

SCHEDULES TO CONCESSION AGREEMENT

for

Design, Build, Finance, Operate, Maintain and Transfer

of

Multi-Species Hatchery and Allied Facilities

**at Maanaagalaa, Gaafu Alif Atoll,
Republic of Maldives**

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SCHEDULE-A

(See Clause 10.1 of Concession Agreement)

SITE FOR MULTI-SPECIES HATCHERY

1 General

The Authority (Ministry of Fisheries, Marine Resources and Agriculture) is proposing to establish a Multi-species Hatchery on Island Maanaagalaa, Gaafu Alif Atoll. A Location Map is appended at the end of this Schedule-A.

2 Rationale for Choice of Location (*Ga Maanaagalaa*):

The choice of location for this proposed Multispecies Hatchery was decided using the following principles: (a) the hatchery should be in an atoll that is away from Male, but around the middle of the archipelago, and not in extreme north or south, so that it is able to service the entire country until other hatcheries come up in the country; (b) the southern atolls face a bigger issue related to bait-fish; these southern atolls have most of the tuna fishing vessels, and there local baitfish stock has already declines; (c) a location close to the route the vessels from southern atolls take is beneficial for the hatchery; (d) the hatchery should be built in an uninhabited island, but should have nearby islands with good number of people and substantial infrastructure, so that the Concessionaire's workforce can avail of the modern facilities as and when required. Concessionaire's workforce who cannot be accommodated in the facilities available in *Ga Maanaagalaa* should also be able to find accommodation and be able to access their workplace daily.

3 Location and Connectivity

The *Ga Maanaagalaa* island is accessible from the nearest island/town - *Ga Villingili* to the southeast, and *Ga Kolamaafushi* to the west both at distance of about 17km. The travel time is about 20 minutes by the speedboats. The nearest airport is Kooddoo, 20km away, and about 20 minutes away by speedboats. Male airport (*Velaana International Airport*) is located 380km from the *Kooddoo Airport*, at a flying time of 70 minutes. Normally, 5 flights operate between Male and Kooddoo daily.

4 Facilities Offered at the Location

- 4.1.1 The entire area of the Ga Maanaagalaa Island, including approximately 5 ha of land and approximately 78 ha of lagoon, will be provided to the Concessionaire on a 21-year lease.
- 4.1.2 Commercial lease rent will be payable to the Authority at the rate of MVR 0.2 per square foot of land area per year, and MVR 0.05 per square foot of water area per year.
- 4.1.3 The lease will cover all the Ancillary Facilities built and provided by the Authority as detailed in **Table 1** below.
- 4.1.4 Authority allows exemption to the Concessionaire from payment of annual lease rent for a period of 5 years from the Date of Signing the Concession Agreement.
- 4.2.1 The ownership of the land and lagoon provided to the Concessionaire on lease-basis will always remain with the Authority. The Concessionaire will allow designated

- government officials of and nominated by Authority access to all part of the land and lagoon, at any time and schedule determined at the sole discretion of the Authority.
- 4.2.2 The Concessionaire will allow and not impede access to designated worksites the contractors engaged by Authority for completion of the Ancillary Facilities in a time schedule and in a manner acceptable to Authority, or any other such contractors engaged by Authority for any purpose that Authority deems fit and suitable to the desired intent and need for developing a world-class multispecies hatchery on this island.
- 4.3.1 The Concessionaire is expected to use the lagoon area (in excess of the lagoon area needed to provide for the core function of the Multi-species Hatchery) to develop its own out-grower farms (cages, pens and rearing tanks). Outside the lagoon area covered by the lease agreement, water surfaces can be used by the Concessionaire for out-grower farms (such as cage farms) only after: (a) proposing technically viable solutions acceptable to Authority, (b) obtaining all required and appropriate licenses such as the approval from the Atoll Council, approval of the relevant environmental impact assessment authorities, and (c) obtaining written permission from Authority.
- 4.3.2 No part of the land and lagoon should be used for purposes other than: (a) Multi-species Hatchery and its associated core functions such as brood bank, brood stock rearing, rearing tanks, nursery, and the storages, warehousing, offices and laboratories that are essential for the functioning of the Multi-species Hatchery; (b) out-grower mariculture farms using fingerlings from the Multi-species Hatchery being operated by the Concessionaire; (c) intended use of the Ancillary Facilities only for the purpose of efficient functioning of the Multi-species Hatchery, the out-grower farms and their core associated functions; and (d) any other function/purpose explicitly agreed with Authority and after obtaining in a written permission from Authority.
- 4.3 No part of the land, lagoon and Ancillary Facilities under the lease can be sub-leased. Sub-leasing will constitute a breach of the Concession Agreement.
- 4.4 The Authority will also provide the following Ancillary Facilities described briefly in **Table 1** below completed before the Date of Signing of Concession Agreement. These Ancillary Facilities will be available for the use of the Concessionaire and its staff by the time work on setting up of the proposed Multi-species Hatchery and Allied Facilities commences. A Site Map of the Island Showing the Ancillary Facilities is attached at the end of this Schedule-A.

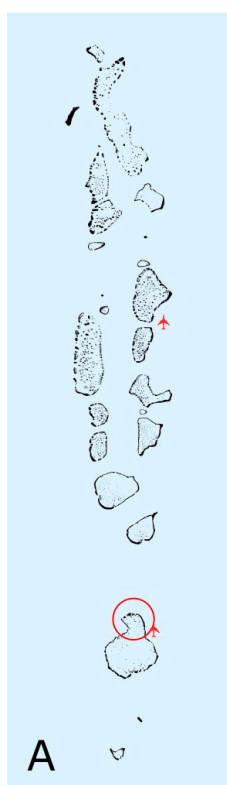
Table 1

Ancillary Facilities provided by Authority at the Project Site

Facilities	Capacity
Entrance Channel to the Island	The arrival channel is 26 meters in length and 30 meters wide, with depth down to 4 meters from the mean sea level. It is suitable for Fishing (or Cargo) Vessels.
Arrival Jetty	The Jetty is 80 meters long, 2.1 meters in width, and will be able to service a substantial number of Common Fishing Vessels per day.
Mosque	The mosque building has 26.5 square meters of built-up area, with additional 106 square meters of designated area around the mosque building. More than 50 persons can pray at a time. Electrical and plumbing services are provided.

Facilities	Capacity
Accommodation, Kitchen and Mess Building	It is unfurnished accommodation and comprises a two-storey building, with built-up area of 1,035 square meters. The Ground Floor with built-up area of 517.5 square meters is for Kitchen and Dining/Mess facilities, and two Bedrooms. Maximum 50 persons can be accommodated in all the residential rooms. One room to be reserved for Authority's staff who visit for inspection or any official work. Electrical and plumbing services are provided.
Recreation Building	It is unfurnished facility comprising a single-story building with a total built-up area of 363.5 square meters. The facility is suitable for installing/providing: (a) video screens and televisions, (ii) music systems; and (iii) indoor games. Electrical and plumbing services are provided.
Office Building	It is an unfurnished single storey building with built-up area of 121 square meters. Electrical and plumbing services are provided.
Building for the RO plant for potable water supply for the facility	An unfurnished space of approximately 36 square meters (within a building of 109 square meters of built up area, of which approximately 73 square meters is used for the Powerhouse). Electrical and plumbing services are provided.
Powerhouse, Diesel Generation Sets, and Power Distribution System	It is a building of 73 square meters area (within the 109 square meters building which has space also for the RO system to be installed by Concessionaire), appropriately furnished, complete with 4 diesel generating sets of 150KVA each.
Road connecting the above facilities, Street Lights	Road complete with finished pavement connecting the Arrival Jetty with all other buildings described above. Streetlights with underground cabling complete along the Road.
Wastewater/Sewage Disposal Facility	Complete for the site.

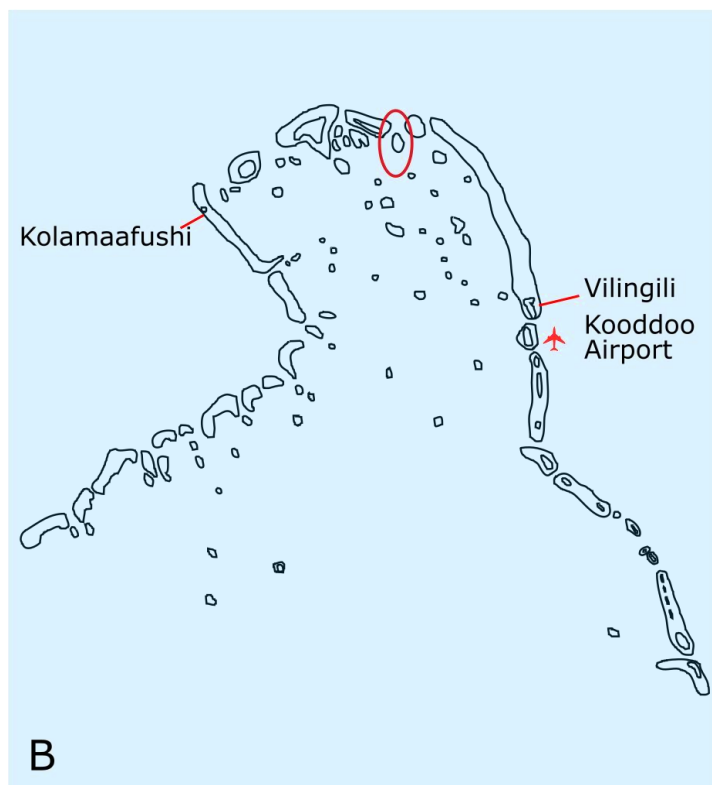
Location Map



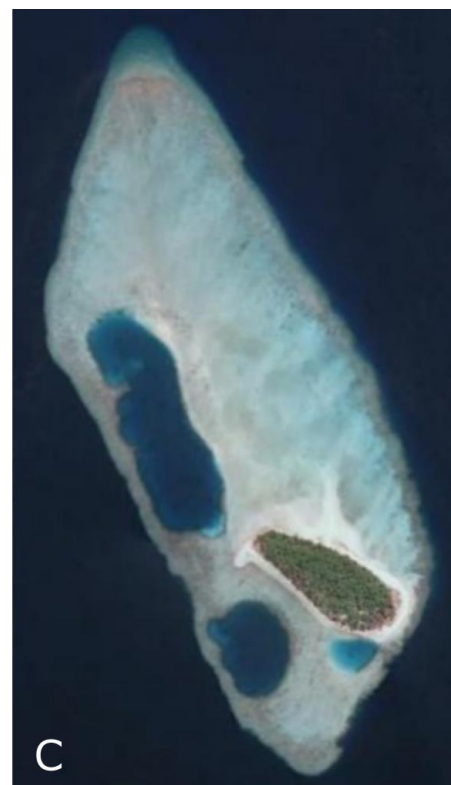
Maldives
showing
Male Airport
&
Gaafu Alif Atoll
(Northern Islands
of the Atoll are
shown as
encircled)

Convenient mode
of travel is by Air
(normally five pair
of flights between
Male and
Kooddoo each
day; travel time is
70 minutes)

Google Map
Image (2016) of
**Maanaagalaa
Island** prior to
construction of
the Ancillary
facilities.



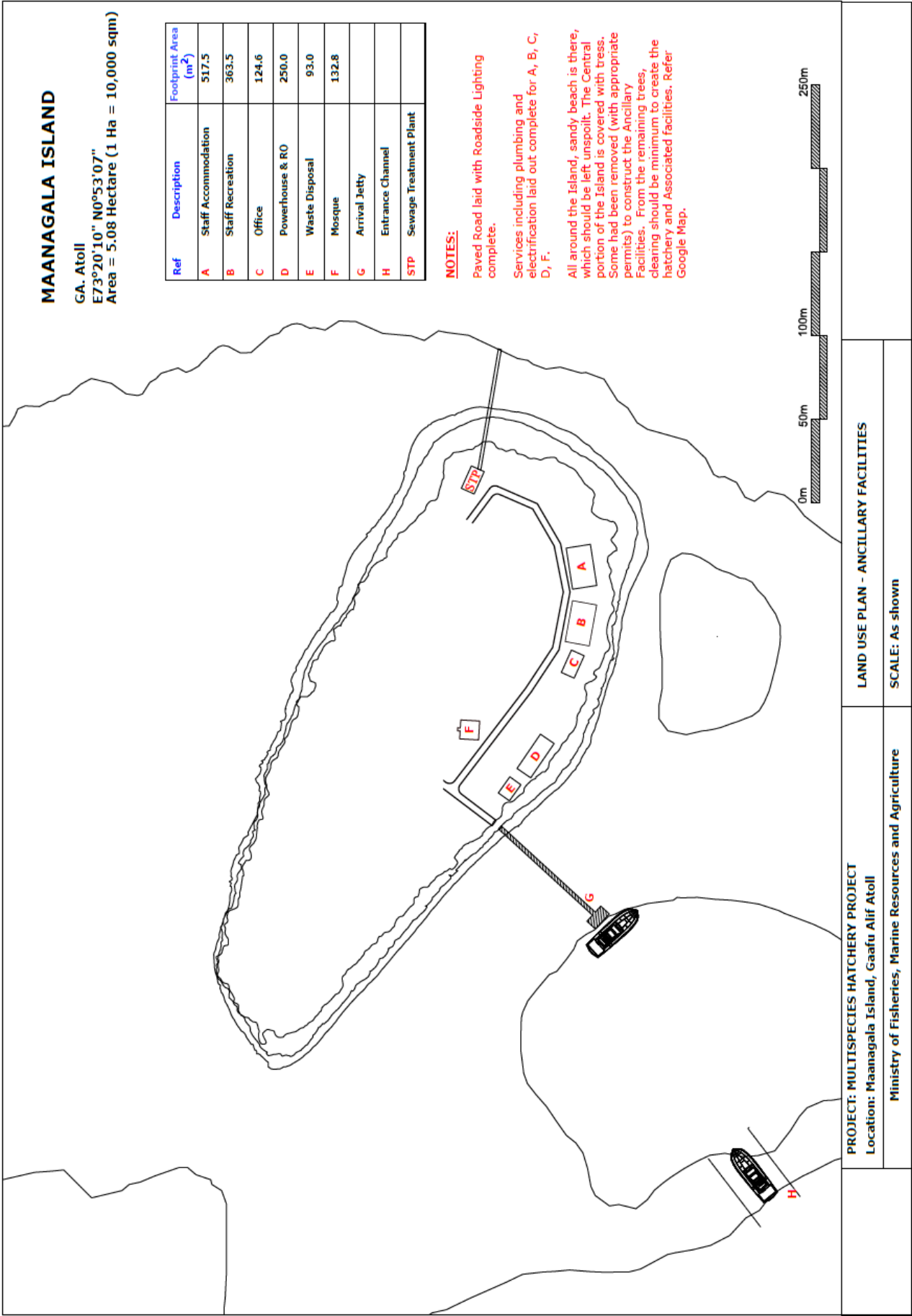
Northern Islands of Gaafu Alif Atoll
showing
Kooddoo Airport
Vilingili Island
Kolamaafushi Island
(all within approximately 20km, with travel
time of about 20 minutes by boat)
&
Maanaagalaa Island
(shown as encircled)



Project Site
including
Maanaagalaa Island
(Land Area 5ha)
&
Lagoon Area
(Water Area 78ha)



Site Map showing the Maanaagalaa Island and the Ancillary Facilities
Provided by the Authority



SCHEDULE-B

(See Clause 12.3 of Concession Agreement)

CONSTRUCTION OF THE PROJECT

1. Description

The Concessionaire shall carry out and be responsible for Design, Construction, Installation, testing and commissioning of Facilities for a Multi-species Hatchery on Island Maanaagalaa, Gaafu Alif Atoll. The Concessionaire's work and services shall cover all necessary or desirable services / activities in accordance with and as contemplated by the Drawings, Specifications and Technical Standards.

