point. *Using figures obtained from the farm, a total*

number of about 450,000 fingerlings stocked in the 11.8 Ha grow-out ponds and harvesting at a mere 8% survival with a mean harvest weight of 300g should yield 10.8MT of fish! The actual yield of 1.125 MT obtained from operations is therefore very difficult to reconcile in terms of losses due to the combined effects of predation, diseases and poaching. In real terms, each fish harvested weighed approximately 31.25g (the weight of one AA battery)!!

iv. Technical expertise.

Given the multiplicity of unknown variables accounting for the abysmal performance of the aquaculture facility, it is difficult to firmly put a hand on the technical competence of the heads of the different units as a major factor in the overall performance of the units. It is imperative, though, that people with requisite training are placed at positions to perform specific functions for which they are trained.

v. Recapitalization.

Periodic recapitalization in aquaculture business does not only improve the equity of shareholders but more importantly, it keeps its operational tools in the 'state of the art' and makes its operations more competitive.

9.0 Recommendations

The team of experts, after a thorough evaluation of the potentials and constraints of the Ellah Lake PLC aquaculture complex make the following recommendations which are without prejudice to the consultants' fore knowledge of operations of viable aquaculture facilities in other parts of the world.

9.1 Infrastructure development

- The main access road leading to the facility as well as accessibility to other facilities like the grow-out ponds should be upgraded.
- The wire fencing securing the facility needs immediate replacement.
- The problems of flooding in a relatively low-lying flood plain in which the Ellah Lake PLC aquaculture complex is situated can be ameliorated only by erecting very good perimeter dyke with an adjoining perimeter canal. In addition to serving as a water break, it will provide a natural patrolling route for the surveillance team to operate more efficiently. Furthermore, the 27%-strong security unit patrolling the facility can be substantially reduced.

9.2 Upgrade of plant and equipment

- The major problem of the feed mill which is thought to be frequent breakdown needs an overhaul to optimise its operations. Given the huge operational capacity of this facility and a relatively high demand of fish and poultry feed in the locality, any reasonable level of investment should be able to pay for itself within a short period.
- The palm oil processing plant could be upgraded to produce palm kernel oil. The palm kernel cake resulting from this operation could form a vital raw material in the feed mill.

9.3 Upgrade and strengthening of operational facilities.

- As a matter of urgency, a wet chemistry laboratory must be set up to provide support services for the operations of the hatchery, the nursery, the intensive care culture unit and the grow-out ponds. For a minimum, such a laboratory must be able to measure temperature, hydrogen ion concentration, dissolved oxygen, conductivity, total suspended solids, and basic nutrients like nitrates phosphates and sulphates. Subsequently, the laboratory must have the capacity to check the microbiological status of the operating water media as well as the trace element levels in the production facilities and in fish and fisheries products. Fish disease diagnostic tools can be an add-on when the facility becomes fully operational.

9.4 Staff strength, technical competence, routine duties, and refresher courses.

An aquaculture farm with an annual production level of 1.125 MT of fish from 11.8 Ha of pond surface (0.095339 MT/Ha or 95.4 kg/ha) cannot justify staff strength of 50-60 people (including casual labourers). This notwithstanding, the staff strength could be retained but realigned. The following can be done:

The fisheries and aquaculture unit should be split into 4 units;

- Broodstock/Hatchery unit
- Intensive care culture unit
- On-land grow-out unit.
- Cage culture unit (pilot)

Each unit should have a unit head that has the requisite training in the allied field. While operating as generally as complementary units, each unit must be autonomous and operate as separate business entity. Thus the broodstock/ hatchery unit must be responsible for the raising of brood stock and production of fish fry for the intensive care culture unit. Supply on request must be quantified and valued at the prevailing market price. The intensive care unit will raise the fish fry to fingerlings and ‘sell’ them to the grow-out facility operation units while

they keep enough fingerlings for their own intensive care culture. Any excess fingerlings could be sold off to consumers outside the complex. This way, each group will be independently accountable for its actions and inactions. The technical team must however, have routine refresher courses organized for them to update their knowledge in novel ideas in fish rearing and management operations.

9.5 Monitoring and evaluation

A monitoring team under the general direction of the GCLME Fisheries Consultant should be put in place to monitor the activities of Ellah Lakes PLC aquaculture staff.