2. Choice of species to be hatched

2.1 It is proposed that the Multi-species Hatchery should produce the following:

- (a) Fingerlings of Groupers (esp. *Epinephelus fuscoguttatus*) – most important to begin with
- (b) Fry sized (5-10 centimetres size) Bait Species¹ (*Chanos chanos*) – also most important to begin with.

Note 1: A nursery will also be required to grow Bait Species to grow to a saleable fry size.

- (c) Fingerlings of Sea cucumber (esp. *Holothuria scabra*)
- (d) In future, in agreement with the Authority, fingerlings of other culturable local and native varieties of groupers found in Maldives (note: culture techniques might need to be developed and/or refined)
- (e) In future, in agreement with the Authority, fingerlings of other local and native species/varieties of bait fish found in Maldives (note: culture techniques might need to be developed and/or refined)
- (f) In future, in agreement with the Authority, fingerlings of any other species of native fish of Maldives where the international market exists and offer significantly high export price FOB Male.

2.2 The Multispecies Hatchery shall, after it is established, start with production of fingerlings of (a) brown marble grouper, (b) Bait Species, and, (c) to a smaller extent, sea cucumber (i.e., sandfish, and if possible, the white teat fish).

2.3 Authority will facilitate establishment of brood-stock at the cost of the Concessionaire. Without any specific liability and only as a gesture, the MRDF (Mariculture Research and Development Section of Maldives Marine Research Institute, Ministry of Fisheries, Marine Resources and Agriculture) will consider transfer of their technical know-how to the Concessionaire should the Concessionaire request it, and should the facility operate successfully for at least three years.

¹ The term "Bait Species" used in this document will mean "bait-sized fry of Milkfish - *Chanos chanos* - or any other local species suitable as a bait for pole-and-line tuna fishery grown to 5-10 centimeters in length"

3. Installed Capacity

- 3.1 At commencement of first year of operations: The Concessionaire shall set up the Multi-species Hatchery with minimum production capacity at the commencement of operation as under:
- (i) Brown Marble Grouper (native variety of Maldives) – 1 million fingerlings per year;
 - (ii) Bait Species (using the hatchery with the nursery for growing up to 5-10 centimetres fry size, to be used as live bait) – 150 tons per year; and
 - (iii) Sea Cucumber – 1.5 million fingerlings per year
- 3.2 At commencement of twentieth year of operation or earlier: The Concessionaire shall step up production capacity at appropriate stages during twenty years' operations so as meet the growing domestic demand as also the projected export potential, targeting achievement of minimum installed capacity indicated below on commencement of 20th (twentieth) year of operation or earlier:
- (i) Bait Species (using the hatchery with the nursery for growing up to 5-10 centimetres fry size, to be used as live bait) – 300 tons per year;
 - (ii) Brown Marble Grouper (native variety of Maldives)– 10 million fingerlings per year; and
 - (iii) Sea Cucumber – 4 million fingerlings per year.

While planning expansion of the facilities progressively during the Operation Period of 20 years, the Concessionaire may take into account the estimates presented in Table 1 below Clause 17.2.1 of the Concession Agreement.

4. Design, Construction and Installation of Facilities, Equipment and Infrastructure

- 4.1 Some of the associated facilities as detailed in **Table 1** below Para 4.6 of Schedule-A have either been provided already or are under construction at the site/island. These facilities will be available for the use of the Concessionaire and its staff by the time work on setting up of the proposed Multispecies Hatchery and Allied Facilities commences. All other facilities, equipment and infrastructure needed for the Multispecies Hatchery at *Ga Maanaagalaa* to be able to meet (a) Production Requirements indicated in **Table 1** below Clause 17.2.1 of the Concession Agreement, and (b) Quality of Production indicated in Clause 17.3.3 of Concession Agreement. The Concessionaire shall always maintain the Environmental Standards applicable in Maldives as well as other operational service standards required by Authority will be constructed/installed by the Concessionaire.
- 4.2 The Concessionaire shall be responsible for detailed plan and detailed design of and justification for all facilities, equipment and infrastructure to be constructed or installed. The conceptual plan attached with the Proposal Document is indicative only. Detailed plans and detailed designs to be prepared by the Concessionaire should at the minimum include the following:
- (a) **Hatcheries** for groupers, Bait Species and sea cucumbers with the capacity of producing the expected amounts of each species specified in **Table 1** below Clause 17.2.1 of the Concession Agreement.
 - (b) **Nurseries** for groupers, Bait Species and sea cucumbers with the capacity to rear the expected production targets for each species specified in **Table 1** below Clause 17.2.1 of the Concession Agreement.

- (c) **Water and Air Circulation Systems complete with Power Distribution Systems** with capacities that would meet the water flow and aeration requirements of the entire facility.
- (d) **Live Feed Production Facilities** including the phytoplankton and zooplankton stock culture areas, scaling up areas, and mass culture areas to produce the required amounts of live feed to meet the expected production targets specified in **Table 17.1** below Clause 17.2.1 of the Concession Agreement.
- (e) **Laboratory** – basic laboratory building complete with equipment and facilities to be able to monitor the growth of the cultured animals, and live feeds, as well as basic diagnostic tests fulfilling all quality requirements specified in Clause 17.3.3 of Concession Agreement.
- (f) **Feed Storage and Chemical Storage** to meet the expected production targets for each species specified in **Table 17.1** below Clause 17.2.1 of Concession Agreement. These may be in buildings attached to the warehouse and should be in proximity of the Live Feed Production Facilities.
- (g) **Sea Cages and/or Land-based Tanks** for the maintenance of brood stock of target species.

4.3 **Allied Facilities:** Schedule-C lists out additional facilities, equipment and infrastructure that might be needed for satisfactory operation of the Multi-species Hatchery.

4.4 At the “Design -Build” stage, the Concessionaire will be required to:

- (a) Propose detailed Site Plans and Detailed Designs for all Facilities, Equipment and Infrastructure to be constructed or installed.
- (b) Prepare an analysis of alternative plans and designs. The Plan and Design Proposals should include justification on the choice of plan and design, showing what alternatives were considered, relative advantage and disadvantage of alternative plans and designs, and rationale for selection of the proposed plan and designs.
- (c) Prepare a description of the scope, extent and schedule of routine, regular and periodic repair and maintenance. Each of the alternative designs described should be accompanied by a statement describing requirement of routine, regular and periodic maintenance and repairs that will be required.
- (d) Propose method statements and schedule of construction/erection and installation of the facilities, equipment and infrastructure, along with the final designs.
- (e) Propose equipment to be installed to be acquired from manufacturers with defendable past performance records, and brand, make and technical specifications acceptable to Authority.

4.5 Concessionaire shall retain services of at least two independent experts acceptable to Authority to review, check and verify their designs including requirements of regular and periodic maintenance throughout the Concession Period. All plans and designs by the Concessionaire will be submitted after obtaining a verification certificate from these two experts retained by the Concessionaire.

4.6 Concessionaire will present the Detailed Design for review and approval of the Authority. Authority may retain, at its discretion, experts or a panel of experts of its choice. The Concessionaire will share with the Authority and the Independent Engineer all background analysis and technical specifications to fulfil the requirements of review and approval.

Although the desire will be to complete review at the shortest possible time as specified in the Concession Agreement, Authority reserves the right to provide approval of plans and designs in stages.

- 4.7 Concessionaire shall ensure that no facility, equipment or infrastructure is constructed/erected or installed until approval of the detailed designs by Authority is available.
- 4.8 Payment towards the cost of design services indicated in the Concessionaire's Price Schedule shall be paid only upon approval of detailed designs during the construction period on pro-rata basis for the designs that are approved. Cost of facilities, equipment and infrastructure constructed or installed shall be paid within the construction period (subject to defects liability), based on proportionate completion of construction/installation.

5. Quality of Construction and Asset Creation

- 5.1 The Concessionaire will be allowed to use its own technology, methods of construction/erection and installation. However, all of these should comply with best construction/installation standards and protocols, and in case of equipment, manual provided by the manufacturers.
- 5.2 Concessionaire will provide technical justification for all proposed designs of facilities, equipment and infrastructure to ensure that these assets will perform efficiently.
- 5.3 Concessionaire will facilitate and support Independent Engineer appointed by the Authority to examine the quality of construction/erection of all facilities and infrastructure and remedy the construction/erection as and if recommended by the Engineer.
- 5.4 At the end of the construction/erection of facilities and infrastructure, Concessionaire will facilitate access of the Independent Engineer to examine the quality of construction/erection to draw up a list of remedies to be implemented during the Defects Liability Period and ensure that such remedies are implemented by them as specified by the Engineers.
- 5.5 At the end of installation of all equipment, the Concessionaire will obtain from manufacturers/suppliers of equipment certification of proper and adequate installation and share with Authority.
- 5.6 Concessionaire will be responsible for internal furnishing, furniture, gadgets and residual fittings that may be required for the facilities provided by the Authority (as detailed in Clause 4.6 of Schedule-A), especially the Mosque, the Kitchen and Cafeteria, Rooms in the Accommodation Building, Office Building and the Recreation Room. Concessionaire will propose installation of such furnishing, furniture, gadgets and residual fittings of brand, make and technical specifications acceptable to the Independent Engineer and the Authority.

6. Deployment of Key Staff and Replacement during the Construction Period

- 6.1 The Concessionaire shall deploy the same staff for the Key Positions given in **Table 2** below whose names along with the CVs were submitted in the Concessionaire's Proposal in response to Request for Proposal (RFP). The qualification requirements for the Key Positions as given in the RFP are tabulated below.

Table 2
Key Positions during Construction Period

S	Key Positions	No	Minimum Qualifications
1	Project Manager	1	Bachelor's Degree in Aquaculture or equivalent with minimum 7 years of management experience in marine finfish rearing (experience with groupers and/or Bait Species would be an added advantage).
2	Construction Engineer (Fulltime at Site/Project during Design and Build period)	1	A Graduate Civil Engineer or equivalent with not less than 5 years' experience in construction including at least 1 year of experience in construction and/or operation of fish seed production facilities, preferably marine finfish hatcheries.
3	Lead Fish Biologist (Fulltime at Site/Project during Design and Build period)	2	Masters Degree in Fishery or Aquaculture or equivalent with 5 years of experience in quality assurance of production, quality control of inputs in aquaculture farms.
4	Environmental Engineer/Officer (Periodically at Site during Design and Build period)	1	Degree in Environmental Engineering/ Science with minimum 5 years' experience or with minimum 3 years' experience in designing and operating pollution control including wastewater management, solid waste management, preferably in a large hatchery or a large aquaculture farm.

- 6.2 If replacement of any of the Key Staff deployed by the Concessionaire during the Construction Period becomes necessary, the Concessionaire shall submit a proposal for Authority's approval, advising therein the name of the replacement staff of equivalent or higher qualifications duly supported by his CV.

7. Project Completion Schedule and Project Milestones

The Concessionaire shall construct the Project in accordance with the Project Completion Schedule set forth below and achieve completion of the Project within Construction Period of twelve (12) months from the Appointed Date. In order that the Project implementation is proceeding on schedule, the Concessionaire shall achieve various milestones failing which the Concessionaire shall be liable to pay Damages to the Authority in accordance with Clause 12.3.2 of the Concession Agreement.

SN	Project Activity/Milestone	Completion time counted from Appointed Date
1	Submission of Design and Drawing by Concessionaire, and approval thereof by Authority	30 days
2	Authority obtaining regulatory clearance for (revised) Environmental Impact Assessment (EIA) based on Design and Drawing submitted by the Concessionaire	60 days
3	Mobilisation and Site clearance	1 day
4	Completion of all Construction of Works and Installation of Equipment and Supplies to be able to	365 days

SN	Project Activity/Milestone	Completion time counted from Appointed Date
	operate the Multi-species Hatchery of the “minimum capacity” specified in the Concession Agreement.	
5	Commissioning and Testing of all Installed plants, machinery and equipment	425 days

8. Technical facilitation

Maldives Marine Research Institute (MMRI) of MOFMRA will facilitate obtaining brood stock for groupers by putting the Concessionaire in touch with fisherpersons across atolls. MMRI will also provide advice in obtaining brood stock for sea cucumber for the first batch of production.

SCHEDULE-C

(See Clause 12.3 of Concession Agreement)

PROJECT FACILITIES

1. Indicative Requirements of Facilities

- 1.1 The Concessionaire shall design all facilities and infrastructure to construct the Multi-species Hatchery with the objective of creating adequate capacity and its further expansion for production of fingerlings and fry size of a variety of fish outlined in Schedule-B.
- 1.2 With a view to guiding the Concessionaire, an indicative list of additional facilities, equipment and infrastructure that might be needed for satisfactory operation of the Multi-species Hatchery is given in **Table 1** below. This list is over and above the Ancillary Facilities already created by the Authority as detailed in Schedule-A. However, the list of facilities in the Table 1 below is not exhaustive. The Concessionaire shall plan and design exact nature, type, number, extent and details of these said facilities, equipment and infrastructure and construct/install them for effective establishment and operation of the Multispecies Hatchery even if not mentioned in this Table 1. The Concessionaire shall, however, follow the process of approval of design and construction/installation described in Schedule-B.

2. Quality of Construction

The Concessionaire shall comply with the Additional Quality Requirements listed in **Table 1** which are non-negotiable.

Table 1

Indicative Requirements of Facilities, Equipment and Infrastructure

Facilities, Equipment, Infrastructure	Requirements/ Capacity/ Size	Additional Quality Requirements
Hatchery Tanks complete in all respects including with all the water and air circulating systems complete with all the electrical systems including back-up.	The Hatchery Tanks should be in modules that can be constructed/ installed as needed to meet the production requirements over the years of Operation as set out in Table 1 below Clause 17.4.1 of Concession Agreement. Ordinarily these should be planned in at least 3 modules. The choice of material for construction of these tanks is left to the Concessionaire (either reinforced polymer tanks, or reinforced cement concrete). Overall covered/semi-covered area is estimated, tentatively to be 1,090 square meters.	Additional Specific Requirements: In an overall sense, all these Hatchery Tanks should be laid on appropriately constructed foundation/base and should be covered as may be needed for atmospheric control by appropriately constructed roof/ cover/ greenhouse. All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Nursery Tanks complete in all	The Nursery Tanks should be in modules that can be constructed/	Unless installed as floating cages appropriately anchored, all

Facilities, Equipment, Infrastructure	Requirements/ Capacity/ Size	Additional Quality Requirements
respects including with water and air circulation systems complete with all the electrical systems including back-up.	installed as needed to meet the production requirements set out in Table 1 below Clause 17.4.1 of Concession Agreement over the years of Operation. Overall area of the Nursery Tanks is estimated, tentatively to be 1,500 square meters. Ordinarily these should be planned in at least 2 modules. The choice of material for construction of these tanks is left to the Concessionaire (either reinforced polymer tanks, or reinforced cement concrete, or floating cages if located on the lagoon).	Nursery Tanks should be laid on appropriately constructed foundation/base and should be covered as may be needed for atmospheric control by appropriately constructed roof/cover/greenhouse. All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Brood Stock holding facilities (tanks or sea cages) complete in all respects including with all the water circulating systems, all the electrical or atmospheric control systems that may be required.	The Brood Stock holding facilities (tanks or sea cages) should be in modules that can be constructed/ installed as needed to meet the production requirements set out in Table 1 below Clause 17.4.1 of Concession Agreement over the years of operation. These Brood Stock Tanks can be either Fixed Tanks or Floating Cages, and the choice of material left to the Concessionaire. Estimated total area of Brood Stock tanks is 560 square meters.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Sea Cages	An appropriate number of sea cages is required. Area and volume of each cage should be appropriate for the purpose for which the cage would be used. Alternatives, such as installation of prefabricated tanks on the land area is permitted depending on the area required and aesthetic requirement of the site.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Outdoor Algae Culture System including Culture Tanks complete with all respects all the water circulating systems, all the electrical or	Outdoor Algae Culture Systems including Tanks should be constructed/ installed as needed to meet the production requirements set out in Table 1 below Clause 17.4.1 of Concession Agreement over the years of Operation. Estimated area of such Algae Culture Tanks, tentatively, is 1,250	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.

Facilities, Equipment, Infrastructure	Requirements/ Capacity/ Size	Additional Quality Requirements
atmospheric control systems that may be required	square meters. Choice of material left to the Concessionaire.	
Indoor Live Feed Culture Modules complete with all respects: consisting of (a) Complete Algae Culture, Rotifier Culture and Artemia Culture Systems, and (b) Rotifier Mass Culture System.	The overall area of the complete Algae Culture, Rotifier Culture and Artemia Culture Systems would be, tentatively, 360 square meters. Similarly, the overall area for the Rotifier Mass Culture System would be, tentatively, 720 square meters. Choice of material left to the Concessionaire.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Warehouse	This should a permanent building of area approximately 625 square meters, with construction appropriate for the purpose, complete with internal storage arrangements.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Laboratory Building	This should a permanent building of area approximately 150 square meters, with construction appropriate for the purpose, complete with facilities and equipment.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Pumping Station and Saltwater Intake	This should a permanent building with construction/installation appropriate for the purpose, complete with equipment and services such as power supply.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.
Waste Disposal Facility including Incinerator(s)	This should a permanent building of area approximately 90 square meters, with construction appropriate for the purpose, complete facilities for segregation of wastes, recovery of recyclables, and an incinerator of required capacity for final disposal of non-recyclable wastes.	All construction/installation must conform to the technical quality, safety and environmental norms as per Clause 17.5.3 of Concession Agreement.

SCHEDULE-D

(See Clause 12.3.1 of Concession Agreement)

SPECIFICATIONS AND STANDARDS

1 PRELIMINARIES

1.1 Standards, Codes and Specifications

- 1.1.1 The Specifications and Standards Appendix consists of Technical Specifications to be followed for during Construction of the Multispecies Hatchery and Allied Facilities for all Civil, Mechanical, Electrical, Plumbing, Instrumentation etc. required to be executed under this Concession Agreement.
- 1.1.2 Notwithstanding to the said specification, the concessionaire is instructed to adopt and follow necessary regulations, standard specifications, approved codes or statutes of the Government of Maldives wherever required for fulfillment of all the works under this Concession Agreement.
- 1.1.3 Where there are no applicable national/standards and specifications, Concessionaire should conform to national standards and acceptable specifications in Western Europe, British Standard Specifications and Codes of Practice or North America, whichever is superior.
- 1.1.4 The Schedule D has to be read in conjunction with Schedule C, specifically 'Indicative Requirements of Facilities, Equipment and Infrastructure'.

1.2 Drawings and Specifications

- 1.2.1 The Concessionaire will be responsible for detailed engineering designs and detailed good for construction drawings for all facilities, equipment and infrastructure to be constructed or installed, along with detailed cost estimates including unit rate analysis, programs of works, and specifications, sufficient in scope to enable procurement of works contractors and subsequent construction of the works, and to allow for the efficient monitoring of quality, progress, measurement, and payment by Authority.
- 1.2.2 The Concessionaire shall produce drawings and specifications for all components of the hatchery and nursery facility including but not limited to: Water intake and discharge systems; Separate hatchery and nursery spaces for the production of groupers, Bait Species and sea cucumber, with adequate numbers and sizes of tanks to achieve the target production as well as adequate drainage capacity; Live feed culture facility, testing laboratory, Feed store with adequate capacity to store artificial feeds for the target production; On-farm feed production facility, air circulation systems and any other facility necessary for the works specified in Schedule C.
- 1.2.3 Drawings and Specifications are intended to complement each other, so that if anything is shown on the Drawings, but not mentioned in the specifications or vice versa, it is to be furnished and built as though specifically set forth in all three. If any discrepancies, errors, ambiguities or omissions occur in the Drawings or Specifications, the same shall be referred to the Authority before proceeding with the Works, and the Authority decision on such discrepancies, errors, ambiguities or omissions shall be final.
- 1.2.4 The Concessionaire will during the progress of the Works furnish additional Drawings, Specifications, and instructions as may be necessary, in the opinion of the Authority for the purpose of the proper and adequate execution and maintenance of the Works, and the

Concessionaire shall make his work conform. Such drawings and instructions shall be deemed to be part of the Concession Agreement Documents.

1.3 Acquaintance with Site Condition

1.3.1 The Concessionaire is deemed to have visited the work site and acquainted self of the nature of the site conditions. No claim or extra will be allowed as a result of any misunderstanding or incorrect assessment or misinformation or ignorance of the Concessionaire on the prevailing site conditions, lagoon conditions, soil strata etc.

1.3.2 All necessary desktop studies, field surveys and engineering investigations, including, but not limited to, topography, seawater sampling, soils and materials' investigations, drainage investigations, earthworks etc. shall be undertaken by the Concessionaire. The measurements and surveys would be jointly signed off by the Concessionaire and the Authority.

1.4 Quality of materials & General Standards of work

1.4.1 The Concessionaire will be allowed to use its own technology, methods of construction/erection and installation. However, all of these should comply with best construction/installation standards and protocols, and in case of equipment, manual provided by the manufacturers and would assume full responsibility for the quality of all material incorporated or brought for incorporation in the work. The quality of works has to adhere to approved national or international standard of safety and environmental norms.

1.4.2 Concessionaire will ensure good biosecurity, efficiency and cost-effectiveness and would develop and implement Standard Operating Procedures (SOPs) in order to maintain productivity and quality.

1.4.3 In all possible cases, sample approval shall be ensured by the Concessionaire from competent authority/ engineer-in charge before bringing in the materials in bulk at site and the approved sample shall be well preserved at site at the risk and cost of the Concessionaire as a ready reference.

1.4.4 Concessionaire will facilitate, and support Engineers nominated by the Authority to examine the quality of construction/erection of all facilities and infrastructure and remedy the construction/erection as and if recommended by the Engineers

1.4.5 In all possible cases, where the warranty of manufacturers is sought for by the Authority, the Concessionaire shall submit the cross warranty in the form as directed and in manner including workmanship etc. along with the manufacturer 's warranty certificate.

1.4.6 At the end of the construction/erection of facilities and infrastructure, Concessionaire will facilitate access of the Engineers nominated by Authority to examine the quality of construction/erection to draw up a list of remedies to be implemented during the Defects Liability Period and ensure that such remedies are implemented by them as specified by the Engineers

1.4.7 The entire island, lagoon area, and the surrounding water areas will be kept always in a clean state comparable to the current pristine environment during the entire construction, operation and maintenance period. Cleaning and disposal of all wastes and pollution will be a regular, continuous responsibility of the Concessionaire.

1.4.8 All workmanship shall be of the best standard. All goods and materials to be incorporated in the Works must be new, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Concession Agreement.

- 1.4.9 The Concessionaire shall submit for the approval of the Authority a list of names and addresses of the manufacturers and trademarks or names of all the various types of materials and goods the Concessionaire proposes to use in the Works. The list shall include reference to the specification's clause or article to which the materials and goods apply.
- 1.4.10 Materials shall be obtained from approved sources and used in accordance with the manufacturer's printed instructions. In the absence of a specification all materials shall comply with a relevant standard. The Authority shall order the removal of any materials, which he has not approved.
- 1.4.11 No orders for materials and goods shall be placed until approval has been obtained for the materials and goods from the Authority.
- 1.4.12 The Concessionaire shall note that it is his responsibility to include in his price for the cost of the materials and products as specified and no adjustment will be allowed should the Authority reject the alternatives.
- 1.5 Samples
- 1.5.1 The Concessionaire shall furnish for the approval with reasonable promptness, all samples as directed by the Authority. The Authority shall check and approve such materials with reasonable promptness only for conformance with the design concept of the Works and for compliance with the information given in the Concession Agreement. The Work shall be in accordance with the approved samples
- 1.5.2 All samples shall be delivered to the Authority's office with all charges in connection therewith paid by the Concessionaire.
- 1.5.3 Duplicate final approved samples, in addition to any required for the Concessionaire's use, shall be furnished to the Authority, one for office use and one for the site.
- 1.5.4 Samples shall be furnished so as not to delay fabrication, allowing the Authority reasonable time for consideration of the sample submitted.
- 1.5.5 Each sample shall be properly labeled with the name and quality of the material, manufacturer's name, name of project, the contractor's name and date of submission, and the specification clause to which the sample refers.
- 1.6 Obvious Work: Where an item of work is obviously required for the type of work being undertaken then it shall be deemed to have been included even though the item is not specifically mentioned or shown in the Drawings or Specifications.
- 1.7 Ordering Materials
- 1.7.1 The Bills of Quantities if any specified by the Authority in the RFP or the Draft Concession Agreement shall not be used as a basis for ordering materials and the Concessionaire is entirely responsible for assessing the quantities of materials to be ordered.
- 1.7.2 Upon receipt of the Authority's order to commence the Works, the Concessionaire shall immediately place orders for all required materials and will be held responsible for any delays occurring due to late placing of such orders.
- 1.7.3 The Concessionaire shall pay all expenses, taxes and dues etc. incurred on the procurement of materials from abroad
- 1.8 Transportation to the Site: The Concessionaire shall provide all necessary transport, handling and storage of all materials, components and the like to their points of installation

on site including transport to and from storage. The Concessionaire shall provide all necessary transport of labour to and from the site.

- 1.9 Schedule and Execution Plan: The Concessionaire shall prepare and submit to the Authority for approval the construction schedule and an execution plan of temporary facilities, stockyards, etc., before the start of the Works.
- 1.10 Repairing and Correction: Any breakage(s) or defect(s) of existing buildings, road utilities, or part(s) of them caused by the Works including transportation for the works shall be repaired or corrected by the Concessionaire with his responsibility.
- 1.11 Protection
 - 1.11.1 The Concessionaire shall have the Works and adjoining properties protected from inclement weather. Any loss or damage caused by weather, carelessness or lack of skill of workers, accident or otherwise shall be of such property that is affected. The Concessionaire shall provide all necessary dust sheets, barriers and guardrails and clear away at completion.
 - 1.11.2 The work shall be suspended for such time as may be directed and/or approved by the Authority if the specified quality of work is difficult to maintain during inclement weather.
- 1.12 Setting Out
 - 1.12.1 The Concessionaire shall be responsible for accurately setting out the Works to the specified positions, dimension, levels and Building Lines and also checking the site surveys for dimensional and level accuracy and reporting any discrepancies before building work commences.
 - 1.12.2 The Concessionaire shall provide the Authority with all facilities, equipment and labour to enable him to check the setting out and levels of the Works at all times.
 - 1.12.3 All setting out points, benchmarks, site rails, pegs and other survey points shall be clearly marked and protected from damage or disturbance during the execution of the Works
- 1.13 Scaffolding
 - 1.13.1 The Concessionaire shall provide, erect, maintain, dismantle and clear away at completion proper and adequate including that required for subcontractor and suppliers. Putlog holes shall be made good to match the adjacent surface as the scaffolding is dismantled.
 - 1.13.2 The Concessionaire shall be responsible for all safety precautions in connection with the scaffolding including the provision of all bracing, scaffold boards, toe boards and the like and for entire sufficiency for the work.
- 1.14 Construction Machinery, Plants and Equipment
 - 1.14.1 All necessary construction machines shall be provided and maintained by the Concessionaire and shall be approved by the Authority.
 - 1.14.2 If cranes or any other type of plant which places any load on the structure are proposed, all details of such plant shall be submitted to the Authority for approval before the work is actually commenced. If approved by the Authority and contractually acceptable, permission may be given for the structure to be strengthened, in order to carry out loads, and the Concessionaire shall be responsible for any resulting additional costs.
 - 1.14.3 The Concessionaire shall be responsible for making good to the satisfaction of the Authority any damage to the permanent structure that may be caused by his plant and equipment.
- 1.15 Water, Electricity, data and network for the Works

- 1.15.1 Ancillary Facilities on site include a powerhouse and a RO plant house.
- 1.15.2 All network (power and plumbing) necessary for the Ancillary Facilities are also complete. The Concessionaire may use these facilities but shall also make all necessary arrangements to connect the networks to all new infrastructure, equipment and facilities constructed or installed under the Concession Agreement.
- 1.15.3 The Concessionaire shall make all necessary arrangements and provide all water for the proper execution of the works, together with all transport, temporary plumbing, storage and distribution, and alter, adept and maintain temporary work as necessary and remove and make good at completion.
- 1.15.4 The Concessionaire shall make all necessary arrangements and provide all artificial lighting and power (maintain a generator if necessary) for the proper execution and security of the Works and its protection, with all meters, temporary wiring and fittings, and alter adapt and maintain the temporary work as necessary and remove and make good at completion.
- 1.16 Site Offices for Concessionaire
- 1.16.1 Office space 121 square meter of built-up area, single-storey, unfurnished building with electrical and plumbing services already completed will be provided to the Concessionaire. However, for any other arrangements for a site office shall be made by the Concessionaire.
- 1.16.2 The Concessionaire shall provide maintain and clear away on completion of the construction all necessary temporary site offices, canteens, messing and welfare facilities, temporary buildings, toilets and the like for all site staff employed by the Concessionaire and required by subcontractors and suppliers.
- 1.16.3 The offices shall be open at all normal working hours to receive instructions, notices and other communications.
- 1.16.4 The Concessionaire shall obtain the approval of the Authority of the proposed site layout, type and drainage arrangement of all the new buildings, if any, prior to erection of same. All buildings shall be supplied and maintained in good condition and of neat appearance at the Concessionaire's expense.
- 1.17 Concessionaire's Site Area
- 1.17.1 Throughout the period of the Concession the Concessionaire shall maintain the area of his operation within the limits of the Site in a clean, tidy and safe condition by arranging materials and the like in an orderly manner. All rubbish, debris, waste materials and the like shall be systematically cleared from the Site as it accumulates.
- 1.17.2 The Concessionaire shall take all steps necessary as directed by the Authority to minimize or eliminate dust, noise or any other nuisance, which may occur. Plant emitting dust, smoke, excessive noise or any other nuisance shall not be permitted.
- 1.18 Progress Meetings, documentation (photographs)
- 1.18.1 During the course of the Works, progress meetings shall be held at fortnightly intervals or any other interval as agreed upon with Authority, for the purpose of coordinating the Concessionaire's works and to ensure that full compliance is maintained. The Concessionaire is supposed to share in writing the detailed schedule of construction and other works.
- 1.18.2 Minutes of such meetings should be recorded; copies will be distributed to all persons concerned and full effect shall be given to all instructions contained therein.