The role of the monitoring team shall be as follows:

- Visit Ellah Lakes PLC aquaculture complex quarterly for periods not exceeding 14 man-days per visit.
- To supervise the 'new beginning' of operation of the aquaculture unit in the following areas:

A. Hatchery operations

i. Installation of a wet chemistry laboratory and training of key personnel in the proper use of equipment, data gathering, data management and data interpretation. Field manuals will be produced in the cause of the training to aid data interpretation. The manual preparation will also cover step to be taken in ameliorating imbalances found in water quality parameters.

ii. Routines in hatchery operation; maintenance of environmental cleanliness through routine clean-ups and wearing of appropriate working gear, time-round operation; regulation of illuminations for specific operations etc will be instituted and ensured strict compliance.

iii. General handling of broodstocks, including replacement schedules.

B. Grow-out facilities

i. Offer training in pond bottom preparations, pond filling, fertilization biogenic production estimation and stocking rates and ratios (if poly culture).

ii. Preparation and installation of cages. Feeding regimes in cage culture.

iii. Monitoring of growth parameters.

C. Feed mill operations.

i. Assist in the formulation of feed for different species of fish.

ii. Direct the preparation and use of wet feed in grow-out facilities (pilot).

D. Record keeping.

i. Training will be offered to the laboratory staff in record keeping in areas of feed administration, feed conversion ratios estimations, quantification of inputs and outputs and basic account/record keeping in each unit.

9.6 Re-institution of management board

The Ellah Lakes PLC aquaculture complex is currently operating more as a charitable organization rather than a business venture. While this may be understandable, given the love and concern that the Board Chairman and owner of the facility has for his people, everybody involved in management will be doing the distinguished Board Chairman a lot of good service by contributing more in a businesslike manner in the running of Ellah Lakes PLC. If this will result in the rejuvenation of the present management board by infusing new ideas and talents, so be it.

9.7 Recapitalization

Ella Lakes PLC urgently needs re-capitalization to begin operating the 8 grow-out ponds (11.28 Ha) and the intensive care culture unit (146m^3 -capacity) as a business venture.

The cash infusion will go to support the setting-up of the wet chemistry laboratory and provide good quality prefabricated feed for the hatchery while lasting solution is sought for feed preparation for the specific age groups and species.

Along these lines the team of consultants recommend a support line of between US$200,000-250,0000 for Ellah Lakes PLC's initial emergency operation. Part of this money could be applied to improve facilities at ELP to set it up as a nucleus farm from where the smaller farm units (out growers) could obtain fish seed, fish feed and various levels of assistance in water quality management to maximize their operations. Furthermore, Ellah Lakes PLC could purchase all produce from the smaller units to reduce their overhead costs in seeking markets. Ellah Lakes PLC will thus become the main marketer of the aquaculture produce in the Port Harcourt area.

In due course, the group of consultants will produce a financial analysis of Ellah Lakes PLC operations to justify the support-line being sought for the company. For the interim, a tentative allotment schedule of funds is presented in table 1 as a guide to judicious use of the resource, when it becomes available.