- 1.18.3 The Concessionaire shall submit all reports in connection with progress meetings, progress of works, photographs (twelve photographs from 36 exposures), every month showing the progress of the works.
- 1.18.4 The photographs shall be submitted in soft copies and hard copies - three copies unmounted of a size not less than 15 x 10 centimeters with the description of the viewpoint stamped in ink on the back. The negative/ soft copies shall have the date on it and remain the property of the Authority and no prints from these negatives may be supplied to others unless previously authorized in writing by the Authority.
- 1.19 Site Signage
- 1.19.1 The Concessionaire shall provide and maintain two billboards for the Site each consisting of a plastic board panel of size not less than 2m x 2m supported 2.5m above the ground with steel angle framing or similar material and fixed in concrete foundations.
- 1.19.2 Each board shall have the following written in both Dhivehi and English by a skilled sign writer:
- (a) The name of Project
 - (b) The name and address of Authority
 - (c) The name and address of Concessionaire
 - (d) A scaled layout shall be prepared and submitted for the Authority's approval before fabrication.
- 1.19.3 No advertising material other than the above will be permitted.
- 1.20 The location and layout of Sub-Concessionaire or Manufacturer's billboards/ signage, if allowed, must be submitted for the Authority's approval.
- 1.21 Loading in Excess of Design Load
- 1.21.1 No loading in excess of the design loading shall be placed on any portion of the structure without the written permission of the Authority. If such permission is granted, all beams or other members of the structure which are subjected to loading other than the designed loading shall be strengthened and supported to the satisfaction of the Authority, and the Concessionaire shall be responsible for any resulting additional costs.
- 1.21.2 The Concessionaire shall be responsible for making good to the satisfaction of the Authority any damage to the permanent structure that may be caused by such excess loading.
- 1.22 Permanent Drainage, Electricity and Water connection: The Concessionaire shall allow for arranging and obtaining the permanent drainage, water and electricity connections to the proposed development and he shall be responsible for making all expenditure in connection therewith.
- 1.23 Completion, Operation and Maintenance Standards
- 1.23.1 Concessionaire shall gain the approvals and respective Completion Certificates from all the local government authorities and the like that the work has been completed in accordance with their requirements. Any expenditure in connection therewith shall be paid by the Concessionaire.
- 1.23.2 All facilities, equipment and infrastructure constructed/erected or installed under the Concession should be maintained as per the approved scope and schedule of routine, regular and periodic repair and maintenance. Any deviation from the scope and schedule will need prior approval of the Authority.

- 1.23.3 All facilities provided at the site by Authority will need to be maintained including routine and regular maintenance, any repair, replacement of internal furnishing, gadgets, fittings etc. by the Concessionaire. Concessionaire will prepare a schedule for periodic maintenance, if any, and submit to Authority for approval. Approved periodic maintenance will be carried out by the Concessionaire, where the cost of such periodic maintenance will be paid by the Authority. Concessionaire will ensure that replacement of such furnishing, furniture, gadgets and residual fittings of brand, make and technical specifications are acceptable to the Authority throughout the Concession Period.
- 1.24 Report on Maintenance: Concessionaire will provide to Authority a 6-monthly report on routine and regular maintenance; and specific reports on periodic maintenance, throughout the Concession Period.
- 1.25 Safety
- 1.25.1 Safety during fabrication and during the maintenance phase is of utmost importance; following items have to be included in the building:
- 1.25.2 Permanent safety lines around the building edges for maintenance inspections, according to Certificate on Health and Safety System OHSAS 18001:2007 And Environment Management Certificate ISO 14001:2004
- 1.25.3 Ensure that, the age of worker is legal. All workers must attend safety training courses.
- 1.25.4 Safety insurance is applied for all workers. Alcohol is prohibited. All behaviors, which violate safety regulations will be punished.
- 1.25.5 Before starting new task, all workers are trained by safety officer. During the working time, workers will be warned about safety by officer.
- 1.25.6 Working under crane or any higher temporary structure is prohibited.
- 1.25.7 Restricted zone will be alerted and separated by barricade.
- 1.25.8 Working at high level must equip hardness, helmet, shoes. In case of night working, the light must be enough to work.
- 1.25.9 Employees must take note of and follow the instruction regarding protective measures against injury to people and damage to materials. Also refer to the ESHS Requirements, as part of the Concession Agreement.
- 1.25.10 During the entire lease period, the Concessionaire is required to organize all equipment and facilities needed for ensuring safety of the Concessionaire's workforce at Site from natural hazards which are to be expected in a low-elevation small island. Concessionaire is also required to heed any safety and security advise from the Government of Maldives and organize the necessary actions entailed for ensuring safety of the Concessionaire's workforce at Site.

2 DESIGN CONSIDERATIONS

2.1 General design considerations

- 2.1.1 Multispecies Hatchery should be designed to ensure good biosecurity, efficiency and cost-effectiveness and should implement Standard Operating Procedures (SOPs) in order to maintain productivity of large numbers of high-quality post-larvae (PL).
- 2.1.2 All construction/installation must conform to the technical quality, safety and environmental norms as applicable as per Government of Maldives standards and specifications or international best practices, standards and specifications of European or North America when national standards and/or specifications are not available.

- 2.1.3 Hatchery should have an effective production system and should ensure all essential infrastructure or facility - inlet water quality and treatment, wastewater treatment, water and air circulating systems, pumping station and saltwater intake, waste disposal facility including an incinerators and the other essential components - are designed, constructed or installed, operated and maintained in a manner taking care of concerns related to highest standards of biosecurity, consideration of Hazard Analysis Critical Control Point (HACCP) approach, and responsible use of chemicals.
- 2.1.4 The design should incorporate various infrastructural requirements and facilities for production and service, including but not limited to the following:
- (a) seawater intake system,
 - (b) freshwater intake system,
 - (c) water treatment and storage,
 - (d) brood stock holding, maturation and spawning facilities including tanks,
 - (e) live Feed culture systems including indoor algal stock culture, intermediary and outdoor algal culture, rotifer culture, artemia hatching and enrichment, larvi-culture and larval rearing facilities, nursery rearing facilities,
 - (f) laboratory,
 - (g) feed and chemical storage,
 - (h) aeration facility,
 - (i) additional wastewater treatment and disposal facilities, and,
 - (j) workshops as may be required.
- NOTE: Ancillary Facilities such as staff accommodation, staff recreation facilities, kitchen, office space, mosque etc., are provided on site by the Authority. Furnishing of these, to acceptable standards and norms, will be responsibility of the Concessionaire.
- 2.1.4 The design should allow positioning of various units at suitable places for easy and economic operation of the hatchery such as illustrated, but not limited, by the following:
- (a) the water pumping stations, and aeration systems should be kept away from the brood stock facility to avoid noise and vibration disturbance to the brooders;
 - (b) the packing area can be placed near to the main entrance, so as to avoid the entry of unauthorized persons and visitors into any of the area where biosecurity issues are major concerns;
 - (c) elevation of water storage tanks have to be carefully designed for easy and free gravitational flow of water from these tanks to various units of the hatchery;
 - (d) every section of the hatchery should have separate entry to avoid cross contamination from one section to other.
- 2.1.5 Brood stock of the target species shall be maintained on site, whether in sea cages or in land-based tank systems to achieve the target production.
- 2.2 Design for modular capacity expansion of the hatchery: The hatchery design is encouraged to be modular adopting flexible solutions to enable future technical upgrading and to be sized to achieve minimum production targets at different stages of the lease period, as shown in Table below:

Target Species	At commencement of Operation	During Lease Period	Additional Capacity to be added at Concessionaire's Request
Brown Marble Grouper fingerlings- grown to 10cm and ready for sea cage transfer	1 million/year	10 million/year	As per Concessionaire's Business Plan agreed by the Authority
Bait Species - up to 10cm size, to be used as live bait	150 tons/year	300 tons/year	
Sea Cucumber fingerlings – 20g size	1.5 million/year	4 million/year	

2.3 Detailed drawings, calculations for construction of Hatchery and Allied Facilities

2.3.1 The Concessionaire shall provide a layout of the proposed hatchery design along with calculations to size the hatchery to achieve the target production, to be approved by the Authority. The layout shall include, but not limited to, all hatchery components, water intake and outfall and road clearances to access the hatchery components. Calculations shall also provide details of power, water and aeration requirements to size generators and pumps for an operational hatchery.

2.3.2 Upon approval of the layout by the Authority, the hatchery the Concessionaire shall prepare all architectural, structural and service drawings of all hatchery components, as well as detailed drawings of road clearances, power and water distribution networks, etc. required for a functional hatchery.

2.4 Quarantine Facility: The quarantine tanks should be of suitable size to match the size of the brooders to be kept. Facilities for continuous supply of seawater, freshwater and aeration should be provided in this facility. The quarantine facility should be placed either near to the entrance of the hatchery or far off from the production area to avoid cross contamination

2.5 Indoor Brood Stock Facility

2.5.1 The indoor brood stock facility requires a clean environment, with adequate water supply for flow through or recirculation systems. The elevation of water inlet, outlet, drainage canals have to be properly designed for easy and free flow of water.

2.5.2 The tank size, water holding capacity and shape has to be designed according to the requirement of brood stock fishes. The brood stock holding tanks have to be painted with suitable colored epoxy paints to maintain the brooders in a congenial environment and the smooth surface is needed to avoid injury to the brooders and for easy cleaning.

2.5.3 Indoor brood stock holding area should have cement/ FRP or lined FRP or lined PVC tanks with proper water supply, aeration lines and lighting to accelerate the gonadal development

2.5.4 When installing recirculation systems, should plan for enough floor space close to the tanks should be planned in the designing stage to place its various components such as mechanical filters, biological filters, pumps, sterilizers, and heating and photo period control equipment

2.6 Outdoor brood stock holding facilities: The Concessionaire may select appropriate material and technology for construction of outdoor brood stock holding facilities such as

either rectangular earthen ponds or concrete tanks of rectangular/round shape or any other material as deem fit as per national/international standards. While designing the earthen ponds or concrete tanks the space availability, easiness for operation and handling of fishes has to be kept under consideration. In addition, marine fishes can be maintained in the HDPE/ Galvanized Iron Pipe cages in the open sea with proper mooring system.

2.7 Spawning and Incubation Facilities

- 2.7.1 Concessionaire may construct spawning tanks in appropriate dimension and material with water holding capacity ideal for spawning. These can be round or rectangular (with rounded corners) tanks and can be made of concrete, FRP, FRP lined tanks or PVC-lined tanks.
- 2.7.2 The spawning tanks should be provided with adequate facilities for altering the photoperiod and temperature regimes, which are essential for faster gonadal maturation.
- 2.7.3 Should be provided with adequate water supply and aeration.
- 2.7.4 The spawning area should be maintained clean and bio secured to avoid stress to the brooders
- 2.7.5 The spawning tanks have to be painted with suitable color epoxy paints to maintain smooth surface to avoid injury to the brooders and for easy cleaning.
- 2.7.6 Thermal insulated walls and roof are advisable in the areas where temperature fluctuations occur.
- 2.7.7 Tanks should have appropriate drainage system and it may be advisable to have drains placed under the floor and the gutters going to the biological filters should be built well above the floor level to prevent dirt or toxic wastes, such as disinfectants used to wash floors, from entering into the recirculation system.

2.8 Live Feed Culture Facilities

- 2.8.1 The Concessionaire shall appropriately plan for the live feed culture facilities shall include the following: Phytoplankton/algae stock and starter culture unit, phytoplankton intermediary culture unit, phytoplankton outdoor mass culture unit, Rotifer stock and starter culture unit, Rotifer culture and enrichment unit, Artemia nauplii production and enrichment unit
- 2.8.2 The Concessionaire is to calculate appropriate size of the facility with tentative guideline of overall area of the complete Algae Culture, Rotifier Culture and Artemia Culture Systems would be, tentatively, 360 square meters. Similarly, the overall area for the Rotifier Mass Culture System would be, tentatively, 720 square meters.
- 2.8.3 Pure strains of algae as well as starter cultures should be kept in an air-conditioned room under sterile conditions to avoid possible contamination. Floor and walls in this unit should be tiled for easy washing and disinfection. An adjacent storage room of smaller size can be constructed to store chemicals, glassware and other consumables. The stock and starter culture facility should have the seawater lines fitted with cartridge filters and UV sterilizers to treat the water prior to use.
- 2.8.4 For stock and starter culture unit wooden or concrete slabs/ racks should be provided for placing the stock cultures in test tubes or glass or plastic vessels with adequate lighting system to accelerate the growth.
- 2.8.5 A CO₂ enriched air supply system can be connected to the culture vessels to provide additional source of carbon and to ensure necessary turbulence for uniform mixing of culture media also in the stock and starter culture unit.

- 2.8.6 The right-size fluorescent tubes have to be conveniently placed to provide light at adequate intensity for pure algal strains and larger starter culture vessels.
- 2.8.7 Aeration is required to create turbulence and to provide oxygen for both pure algae and starter cultures
- 2.8.8 Intermediate algae culture unit shall be equipped to culture algae in large quantities in polyethylene (PE) bags/ Acrylic carboys/ FRP Tanks or any other appropriate material. The bags/ carboys/FRP tanks have to be housed in a dedicated area adjacent to the stock culture/starter culture unit
- 2.8.9 The floor of Intermediate algae culture unit should be tiled to facilitate easy cleaning and should have proper slope towards drainage canal
- 2.8.10 Adequate fluorescent lights should be provided to accelerate the algal growth in the intermediate algae culture units.
- 2.8.11 The number of bags/carboys/FRP tanks required has to be calculated according to the time taken for the culture to mature to the harvestable level and daily requirement for use in the outdoor culture units. At least 20% additional volume has to be reared to supplement the loss due to algal crash and slow growth during different climatic conditions.
- 2.8.12 The aeration, water supply, CO₂ supply have to be provided according to the requirement in the intermediate algae culture units.
- 2.8.13 The electric system in Intermediate algae culture unit should be designed with a few waterproof sockets, which could be used to connect plastic pumps for harvesting, transfer and inoculum operations. All material such as switches, plugs or sockets used in the electricity network should be waterproof, with each socket controlled by a safety switch on the sub-unit control pane
- 2.8.14 Outdoor algal mass culture unit would have FRP/ concrete tanks placed in a dedicated area adjacent to the intermediary culture unit. Sufficient lighting arrangement has to be provided through transparent roofing. The tanks should be painted with white epoxy paint for improved light reflection. The floor of this unit should be tiled to facilitate easy cleaning and should have proper slope towards drainage canal.
- 2.8.15 The number of FRP /cement tanks required for outdoor algal mass culture unit has to be calculated according to the daily requirement of algae and time taken for the culture to mature to the harvestable. At least 20 percent additional volume has to be reared to supplement the loss due to algal crash and slow growth during different climatic conditions. The aeration, sea water and fresh water supply, have to be provided according to the requirement. Estimated area of such Algae Culture Tanks, tentatively, is 1,250 square meters, however Concessionaire is required to calculate the exact area.
- 2.8.16 A similar set of facility like phytoplankton stock and starter culture unit except CO₂ supply shall be provided for the pure culture and starter culture of rotifers. Care should be taken to avoid cross contamination while maintaining different varieties and sizes of rotifers maintained in this unit.
- 2.8.17 Rotifer culture and enrichment unit should be maintained little away from the algal culture units to avoid cross contamination. The tanks can be rectangular in shape made of FRP material or cement tanks with Epoxy painting. The epoxy paint color has to assist in light penetration and easy for observation and cleaning. The rotifer culture unit has to be divided into multiple sub sections according to type and size of the rotifers cultured. To avoid cross contaminations separate water lines, aeration supply and impediments should be provided. Floor and walls should be covered with tiles for frequent washing and

disinfection to maintain hygienic conditions. As harvesting has to be done in the same room, involving large quantities of culture water, an efficient drainage system is required.

- 2.8.18 The space occupied by rotifer culture unit should be determined by the expected maximum daily consumption of rotifers by the larval fish rearing unit
- 2.8.19 The production of Artemia larval stages (*nauplii* and *metanauplii*) has to be carried out in a separate area, usually adjacent to the rotifer culture unit. Separate seawater and freshwater lines, aeration lines should be provided. The tanks may be made of FRP material or any other material as appropriate and can have conical bottom for easy harvest of nauplii. As in the other units, the floor and walls should be tiled to help maintain good hygienic conditions. As harvesting takes place in the same room with tons of culture water being filtered daily, an adequate drainage system is necessary. The daily requirement of nauplii and *metanauplii* for the *larviculture* has to be calculated and accordingly the number and size of the tanks have to be calculated.

2.9 Fish Larvi-Culture Unit

- 2.9.1 This unit shall be separate from all other units and have proper bio security to avoid cross contamination from outside and tanks within the facility. Adequate lighting has to be provided for this unit. The tanks can be of either FRP or concrete materials.
- 2.9.2 The tanks can be rectangular with epoxy painting. The epoxy color should assist the larvae for easy prey catching and feeding. Floor and walls should be tiled to secure proper hygienic conditions and to facilitate frequent cleaning. Since at harvest the tanks are emptied, an adequate drainage system is required.
- 2.9.3 When a recirculation aquaculture system is used, enough floor space close to the larval rearing tanks should be provided to place components such as mechanical and biological filters, pumps, sterilizers and heating/cooling devices.
- 2.9.4 Each tank should be provided with an independent inlet and angle at which water enters the tank will depend on tank design and on the age of the fish population.
- 2.9.5 To prevent excessive turbulence, the aeration in fish larval rearing tanks should be very gentle, with a low air flow. Aeration has to be provided by means of one or more fine diffusers placed on the tank bottom. Freshwater with a few delivery points and a washbasin for cleaning purposes has to be provided.

2.10 Nursery Rearing Unit

- 2.10.1 Nursery tanks are usually constructed adjacent to the larval rearing unit to facilitate the easy transfer of fish larvae are to be constructed/installed in modules as needed to meet the production requirement.
- 2.10.2 Overall area of the Nursery Tanks is estimated, tentatively to be 1,500 square meters. Ordinarily these should be planned in at least 2 modules, however the Concessionaire shall calculate the exact area required as per requisite design.
- 2.10.3 Either rectangular or circular tanks can be used as nursery rearing tanks. These tanks shall be made of either reinforced polymer tanks, or reinforced cement concrete with smooth finishing avoid bacterial and algal growth on the walls, or floating cages if located on the lagoon. The tank colour should assist the easy cleaning, visibility etc
- 2.10.4 Unless installed as floating cages appropriately anchored, all Nursery Tanks should be laid on appropriately constructed foundation/base and should be covered as may be needed for atmospheric control by appropriately constructed roof/cover/greenhouse. All

construction/installation must conform to the technical quality, safety and environmental norms.

- 2.10.5 Seawater, freshwater, aeration lines should be provided to this facility with adequate lighting.

2.11 Hatchery Tanks

- 2.11.1 The Hatchery Tanks should be in modules that can be constructed/ installed as needed to meet the production requirements and should be equipped with all the water and air circulating systems complete with all the electrical systems including back-up.
- 2.11.2 Ordinarily these should be planned in at least 3 modules. The choice of material for construction of these tanks is left to the Operator (either reinforced polymer tanks, or reinforced cement concrete). Overall covered/semi-covered area is estimated, tentatively to be 1,090 square meters
- 2.11.3 Hatchery Tanks should be laid on appropriately constructed foundation/base and should be covered as may be needed for atmospheric control by appropriately constructed roof/ cover/ greenhouse.
- 2.11.4 All construction/installation must conform to the technical quality, safety and environmental norms

2.12 Pumping Station and Air Blower Room

- 2.12.1 The size of the pumping station depends on the quantity of water needed and, on the type, dimensions, and number of pumps installed, including stand-by units. The site where the pumping station is to be located should be easily accessible, to simplify transport of pumps and other equipment. Moreover, the pumping station should be located as close as possible to the hatchery to facilitate constant surveillance.
- 2.12.2 The pumping station should be a protected, permanent building/shed.
- 2.12.3 The pumping station, even when submersible pumps are used, should be protected at least by a shed and should have good lighting, to facilitate maintenance and eventual repairs. Auxiliary electrical sockets should be provided
- 2.12.4 Proper freshwater lines should be provided in the pump room for priming of the pumps.
- 2.12.5 If the pumping station is located near the seashore, it should be protected, not only against wave action, but also against salty sea spray.
- 2.12.6 Horizontal pumps are normally placed inside a small room, together with the electrical control and alarm panels, to ensure a degree of protection against atmospheric agents. This room usually also includes a small workshop where the most commonly used tools for pump maintenance and repair are permanently stored.
- 2.12.7 Air blowers have to be placed nearer to the pump house or nearby area. The blower capacity has to be calculated according to the aeration requirement in each section.
- 2.12.8 A standby blower has to be installed for use in the event of failure of the main blower. The blower room shall be covered completely to reduce the entry of dirt into the blowers. and to avoid sound pollution

2.13 Seawater Filtration and Water Storage

- 2.13.1 The sea water pumped should be filtered through various types of filtration systems like slow sand filters and rapid sand filters and can be stored in large sumps designed according to the daily requirement of water in the hatchery

- 2.13.2 Sea water and freshwater sumps have to be constructed to store sufficient quantity of water required for the hatchery use. The seawater sumps should have provision for chlorination and de-chlorination of water. In addition, Overhead tanks would also be constructed within the hatchery premises to store copious amount of sea water and fresh water for the storage of water for day to day use
- 2.14 Electrical Generator
- 2.14.1 An electrical generator of suitable capacity has to be installed in the hatchery premises after calculating the load requirement for the blowers, pumps, general lighting and heating equipment. The generator has to be installed in a soundproof casing to avoid sound pollution and preferably and has to be placed far off from the brood stock holding area. A standby generator is needed for pumps and blowers and general lighting in the event of the failure of the main generators. Construction standards should respect the same national/local safety rules.
- 2.14.2 Authority will allow installation of additional generator (or replacement of existing generator in the Generator Room already provided with generators as part of the existing Ancillary Facilities) if the Concessionaire is able to show that such additional capacity can be installed in the said rooms.
- 2.14.3 Authority will encourage the Concessionaire to install the maximum number of solar panels to be installed as either roof-top on the buildings of the Ancillary Facilities already provided by the Authority, if such loading of roof-top is safe from a structural point of view, or stand-standing solar panels at the Site – not only to provide for the additional power required for the hatchery systems and associated facilities, but also to reduce the diesel consumption need for the entire Site.
- 2.15 Workshop /Warehouse and Storage Room
- 2.15.1 A full-fledged workshop is required in the hatchery to meet the day to day maintenance activities like pump repair, electrical maintenance works, blower repair etc.,
- 2.15.2 This unit has to be provided with electrical supply, welding machines, cutting tools, pump and blower repair equipment and accessories. This should a permanent building of area approximately 625 square meters however Concessionaire shall do his own calculations as per the design, with construction appropriate for the purpose, complete with internal storage arrangements.
- 2.15.3 This facility should have a storage room for stocking of aeration and water pipes, other utilities of the hatchery.
- 2.15.4 All construction/installation must conform to the technical quality, safety and environmental norms.
- 2.16 Fish Feed Store
- 2.16.1 This storage facility should have air conditioning unit to store the larval feeds, inert diets, artemia cysts, hormones, antibiotics, health management chemicals etc.
- 2.16.2 This storeroom should be kept away from the area where water is extensively used.
- 2.16.3 Deep freezers can be installed outside this room to store feeds for the brood stock like, squids, crabs, shrimps, fish etc.
- 2.16.4 All construction/installation must conform to the technical quality, safety and environmental norms.
- 2.17 Laboratory

- 2.17.1 The laboratory room has to be located close to the phyto/zooplankton unit or larvi-culture unit.
- 2.17.2 This laboratory should be completed with microscopes, autoclaves, hot air ovens, etc.
- 2.17.3 This should a permanent building of area approximately 150 square meters, with construction appropriate for the purpose, complete with facilities and equipment. However, the Concessionaire would calculate size of the facility in respect to design requirements.
- 2.17.4 Furniture in the laboratory should be similar to that of a research laboratory, including, anti-corrosion benches for scientific instruments, cupboards with transparent doors for storing glassware and chemical products, and large desks with shelves.
- 2.17.5 The laboratory is a "wet room" and safer standards in particular for electricity circuits and slippery floors should be maintained. Cement floored open areas for drying of glassware, utensils, tanks etc., are recommended.
- 2.17.6 All construction/installation must conform to the technical quality, safety and environmental norms.
- 2.18 Office and Seed Packing Area
- 2.18.1 Office and seed packing area should be located near the entrance of the hatchery to avoid entry of visitors into the production facilities.
- 2.18.2 A residential accommodation area for the technical staff and kitchen are already provided by the Authority as part of the Ancillary Facilities.
- 2.19 Waste Disposal Facility including an Incinerator
- 2.19.1 This should a permanent building of area approximately 90 square meters, with construction appropriate for the purpose, complete facilities for segregation of wastes, recovery of recyclables, and an incinerator of required capacity for final disposal of non-recyclable wastes. Concessionaire would calculate size of the facility in respect to design requirements.
- 2.19.2 All construction/installation must conform to the technical quality, safety and environmental norms.
- 2.20 Wastewater Discharge and Treatment System
- 2.20.1 Concessionaire to ensure that drainage pipes, canals and treatment tanks are of adequate capacity to handle the maximum predicted flow of discharge water (taking into account the residence time in the treatment tank). Wastewater treatment may be done through a process wherein wastewater from each facility could be released into special concrete or lined sedimentation tanks, from which. it overflows into treatment tanks where the water will be chlorinated and dechlorinated through aeration.
- 2.20.2 All water discharged from the hatchery, particularly that known or suspected to be contaminated (for example, water originating from the quarantine areas) should be held temporarily and treated with hypochlorite solution (>20 ppm active chlorine for >60 min or 50 ppm for >30 min) or another effective disinfectant and then well aerated (to dechlorinate) prior to discharge
- 2.20.3 Water quality parameters that must be monitored in the discharge in order to comply with the general standards and to prevent polluting the environment surrounding the hatchery.
- 2.20.4 Sewage sullage or any other wastewater should not be discharged into any waterbody without treatment and should be separated from the treatment of hatchery wastewater.

3 TECHNICAL SPECIFICATIONS

3.1 Site Clearing

- 3.1.1 Site clearing including clearing of any vegetation, rock, and surface soil shall be absolutely minimized.
- 3.1.2 No sand or sandy beaches should be disturbed.
- 3.1.3 When clearance of any tree, palm tree or other vegetation is required, only after approval from the Authority.
- 3.1.4 Palm trees should be cleared only after obtaining requisite permits from local government authorities.
- 3.1.5 During the construction/installation and operation stages under this lease, care should be taken to minimize any damage or disturbance of the trees, landform including corals, the beaches and the surrounding water.
- 3.1.6 Spreading, leveling and consolidating on site where required, shall be made with suitable surplus excavated material obtained from the Site. Other soils used for filling shall be approved by the Authority.
- 3.1.7 The Concessionaire shall dispose all unsuitable and surplus excavated material
- 3.1.8 The Concessionaire shall always tidy up and keep the Site in a clean and sanitary condition during the execution of the Works and during the entire period of lease.