Table 1. Projected Revenue Allocation for Rehabilitation Works at ELP

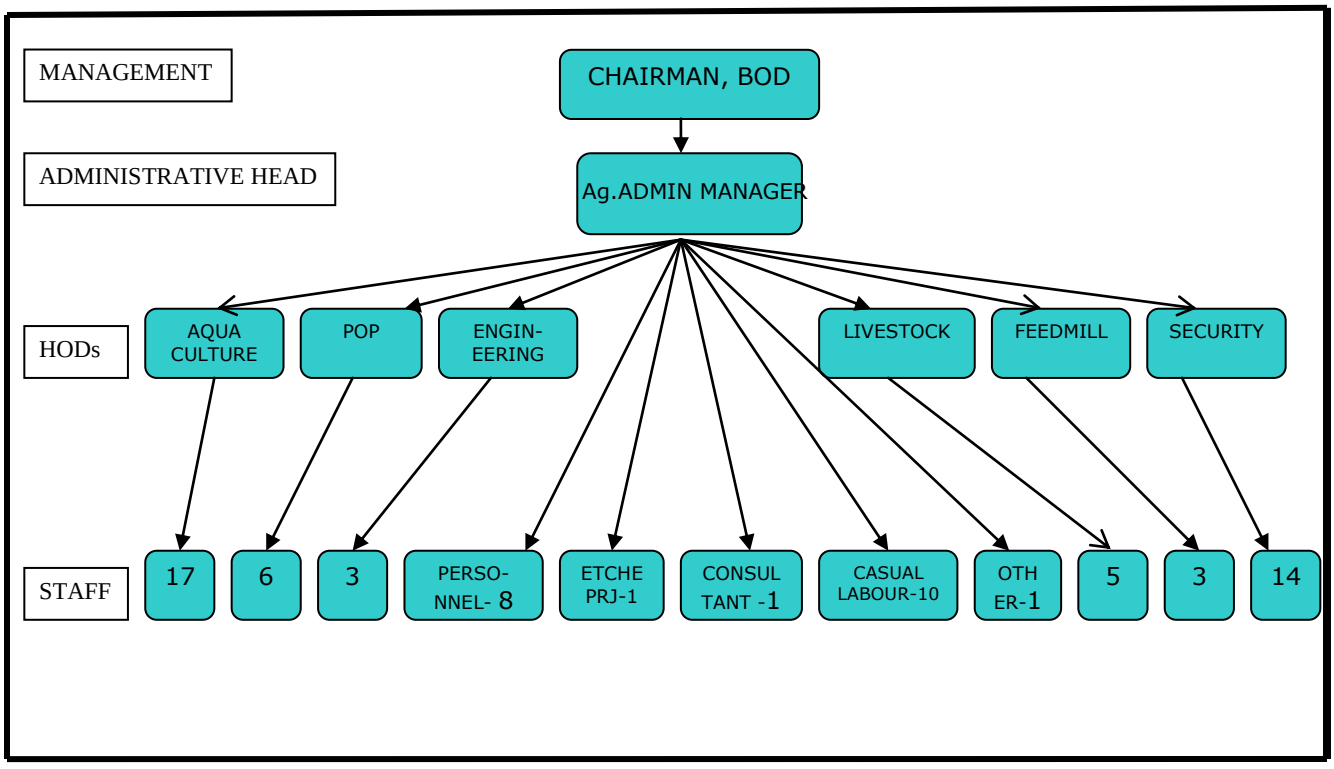
Department/Unit	Level of Assistance (US$)	Remarks
Wet chemistry laboratory	50000	Equipment and lab reagents for 2 year supply
Intensive care unit	25000	Standard aerators and water filtration units
Hatchery support services	10000	Support staff working gear and chemical reagent
Feed mill	25000	Overhaul of obsolete equipment
Access	20000	Secure approximate 200m access road and security points to the facility
Perimeter dyke construction	50000	Very necessary to check flooding of facility and to provide easy access for ELP surveillance team
General administration	10000	Upgrade working tools for secretariat staff and to make them more efficient
Contingency	10000	Serve as a back-up for any of the projects.