3.2 Excavation

- 3.2.1 Excavation shall be performed to the required depth as specified in the detailed drawings submitted by the Concessionaire and approved by the Authority.
- 3.2.2 A survey of the existing site shall be made and the results of same submitted to the Authority before commencement of the work.
- 3.2.3 Excavation area shall be protected from any water flowing in. Sides of excavations shall be shored or inclined to retain excavation unless otherwise specified.
- 3.2.4 Excavation near adjoining structures shall be executed with care so as not to damage those structures.
- 3.2.5 The Concessionaire shall take all necessary precautions during the excavation for the Works particularly those excavation which are adjoining existing buildings and shall protect such buildings from the damage or collapse by means of temporary or permanent shoring, strutting, sheet piling or underpinning or excavation in short lengths and/or other methods as he deems fit and also the Concessionaire shall properly support all foundations, trenches, walls, floors, etc. affecting the safety of the adjoining existing buildings.
- 3.2.6 The Concessionaire shall alter, adopt and maintain all such works described above for the whole Concession Period and shall finally clear away and make good all damages done.
- 3.2.7 The construction and efficiency of the shoring, underpinning, strutting and the like for the purpose for which it is erected shall be the responsibility of the Concessionaire, should any subsidence or any other damage occur due to the inefficiency of the shoring, underpinning, strutting and the like or any other support provided, the damage shall be made good by the Concessionaire at his own expense and responsibility.
- 3.2.8 The Concessionaire shall be held solely responsible for the safety of the adjoining existing buildings, the sufficiency of all temporary or permanent shoring, underpinning, piling, and the like.

- 3.2.9 The Concessionaire shall keep the Authority informed as to manner in which the Concessionaire intends to proceed with the execution of the excavations and obtain his approval. Such approval if given shall not absolve the Concessionaire of his responsibility.
- 3.2.10 Excavation shall extend a sufficient distance from walls, footings, etc. to allow space for placing and removing shoring and formwork, for performing all work in the excavations and for the inspection of same.
- 3.2.11 Excavated material shall be deposited within specified areas as directed unless otherwise specified.
- 3.2.12 The Concessionaire is deemed to have inspected the site and to leave ascertained for himself as to the nature of the soil, etc. and also the areas where to collect and stack the materials for which necessary site clearance shall have to be made at his own cost.
- 3.2.13 Stacking or excavated materials shall be done at places approved by the Authority and he shall have recorded the original ground levels of such places jointly with the Concessionaire before commencement of stacking operation.
- 3.2.14 All foundation trenches shall be excavated to the full widths and depths shown on the drawings or to such greater or smaller depths as may be found necessary in the opinion of the Authority and so instructed by the Engineer.
- 3.2.15 The Concessionaire shall notify to the Authority when the excavation is completed and no concrete or masonry shall be laid until the Authority has inspected of the soil for each individual footing.
- 3.2.16 All foundation pits shall be refilled to the original surface of the ground with approved materials, which shall be well consolidated as instructed by the Authority.
- 3.2.17 The Concessionaire shall erect temporary barricades around the excavations and if necessary, make provisions of red lamps or other safety barriers.
- 3.3 De-watering
- 3.3.1 Where the excavation level is below the natural water table and it is necessary to pump continuously from the excavation or to install a specialist type of dewatering equipment around the perimeter of the site or excavation, the Concessionaire will be responsible for ensuring the safety and stability of all adjoining structures and services or utilities above or below ground level.
- 3.3.2 It will also be the responsibility of the Concessionaire that the equipment installed shall ensure that the excavation and subsequent construction is carried out in dry conditions.
- 3.3.3 Continuous or permanent de-watering of the excavation or Site may not be undertaken without the written approval of the Authority and the methods to be employed shall also comply with Codes of Practice and Local Authority requirements.
- 3.3.4 The water pumped from the excavations or well points shall be pumped to disposal points or sumps approved by the Authority and required to be passed through settling tanks before disposal.
- 3.4 Backfill
- 3.4.1 All earth used for filling shall unless otherwise stated, be selected hard dry material from the excavation. The maximum dry density of the fill material shall be not less than 1600 kg/m³.

- 3.4.2 The backfill of excavations shall be placed in horizontal layers not exceeding 300mm in thickness. Each layer shall be compacted by hand or other mechanical means to the required density before the next layer is added.
- 3.4.3 Care shall be taken when filling or back-filling to avoid any wedging action or eccentric action upon or against the structure of the work.
- 3.4.4 Before placing of fill, the surface of the sub-grade shall be compacted at optimum water content to the same percentage of maximum dry density required of subsequent lay.
- 3.4.5 The Authority can inspect all compacting devices that the Concessionaire proposes and shall have the right to reject any device which he feels is unsuitable for the job.
- 3.4.6 Heavy equipment for spreading and compacting fill and backfill shall not be operated closer to walls than a distance to the difference in height between the top of the footings and the layer being compacted.
- 3.4.7 When backfilling behind retaining walls, basement walls and the like the said structures shall be kept propped during the complete operation. The hydraulic compaction of fill shall not be permitted, and the back filling shall be carried out in layers not exceeding 150mm thick.
- 3.4.8 Each layer shall be compacted to 90% of the modified compaction. No back filling shall be carried out until the wall concrete has achieved its full works cube strength and care shall be exercised so as not to damage the external tanking membrane and its protection.
- 3.5 Concrete Works
- 3.5.1 Materials used in the Works shall be new, of the qualities and kinds specified herein and equal to approved samples. Delivery shall be made sufficiently in advance to enable further samples to be taken and tested if required. No materials shall be used until approved and materials not approved shall be immediately removed from the Works.
- 3.5.2 Materials shall be transported, handled and stored on the site or elsewhere in such a manner to prevent damage, deterioration or contamination.
- 3.5.3 Cement
- (a) Cement shall be Ordinary Portland cement of an approved brand.
 - (b) Cement shall conform to BS (British Standard) 12.
 - (c) Cement shall be of recent manufacturer and used within 6 months of manufactured date.
 - (d) The Concessionaire shall maintain with each fresh consignment of cement delivered to the site copy of the Manufacturer's statement of compliance with the above Standard Specifications together with the date of manufacture, certified by an independent agency in the country of origin and its date of delivery to Site and shall submit to the Authority when sought or on agreed progress meetings/reporting schedule.
 - (e) All mandatory check tests shall be carried out at the Concessionaire's expense.
 - (f) Any cement failing to meet the required standards will be rejected and replaced at the Concessionaire's expense.
 - (g) Any cement not conforming to BS 12 shall not be used unless otherwise approved by the Authority.
- 3.5.4 Aggregate

- (a) Fine aggregate shall be river sand conforming to BS 882.
- (b) Coarse aggregate shall be crushed stone excluding limestone or derivatives of limestone conforming to BS 812.
- (c) Aggregate shall not contain injurious amount of rubbish, dirt, organic impurities and other foreign matters.
- (d) Strength of aggregate shall be more than that of hardened concrete paste.
- (e) Shape of coarse aggregate shall not be flat or slender.
- (f) Aggregate to be used in concrete shall possess the qualities indicated in the following tables.

Grading requirements for aggregates

Type	Max. size (mm)	Nominal sieve size (mm)	Percentage passing each sieve by weight (%)										
		40	30	25	20	15	10	5	2.5	1.2	0.6	0.3	0.15
Coarse	25	100	100	90 ↓ 100	60 ↓ 90		20 ↓ 50	0 ↓ 10	0 ↓ 5				
	20			100	90 ↓ 100		20 ↓ 55	0 ↓ 10	0 ↓ 50				
Fine							100	90 ↓ 100	80 ↓ 100	50 ↓ 90	25 ↓ 65	10 ↓ 35	2 ↓ 10

- (g) Manufactured sand and blast furnace slag to be use in concrete shall not be used unless otherwise specified or approved by the Authority if required.

Quality of Aggregates

Aggregate type	Open dry specific gravity	Percentage of water absorption (%)	Percentage of solid volume for the evaluation of particle shape (%)	Clay lump (%)	Loss in washing test (%)	Organic impurity (%)	Water soluble chloride (%)
Coarse	≤ 2.5	≤ 3.0	≥ 55	≤ 0.25	≤ 1.0	0	≤ 0.25
Fine	≥ 2.5	≤ 3.5	-	≤ 1.0	≤ 3.0	0	≤ 0.01

* Color of test solution not to be darker than standard solution

- (h) In case of using fine aggregate of 0.01% or more water soluble chloride content, the necessary measures for corrosion inhibiting of reinforcement shall be taken by the Concessionaire
- (i) The maximum size of coarse aggregate shall be 25 mm.
- (j) Sources of aggregate shall be to the approval of the Authority and samples of aggregate from the proposed source shall be submitted to the Authority at least 28 days before its intended use, if required.

3.5.5 Water

- (a) Water shall not contain injurious amount of impurities that may adversely affect concrete and reinforcement.
- (b) Ground water shall not be used for concrete works.
- (c) Water shall be obtained from a public supply where possible and shall be taken from any other sources only if approved by the Authority.
- (d) Only water of approved quality shall be used for washing out formwork, curing concrete and similar surfaces.

3.6 Handling and Storage of Material

3.6.1 Cement

- (a) Cement shall be stored in a manner to prevent weathering.
- (b) Bagged cement shall be piled no more than 10 bags so as to permit easy inspection
- (c) Cement caked even to the slightest extent shall not be used. Such cement and rejected cement shall be immediately separated from other bags of cement so that they shall not be mistaken for others.

3.6.2 Aggregate

- (a) Aggregate shall be stored in a manner effectively separating coarse and fine aggregate according to type and shall be prevented from inclusion of dirt, rubbish and other undesirable foreign matters.
- (b) Coarse aggregate shall be unloaded and piled in a manner not to cause segregation of small and large particles. Aggregate to be stored in piles shall be in mounds of moderate height and at a location where good drainage is provided.

3.7 Mix Proportion and Strength

- 3.7.1 Mix ratio for reinforced concrete shall achieve at minimum 25 N/mm² for all substructure works and 40 N/mm² for all superstructure works.
- 3.7.2 Mix ratio for lean concrete shall be in the proportion 1:2:6 (cement: fine aggregate: coarse aggregate) by dry volume.
- 3.7.3 Water-cement ratio for concrete shall be 0.4% to 0.45%
- 3.7.4 The specified design strength of reinforced concrete shall be not less than 25 N/mm² for superstructure and 40 N/mm² for all substructure works.
- 3.7.5 The required slump of concrete shall be 100 mm.
- 3.7.6 Design mix proportion shall be to obtain required workability, consistency and durability.

3.8 Production of Concrete

- 3.8.1 Field-mixed Concrete Plant: The Concessionaire shall select the necessary facilities for storage, batching, mixing and transporting of each of the materials and submit them for approval of the Authority prior to start work, if required or asked for.
- 3.8.2 Mixing Control: Concrete mixture shall be constantly controlled to obtain required workability and mixed strength. Mixing time for each batch shall be not more than 3 minutes.
- 3.8.3 Quality Control: The Concessionaire shall conduct tests for quality control toward ensuring that concrete of the required quality is constantly produced. The Concessionaire

shall have all quality control tests report ready for submission as and if required by the Authority.

3.8.4 Quality Inspection of Concrete at the Point of Placement: The Concessionaire shall conduct tests on concrete at the point of placement. When test results meet the tolerances given below, the concrete shall be qualified to have passed the tests.

3.8.5 The tolerance between actual slump and required slump of the concrete shall be ± 2.0 mm

3.8.6 For the estimation of compressive strength of concrete in compressive strength tests, when the average value of compressive strength of concrete obtained in a test is not less than the specified design strength, it shall be qualified to have passed the test. In case of failure to achieve the above requirements, the Concessionaire shall take necessary measures.

3.9 Transporting and Placing of Concrete

3.9.1 The Concessionaire shall establish manner and schedule for transporting and placing of concrete and obtain approval of the Authority.

3.9.2 Concrete shall be transported in a manner to minimize segregation, spill, age and other changes in quality thereof.

3.9.3 Concrete shall be placed and consolidated in a manner to insure uniformity and optimum density.

3.9.4 In case of rain or other conditions that may affect the quality of concrete during concreting, the Concessionaire shall take necessary measures as deem fit for good quality construction.

3.9.5 Time Limit: The time limit from start of mixing to completion of placing of a batch as rule, shall be 30 minutes.

3.9.6 Preparation prior to Placing: The place where concrete is to be deposited shall be cleaned and sheathing shall be sprinkled with water. Subsequently, water accumulated in the form shall be removed.

3.9.7 Construction Joint: Joint surfaces shall be cleaned, made free of laitance and other foreign matters, and wetted prior to concreting. Joint surface shall be roughened if need be.

3.9.8 Concrete Placing:

(a) Concrete placing shall be proceeded to keep the surface of placed concrete as horizontal as possible.

(b) Concrete shall be continuously poured to compact around reinforcing bars and corners of formwork.

(c) The maximum time interval between placement of continuous concreting shall not exceed 0.5 hours. However, when special measures are taken this time limit may be changed and reported to and same should be shared and agreed with the Authority.

3.9.9 Consolidation of Concrete

(a) Vibrating of concrete and tapping of formwork shall be performed to wall, column and other places difficult for concrete to proceed. Proper number of workers for placing and compacting concrete shall be arranged.

(b) Vibrator shall be operated for concrete called for water tightness, difficult portion for concrete to proceed and other cases as deem fit by the Concessionaire and/or Authority. However, vibrator shall not be touched reinforcing bars and shall not be operated more than 30 seconds at same spot.

- (c) Concrete shall be placed 300 - 600 mm thickness at once in case vibrator is performing. In case flexible-insert-vibrator is called for, concrete shall not be placed thicker than the length of the insert or vibrator at one pouring.

3.9.10 Placing Speed: Concrete shall be placed at the speed suited for the workability of the concrete and condition of the place of placement, which insures proper consolidation of concrete.

3.9.11 Concrete Curing

- (a) After concrete has been placed, the concrete surface shall be kept moist by sprayed with water or by other appropriate methods and shall be protected from direct sunlight and rapid drying. The top surface of slabs shall be kept flooded with water at all times after concreting for the duration of curing period. This curing period shall be for not less than 14 days.
- (b) As a rule, no foot traffic or loads shall be permitted on concrete for at least 24 hours after placement.

3.10 Tests

3.10.1 The Concessionaire shall be required to conduct all tests according to BS method and procedure.

3.10.2 Test, as a rule, shall be conducted at the locations directed or at the testing institutions approved by the Authority.

3.10.3 The Concessionaire shall conduct test, as a rule.

3.10.4 In case of failure in test, appropriate measure shall be taken as agreed jointly by the Authority and Concessionaire

3.10.5 The Concessionaire shall keep test records during the work and for 2 years after completion of the Construction Works.

3.10.6 Documentation of tests to be provided by the Concessionaire will include:

- (a) Cement Test including (i) setting test – at least 1 test per day, (ii) soundness test for every 2,000 bags of cement, and (iii) compressive strength test – for every 2,000 bags of cement.
- (b) Aggregate test: grading and fineness modules.