10.0 Annexes

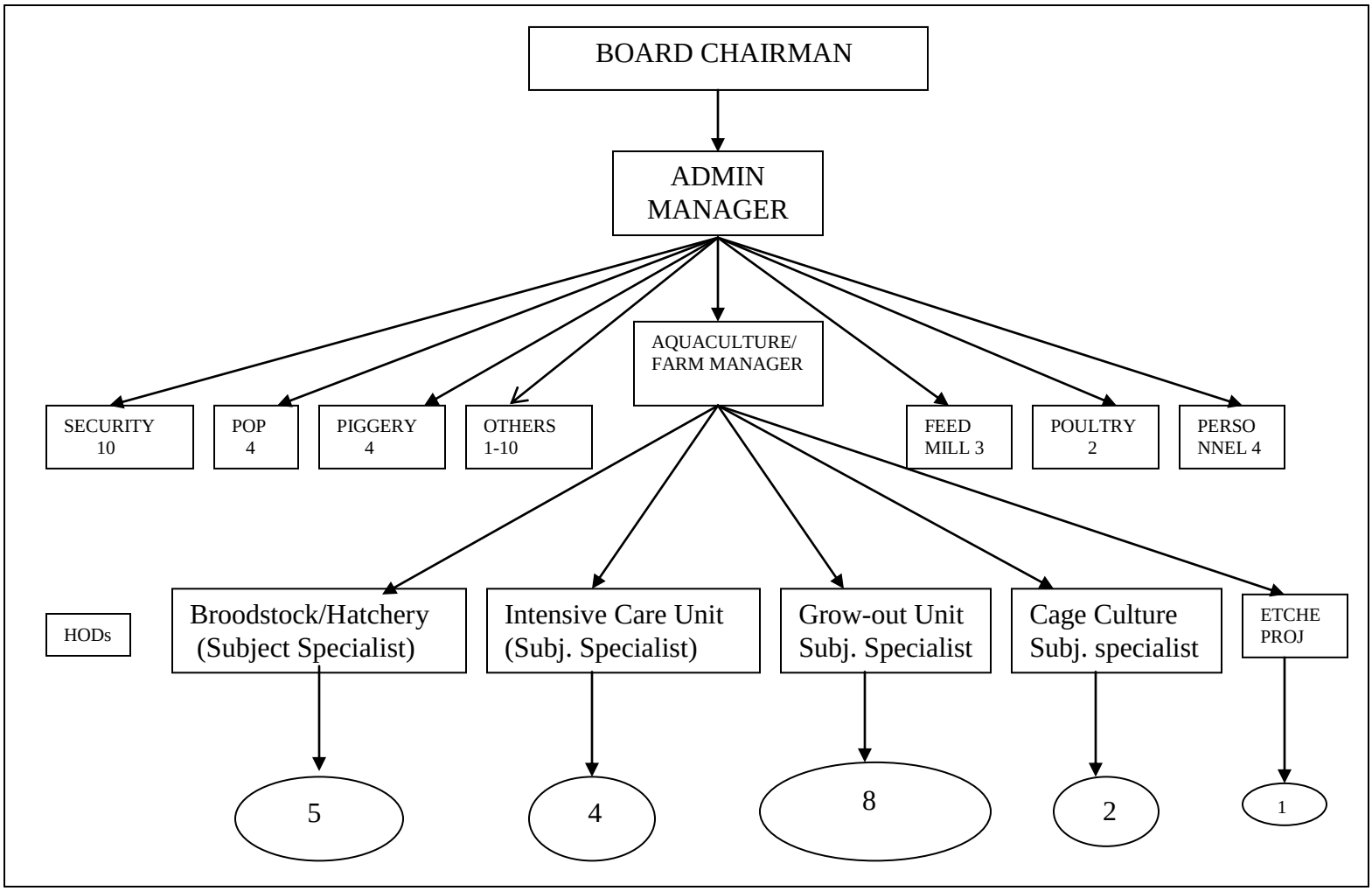
Annex 1: Aquaculture Facilities in Other Parts of the Port Harcourt Area.

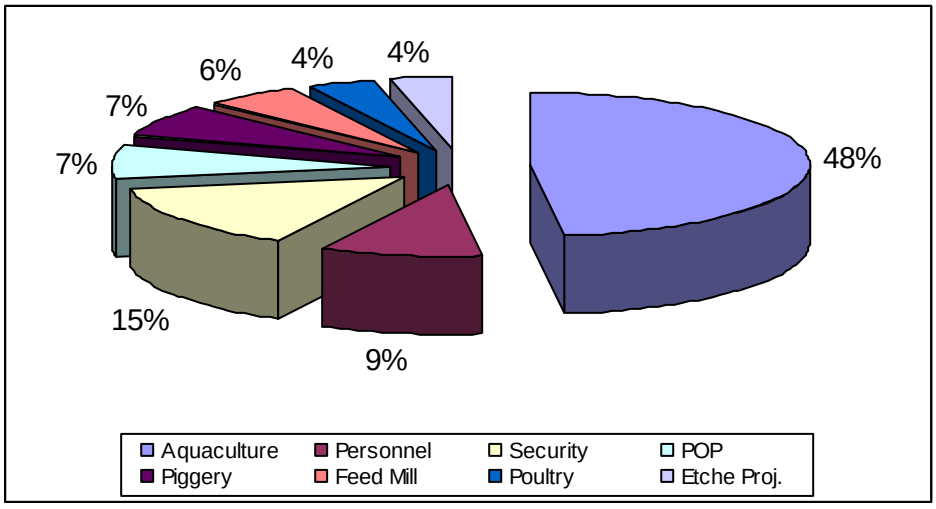
Name of Aquaculture Facility	Location	Remarks
Green River Project	ONELGA	Set up to demonstrate that NOAC's oil operation activities do not impact negatively on fisheries activities
Ogba Farms	ONELGA	N/A
Ike Issiah Farms	Ahoada	N/A
Speakers Farms	-	N/A
Emeka Ogbo Farms	Ede	N/A
Elf Farm Project	Obaji	Possibly to demonstrate zero effect of Elfs oil drilling operations in that community.
ARAC-Aluu	Univ. of Port Harcouryt	Centre for training in aquaculture

Annex 2. Organizational Structure of ELLah Lakes PLC Aquaculture Complex



Annex 3. Proposed Organizational Structure and Staff Strengths in Units at ELP





Annex 4. Proposed Staff Strengths in Different Units at ELP

Annex 5. Photo Documentation

1 A typical Functional Grow-out Pond at ELP

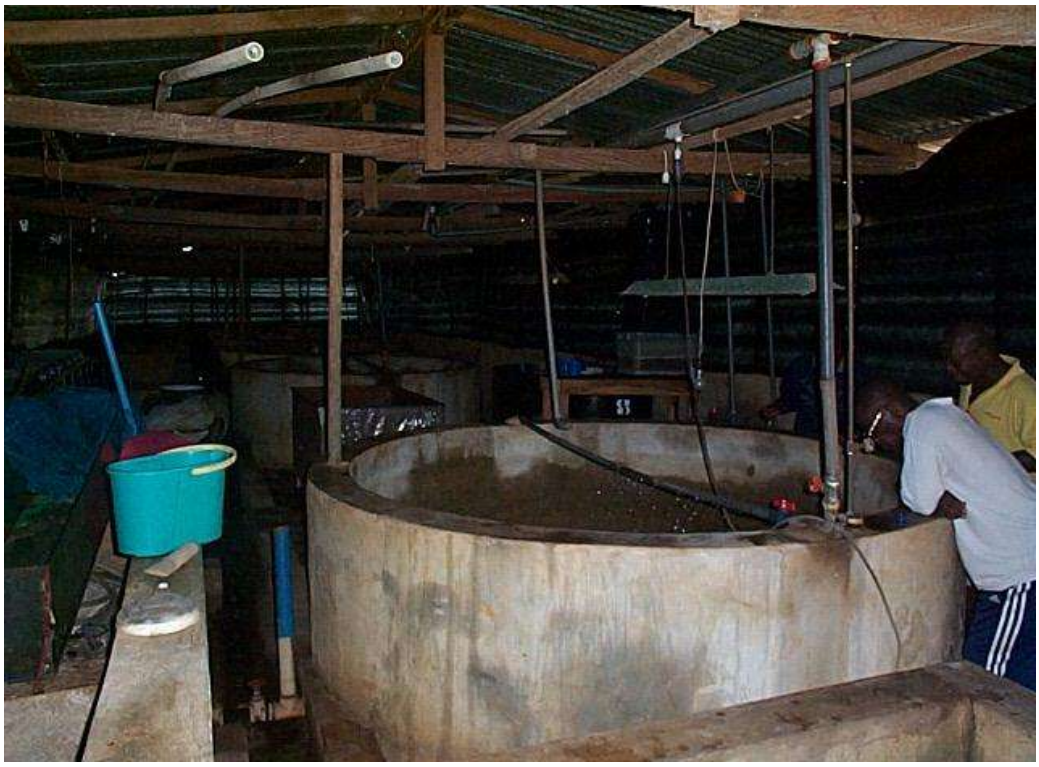
2 A Typical Non-functional Pond (overgrown with weed) at ELP

3 Harvesting Fish from a Grow-out Pond

4 Fish Catch from a Grow-out Pond

5 Stripping a Catfish for Eggs after 18 hours Inducement

6 GCLME Consultants Inspecting a Hatchery Tank in the Dark Room



7 ELP Board Chairman, Dist. Sen. Ellah in a Group Photograph with Staff and GCLME Consultants

8 GCLME Consultants in a Chat with ELP Senior Staff