3.10.7 Concrete

- (a) Fresh concrete: Slump, air content, shall be conducted daily, and more often at request of the Authority. The test for estimation of strength of concrete in structure is as under:
 - i. In order to assume estimated strength of concrete in structure, compressive strength test shall be conducted for prepared test pieces on the 7th day and 28th day and those test pieces shall be made for sampling at placing of concreting.
 - ii. Strength test shall be conducted for each of the following conditions: each day's pour, each class of concrete, each change of supplies or source and each 100m³ of concrete or fraction thereof. The number of test pieces to be used in a test shall be not less than 3 for each test of the 7th day and the 28th day unless otherwise deem fit by Concessionaire and/or Authority.

- iii. Test pieces shall be made in accordance with British Standards, and sampling shall be taken as near as possible at the point of placement.
- iv. Test pieces shall be stored without being disturbed and shall be covered during the first 24 hours, and carefully transported specimens to the testing laboratory. Test pieces shall be cured in water after demoulding. The temperature of test pieces shall be kept as close as possible to the temperature of the concrete in structure until the time of testing.
- v. The test results shall be expressed in the average value by calculating the average compressive strength of all test pieces. The average value must be equal to or greater than the specified strength.

3.11 Defective Concrete and Finishes

- 3.11.1 Honeycombed surfaces shall be made good or on the instruction of the Authority be cut out by the Concessionaire and make good at his own expense.
- 3.11.2 Concealed concrete faces shall be left as from the formwork except honeycombed surfaces shall be made good. Faces of concrete to be rendered shall be roughened by approved means to form a key. Faces of concrete that are to have finished other than those specified shall be prepared in an approved manner as deem fit by Concessionaire and/or Authority.

3.12 Concrete works for flooring

- 3.12.1 A cement-bonded base with synthetic (resin) finishing layers is recommended for flooring at production units
- 3.12.2 Drains and gulleys are situated in processing areas and passages, where easy access for regular cleaning reduces the level and subsequent risk of contamination. With a smooth, durable surface, stainless drains are easily cleaned and strong enough to support the weight of moving loads. Wide, gridded drains are recommended for areas such as the hatcher room, washing and chick handling areas, where a larger capacity is more efficient for the removal of eggshell and other detritus during washdowns. Narrow drains are suitable in hallways and less polluted areas.

3.13 Concrete Formwork

3.13.1 Applicable Codes and Standards

- (a) The BS Codes and Standards would be applicable to the work under this section. Other applicable codes are also listed below, however the BS codes shall prevail in times of contradiction.
 - (i) DIN - Deutsches Institute fur Normung, DIN 1045 1.2.2
 - (ii) BSI - British Standard Institute
 - (iii) ASTM - American society for Testing and Materials

3.13.2 Structure

- (i) Formwork shall be performed to obtain accurate concrete in accordance with the designated drawings.
- (ii) Formwork shall be firmed and secured to bear the force of concreting and tightened to avoid cement paste seeping.

3.13.3 Materials List: Material that are predominantly permissible are:

- (i) Steel - Straight, uniform and free of surface defects.

- (ii) Plywood - Product Standard PS 1, Waterproof, resin-bonded.
- (iii) Lumber - Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
- (iv) Chamfer Strips - Clear lumber, surface against concrete planed.
- (v) Form Coating - Single component, pigmented copolymer resin type, applied in accordance with the manufacturer's recommendations.

3.13.4 Sheathing for formwork shall be waterproof plywood of not less than 12 mm thick. Joint of sheathing shall be butt joint and firmly assembled. In case of using wood board for sheathing, boards shall be 15 mm thick and applied planer. Joint shall be tongued and grooved unless otherwise deemed fit and agreed upon by Concessionaire and/or Authority

3.13.5 Form liners shall be sound and suitable materials to accurately and safely cast the in-situ concrete structure as shown on the Drawings.

3.13.5 Timber form boards for sheathing where used for fair-faced concrete shall be of such new materials as not to cause any defects to the surface of the concrete. Special care shall be taken in fabrication, storage and protection of these boards.

3.13.6 Other Material

- (i) Fastening hardware to be used shall be those with allowable tensile strength guaranteed by manufacturer through strength tests.
- (ii) Form oil shall not have injurious effects on quality of concrete nor to bonding of surface finishing materials.

3.13.7 Performance

- (i) Formwork shall be designed to withstand construction loads during concreting, lateral pressure of fresh concrete, shock and vibrators due to concrete placing.
- (ii) Formwork shall be free of injurious leakage of water, easy to remove, and shall not damage concrete at removal.
- (iii) Supports shall be provided with the adequate horizontal and diagonal bracing and/or stays to prevent collapsing, heaving and twisting of formwork due to horizontal loads working during concrete placing.

3.13.8 Tolerance

- (i) The dimensional tolerances in location and cross section of concrete member used for designing and construction of formwork shall conform to the following table:

Standard Values of Dimensional tolerances

Item	Tolerance (mm)
Tolerance in distance from datum line of each floor to respective members	+ 2
Tolerance in cross section of columns, beams and walls	- 2, + 2
Tolerance in thickness of floor and roof slabs	-2, +2

3.13.8 Fabrication and Erection

- (i) Erection of formwork, and transportation and storage of materials thereof shall be started only after previously placed concrete has reached an age which acceptance of these loads will not have any adverse effect on the concrete.

- (ii) Sheathing shall be fabricated and installed accurately to match the locations, shapes and dimensions of members called for in the Drawings.
- (iii) Sheathing shall be installed tightly so as not to permit cement paste or mortar to escape from joints.
- (iv) Pipes, boxes and other embedded hardware shall be properly secured to sheathing or others so that they will not move during concrete placing.
- (v) Supports shall be erected plumb. Supports at any two vertically consecutive floors shall be erected as near as possible to identical locations on a common plane.
- (vi) Shoring shall be erected paying special attention to safety.
- (vii) If sheathing is reused, the surface in contact with the concrete shall be thoroughly cleaned off and sufficiently repaired before reuse. In case of using for fair-faced concrete, the same sheathings shall be used twice.

3.13.9 Inspection

- (i) Formwork may be inspected by the Authority as per the agreed terms, prior to placing of concrete.
- (ii) Pre- placement inspection - Prior to rigidly securing all forms, reinforcement, anchor bolts, and embedded parts in their proper position, all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete and all surfaces encrusted with dried concrete from previous placement operations shall be cleaned.

3.13.10 Striking of forms

- (i) The minimum period for keeping the forms in position and for watering after laying the concrete shall be as stated below, except otherwise specified in drawings. Forms shall be removed in such a manner as to ensure the complete safety of the structure, so that there is no shock or vibration as would damage the reinforced concrete.
- (ii) The responsibility for the safety of the concrete shall rest entirely with the Concessionaire and the Concessionaire shall be held liable for any damage done and shall have to make good the same at his own expenses.
- (iii) The Concessionaire shall keep the Authority informed when he intends to remove shuttering
- (iv) The minimum time for formwork to remain in place shall be as per the following table

Vertical sides of beams, slabs and columns	24 hours
Soffits of slab	10 days
Soffits of beams	21 days
Cantilevers	28 days

3.13.11 Relocation of Support

Supports under concrete shall be not relocated

3.13.12 Removal of formwork

- (i) Formwork shall be removed gently, the time of removal should be communicated to the Authority

- (ii) Authority would have the right to inspect and Concessionaire shall keep the authority informed immediately after the removal of sheathing and defects shall be immediately remedied according if/when highlighted by the Authority
- (iii) After shoring have been removed, members shall be carefully observed for cracking and deflection, when found, they shall be reported immediately to the Authority

3.14 STEEL REINFORCEMENT

3.14.1 Material

- (i) Reinforcing steel shall be of the dimensions proposed in the approved Drawings.
- (ii) Reinforcing bars shall comply with the requirement of B.S.4449. and welded wire fabric, square bar fabric and expanded metal shall comply with appropriate part of B.S.4483.
- (iii) Diameter 6mm reinforcing steel shall be round mild steel bars, and 12mm, 16mm, 20mm and 25mm shall be deformed high strength bars.
- (iv) Any other non-specified reinforcing steel shall be used only with the approval of the Authority
- (v) All reinforcing steel and binding wire shall be stored under cover and shall be at least 250mm above the ground.

3.14.2 Cleaning

Reinforcing bars shall be cleaned before use so that it is free from rust, oil, dirt or other coatings that reduce bond.

3.14.3 Bending and Laps

- (i) The reinforcement shall be bent cold in an approved bar bending machine.
- (ii) Preferably bars of full length shall be used. Lapping of bars where necessary shall conform to BS1487 'Bending Dimensions of Bars of Concrete reinforcement'.

3.14.4 Reinforcement Cover: Concrete cover for reinforcement shall be as follows:

For any steel in underground concrete	50mm
Clear cover in slabs	25-30mm
Clear cover in beams soffit	30-35mm
Clear cover in sides of beams	30mm
Clear cover in columns	40mm

3.14.5 Placing

- (i) Reinforcement intended for contact when passing each other shall be securely tied together with binding wire.
- (ii) Binders and stirrups shall tightly embrace the longitudinal reinforcement to which they shall be security bound or spot welded.
- (iii) Binding wire shall be turned in from the formwork and shall not project beyond reinforcing bars.
- (iv) All reinforcement may be inspected by the Authority and approved as per the terms laid out between Concessionaire and Authority, before concrete is placed in the forms.

3.15 Water Proofing

3.15.1 Description of work

- (i) Extent of water proofing work to be demarcated on drawings.
- (ii) Install slurry type water proofing to top surfaces of balcony slabs and external surfaces of underground concrete work.
- (iii) Install crystalline type water proofing to underground water tanks and roof slabs in strict accordance with the approved manufacture's printed instructions.

3.15.2 Materials

- (i) Crystalline Type: Material used shall be a cementitious coating containing catalytic chemicals which migrate in to the concrete using moisture present in the concrete as the migrating medium, and which cause the moisture and the un-hydrated cement in the concrete to react causing the growth of non-soluble crystals of dendritic fibers in the void and capillary tracks of the concrete that allow passage of water, there by rendering the concrete itself water proof.
- (ii) Acceptable products: CONMIX Waterproofing chemicals or Equivalent.

3.15.3 Storage of materials

General: All materials shall be stored in original undamaged containers with manufactures seals and labels intact. Material shall be stored off the ground in a dry enclosed area.

3.15.4 Surface preparation

- (i) General: All surfaces shall be examined for form tie holes and defects such as honeycombing, rock pockets, cracks, etc. These areas shall be repaired in accordance with these specifications and the manufactures printed instructions.
- (ii) Concrete finish: concrete surfaces shall have an open capillary system to provide tooth and suction shall be clean; free from scale, excess form oil, laitance, curing compounds and other foreign matter.
- (iii) Smooth surfaces or surfaces covered with excess form oil or other contaminants shall be washed lightly sandblasted, water blasted, or acid -etched with muriatic acid, as required to provide clean absorbent surfaces.
- (iv) Horizontal surfaces shall not be troweled or power - troweled and shall be left with a rough float finish or a broom finish. Vertical surfaces may have a sacked finish. Comply with manufactures specifications for requirements pertaining to minimum 'age' of concrete deck surface scheduled to receive water proofing.
- (v) Surface moisture: Water proofing shall be applied to 'green' concrete as soon as possible after forms have been stripped or to older pours which have been thoroughly moistened with clean water prior to application. Free water shall be removed prior to application.
- (vi) Mixing of crystalline water proofing compound: comply with manufactures specification for 2-coat installation.

3.15.5 Application

- (i) General: Apply all materials under the direction of the manufacturer's representative.
- (ii) Construction joints and surface defects: Comply with waterproofing material manufacturer's printed directions in the preparation, and treatment of construction joints and surface defects.

- (iii) Surface application: After all repair, patching and sealing strip placement has been prepared in accordance with manufacturer's recommendations and approved by manufacturer's representative, treat concrete surface with first coat slurry mix of crystalline waterproofing compound.
- (iv) Brushing: Use a short bristle or broom to work the slurry well into the concrete, filling all hairline cracks and surface pores.
- (v) Second coat: Apply second coat while first coat is still 'green' but after it has reached an initial set, all as recommended by the water proofing material manufacturer.

3.15.6 Curing

- (i) General: Curing shall begin as soon as the waterproofing materials have set up sufficiently so as not to be damaged by a fine spray. Treated surface shall be sprayed three times a day for a three-day period. Allow material to set 12 days before filling the structure with liquid
- (ii) Protect treated surfaces from damage due to wind, sun, rain and temperatures below 35 degrees F. For a period of 48 hours after application, arrange protections to permit proper curing conditions for waterproofing material.
- (iii) Clean up: Remove all surplus materials from the premises and leave all areas broom-cleaned. In the case of temporary protections remove all such items carefully to avoid damage to treated surfaces. Assemble all such materials and remove from premises followed by broom cleaning as noted.

3.16 Reinforced Plastic

3.16.1 Materials

- (i) Appropriate to the use and scope of work, Concessionaire shall select appropriate reinforced plastic or composite material which may include any or composition of any of the following, provided each shall adhere to all technical and quality specifications as requisite:
 - (a) FRP Moulded and Filament Wound using Isophthalic, Bisphenol, Vinylester and Epoxy Resin,
 - (b) PP and HDPE Spiral Wound,
 - (c) PP/FRP, PPH/FRP, PVC/FRP,
 - (d) CPVC/FRP, PVDF/FRP, ECTFE/FRP, FEP/FRP.
- (ii) All the tanks required as per the Agreement and/or Approved Plans of the Multispecies Hatchery can be made entirely from the composite/FRP, or FRP can be used as a liner, as appropriate.
- (iii) The FRP thermoplastic liner is usually 2.3mm thick (100 mils) and is usually cured before winding or lay-up continues, by using either a BPO/DMA system, or using an MEKP catalyst with cobalt in the resin.
- (iv) Any of any combination of PP, PVC, PTFE, ECTFE, ETFE, FEP, CPVC, PVDF are used as common thermoplastic liners.

3.16.2 Codes and Standards

- (i) Applicable codes for the design and manufacture of non-metallic storage tanks would include:

- (a) BS 4994-87 - the British Standards Standard for FRP Tanks and Vessels superseded by EN 13121.
 - (b) EN 13121
 - (c) ASME RTP-1 (Reinforced Thermoset Plastic Corrosion Resistant Equipment) is the standard for FRP tanks and vessels held within the United States under 15 psig and located partially or fully above ground.
 - (d) ASTM 3299 which is only a product specification, governs the filament winding process for tanks. It is not a design standard.
 - (e) SS245:1995 Singapore Standard for Sectional GRP Water Storage Tanks.
- (ii) In addition, relevant codes and regulations for the following will be adhered to, as per national standards, British standards, European or US Standards:
- (a) Pressure Systems Safety Regulations
 - (b) Control of Major Accident Hazards Regulations
 - (c) Dangerous Substances and Explosive Atmospheres Regulations

3.16.3 Installation

- (i) The berthing site should be inspected before installation to identify any defects or debris, and take corrective action, if necessary, before the unit is berthed.
- (ii) GRP/FRC tanks and vessels should be installed in accordance with the relevant standard. Reference should also be made to the manufacturer's recommendations, and installation instructions should be followed.
- (iii) Lifting and loading a GRP tank or vessel should be in accordance with the relevant standard, with the manufacturer's instructions for handling and lifting the vessel or tank.
- (iv) Slings should be done using purpose-made equipment. Chain and wire rope slings should not be used as these are likely to cause mechanical damage. Fiber slings or ropes, as detailed in the relevant standards, may be used and the unit should be carefully handled at all times to avoid impact damage. Use should be made of the manufacturer's lifting lugs where possible. Fittings such as nozzles, branches or accessories should not be used. The lifting appliance should have sufficient capacity to lift the vessel or tank without the need for dragging the vessel or tank along the ground.
- (v) Connecting pipework should be supported so that the total loads local to the branches do not exceed the design values of the tank or vessel. Similarly, install any fixing bolts in accordance with manufacturer's recommendations to avoid stressing the unit. The use of levers to finely position the unit on its support should be prohibited
- (vi) Where temporary storage is required, take care to store on a flat surface, clear of any debris, protected from the risk of impact and in its correct orientation. The unit should be anchored to prevent any movement, e.g., due to wind.
- (vii) Tanks and vessels should be anchored. Take care to choose materials for hold-down brackets, bolts and earth connections that are compatible with specific requirement.
- (viii) Careful consideration should be given to siting GRP tanks within a multiple tank secondary containment area where materials not compatible with GRP may be stored.

- (ix) Underground tanks should be installed in excavations which are large enough to allow them to be installed without an increased risk of damage to the tank due to limited space. They should be installed in ground which is well drained and be supported on a firm foundation. Underground tanks should also be securely anchored or weighted to prevent flotation from floodwater or a high-water table.
- (x) Tanks likely to be subject to loadings from above ground (e.g., from traffic) should be protected by a reinforced concrete slab or other adequate cover. Alternatively, the area around the tank may be fenced off with the tank perimeter clearly marked

3.16.4 Operation

- (i) GRP/FRP tanks and vessels should be operated within defined safe operating limits, based on the original design or a revised duty verified by a competent person.
- (ii) Where a tank or vessel is subjected to conditions outside the allowable operating limits, e.g., during a process upset, which may raise the temperature above the maximum allowable limit, this should trigger a review of the possible effects arising from the deviation to verify the continuing integrity of the item.

3.16.5 Examination

- (i) After installation and before use, a competent person should inspect the unit. The relevant standards give detailed guidance on inspection and testing procedures to be adopted after completion of fabrication and before tanks or vessels enter service.
- (ii) Underground tanks should be examined before installation and tested for soundness by a competent person after lowering into the excavation but before infilling takes place.
- (iii) A pre-commissioning examination provides a record of the as-new condition. This sets a baseline against which deterioration can be judged when assessing the results of future examinations. It also confirms that no damage has been caused to the unit before first use.
- (iv) Subsequent internal and external inspections should be undertaken at appropriate intervals as determined by the user and competent person.
- (v) Concessionaire will undertake all the above examination and inform/report to the Authority and Authority would have the right to inspect the same.
- (vii) Concessionaire would schedule a routinely examination of the tanks and report the same to Authority

3.17 Embedded Dampproof Membrane

3.17.1 General: This section deals with laying of flexible sheet as damp proof membranes or has chemical or vapor barriers embedded in the fabric of the building. It does not deal with the weatherproof roof sheeting, or with vapor barriers.

3.17.2 Products

- (i) Polythene sheets for under slab DPM: gauge 500, manufacturer and reference to approval.
- (ii) Adhesive tape: A type recommended by the sheet manufacturer.

3.17.3 Workmanship

- (i) **Manufacturers Recommendations:** to be strictly followed for all products and materials. Apply sheets to clean, dry surfaces with all joints sealed to give a completely waterproof continuous membrane.
- (ii) **Polythene Sheet Under-Slab DPM:** lay a level bed of fine sand, not less than 13mm thick or as specified to receive membrane.
- (iii) **Polythene Sheet DPM:** ensure that sheets are clean and dry. Lay single layer loose on base, lap edges 150mm and seal with mastic or adhesive tape.
- (iv) **Pipe etc.:** where pipe etc. pass through sheeting make junction completely watertight by forming collars fully bonded / sealed to both pipes and sheeting.
- (v) **Finished sheeting adequately and prevent puncturing during following work.** sheet to be covered by permanent over laying construction as soon as possible.

3.18 Structural Steel

3.18.1 **Scope:** This section shall apply to the work involved with structural steels. All incidental items of structural steel shall be stated in the particular specifications.

3.18.2 **Applicable Codes**

- (i) The buildings included in this proposal will be designed (if any) and manufactured in accordance with the Latest American Codes described as follows:
 - (a) AISC MARCH 9, 2010 LATEST EDITION - Specification for Structural Steel Buildings, American Institute of Steel Construction.
 - (b) AISI 2001 EDITION UPDATED ON JANUARY 10, 2003 LATEST EDITION - North American Specification for the Design of Cold-Formed Steel Structural Members, American Iron and Steel Institute.
 - (c) MBMA 2006/10 LATEST EDITION - Metal Building Systems Manual, Metal Building Manufacturers Association.
 - (d) AWS D1.1/D1.1M 2006 LATEST EDITION - Structural Welding Code-Steel, American Welding Society.
 - (e) IBC 2006 LATEST EDITION - International Building Code, International Code Council ICC.
 - (f) ASCE/SEI 7-10 LATEST EDITION - Minimum Design Loads for Buildings and Other Structures.
 - (g) MANUFACTURING TOLERANCES – MBMA 2006 LATEST EDITION
Manufacturing tolerances will be in accordance with Part IV, Section 9- Fabrication Tolerances.

3.18.3 **Materials Standard**

- (i) Standards mentioned or referred to on the drawings and in this Specification shall be the most up-to-date versions of the following: American Society for Testing Materials (ASTM).
- (ii) Specifications: (applied as specifications approved by Independent Engineer)

No.	Items		Specifications	Intensity
1	Built-up	Plate steel	ASTM A572 or equivalent grade	Fy = 34.5 kN/cm ²
2	Hot-rolled	Rod	SS400 or equivalent grade	Fy = 24.5 kN/cm ²

		L shape	SS400 or equivalent grade	$F_y = 24.5 \text{ kN/cm}^2$
		C shape	SS400 or equivalent grade	$F_y = 24.5 \text{ kN/cm}^2$
		I shape	SS400 or equivalent grade	$F_y = 24.5 \text{ kN/cm}^2$
3	Cold-formed	Z cold-formed	ASTM Z275 G450	$F_y = 45.0 \text{ kN/cm}^2$
4	Steel panel		AS 1397 & AS 2728	$F_y = 35.0 \text{ kN/cm}^2$ $F_y = 55.0 \text{ kN/cm}^2$
5	Anchor bolt		ASTM A-36	$F_v = 19 \text{ kN/cm}^2$
6	High strength bolts		ASTM A325	$F_t = 40.0 \text{ kN/cm}^2$ $F_v = 32.0 \text{ kN/cm}^2$
7	Normal bolts		DIN933 CLASS 4.6	$F_t = 25 \text{ kN/cm}^2$ $F_v = 23 \text{ kN/cm}^2$

3.18.4 Testing Institutes: Materials shall, unless otherwise directed by the Authority, be tested before leaving the manufacturer's premises and the Concessionaire shall obtain and supply to the Authority for his approval certificates from the manufacturer, showing that the materials have been tested according to the relevant spec or Standard.

3.18.5 Welding Inspection

- (i) Check welding by means of ultrasound or magnetic:
- (ii) If testing by ultrasonic method, the volume of tests is 5% of the total welding length over 5% welded structures.
- (iii) If testing by magnetic method, the mass of the tests is 10% of total welding length over 10% welded structures.

3.18.6 Welded connections

- (i) Highly loaded welded connections shall be avoided. Where such connections are unavoidable then all such welds should be 100% ultrasonic tested (UT) and the results passed to the Authority.
- (ii) Gaps between end plates and the end of a member shall be sealed with full circumferential welds.
- (iii) Fillet welds to be conform calculations but should normally be $\geq 6 \text{ mm}$.

3.18.7 Movement connections: Where slotted holes are required for movement connections bolt assemblies shall be used which will ensure that the joint will be free to move.

3.18.8 Proprietary Materials and Articles: Where in this Specification, makes or named products of individual manufacturers are mentioned, this is only an indication of the quality and type of goods which are considered satisfactory by the Authority. The Concessionaire may substitute similar products of at least equal quality and suitability, subject to the Concessionaire proving the quality and suitability and to the approval of the Authority.

3.18.9 Discrepancies between Drawings and Specifications: Should any discrepancy occur between the Drawings and this Specification the matter is to be immediately referred in writing to the Authority.

3.18.10 Finish will be as per the following:

ITEM	DESCRIPTION	FINISH LAYER
1	Built-Up / HR sections	- Surface Treatment: Hot Dip Galvanized 600g/m ²
2	Cold Formed Sections	Zinc Coated (275 g/m ² minimum of coating mass)
3	Anchor bolts	Electric Galvanized
4	Roof Sheetting Specifications	<ul style="list-style-type: none"> • Panel thickness: 50mm • Steel thickness: 0.5mm external, 0.4mm internal • Metal sheet AZ150G550 • Insulation: PIR with U = 0.4W/m²K • Fire class: EN13501-1 (Bs1d0) • FM Approved
5	Other components	Other steel components and auxiliary are cleaned at supplier factory.

3.18.11 Galvanizing:

- (i) Where specified or described on the drawings as being galvanised, steelwork shall be protected with a zinc coating not less than 80 microns thick, applied by the hot-dip galvanizing process.
- (ii) Before the application of this coating, the steel shall be prepared by sandblasting as described. Items not suited for hot-dip galvanizing shall be protected with a coating of zinc not less than 40 microns thick, applied by spraying or other suitable approved method. Bolts, nuts, washers etc. used for assembling the galvanized steel works shall be protected with a zinc coating applied by sherardizing or comparable process.
- (iii) Components deformed in the hot-dip galvanizing process shall be re-straightened. Damages to the zinc coating shall be repaired with an approved zinc-rich paint.

3.18.12 Preparation of steel substrates before application of paints and related products

- (i) Abrasive blast cleaning according ISO 8501-1 to a cleanliness of Sa 2½ and achieving a surface roughness profile of 30 – 75 microns as determined by TESTEX tape or similar instrument - to further control the surface preparation reference is made to the requirements for good practice as laid out in the ISO12944 Part 4, including reference to requirements and test methods individually documented in ISO 8501, 8502, 8503 and 8504.
- (ii) Under no circumstances the various coated finished architectural and structural elements should form any place for microbial growth. They should be easy to clean with hot water or with weak alkaline cleansers without any adverse effects on the material of the walls/partitions.
- (iii) Under no circumstances the coating should have any effect on human beings with regard to taste, smell or produce any other irritation. Any walls/partitions/structural steel elements should be protected against potential damage from the passage of forklift trucks.

3.18.13 Quality Inspection

- (i) The following Standard should be followed by the Concessionaire and the regular reporting to be done to the Authority.

N o	Stage of Production	Applicable Specifications/ Procedures	Extent of Inspection	QC Activity
1	Material selection and Verification: Plates, sheets, shapes, tubular, fasteners, etc.	JIS G3101/SS400 or Equivalent (material) A572	Dimensional: ~ 5% Review of MTRs ~ 100% Visual ~ 30%	W
2	Welding WPS/ PQR: Welding Record, Approved Welding Procedures	AWS D1.1 - 2010	Review ~100%	R
3	Material Preparation: Shearing, cutting, drilling, punching, making, etc.	Shop drawing MBMA	Dimensional ~ 10%	R
4	Fabrication of Components: Built up member, Cold formed secondary member small sundry parts, panel (roof, wall, other shapes to form eaves, trim, etc.)	Shop Drawing AWS D1.1 – 2006 MBMA FAB – Tolerance Attached	Visual ~100% Dimensional ~ 10% Visual 100% for Crane Beam and Bracket Joints	R
5	In Processing Welding	AWS D1.1 – 2006 Weld Map	Visual ~ 100% Dimensional ~ 10% MT ~ 5% *	W
6	Surface Preparation/ Painting	Shot blasting PIF (Project Information Form)	Visual ~20% Paint DFT ~ 10% SSPC – PA2	W
7	Preparing Shipment Documentation	Factory standard Packing list	Visual ~10% Review ~ 20%	R
Legend: R = review point W = witness Point H = Hold Point Other Abbreviations: MTR = Manufacture's Test Report P.O. = Purchase Oder				

3.18.14 Quality Control: Materials and equipment, as agreed upon/ or all - to be used in the Works are to be approved by Authority, by means of a Request for Approval form (RFA), before being used on the Project Site or incorporated in the Works. All the Works must be subject to inspection by the Authority and receive approval before being accepted.

3.18.15 Fabrication

- (i) Main fabrication shall be done from factory and ship to assemble on site unless otherwise specified or approved by the Authority
- (ii) Full scale drawing of each section shall be drawn prior to fabrication by the Concessionaire and could be checked by Authority
- (iii) Section of each material shall be cut perpendicular to axis unless otherwise specified in the drawing.
- (iv) Saw and angle cutter shall be used for cutting and cut section shall be free of any noticeable defect.
- (v) Deformation caused by cutting shall be corrected.
- (vi) Normal temperature or hot drawn process shall do bending process. Steel shall be red heat in hot drawn process.
- (vii) Those directed in the drawing shall be chiseled finish and completely attached.

(viii) Materials shall be checked for bend, distortion, warp, etc. before fabrication.

3.18.16 Bolt

(i) Spacing of bolt holes (mm) shall be as directed in the following table.

Diameter of Bolt	Standard Pitch	Minimum Pitch	End Distance	Edge Distance
12	50	30	30	25
16	50	40	40	30

(ii) Minimum pitch and end distance for lightweight steel shape shall be more than 3 times and 2.5 times a Bolt diameter respectively.

(iii) Diameter of hole shall not be over 0.5 mm larger than bolt diameter. However, for anchor bolt 5mm clearance shall be allowed between bolt diameter and diameter of hole unless otherwise specified.

(iv) Bolt hole shall either be drilled open or reamed after sub punching. Punching can only be permitted for a material thickness less than 13 mm.

(v) Rolled edge around a hole shall be removed.

(vi) Position of a bolt hole shall be precise so that the center of all holes aligns.

3.18.17 Protection against loosening of Nuts: Nuts shall be protected against loosening by concrete covering, double nuts or other proper means.

3.18.18 Welding

(i) Welder shall have an authorized qualification in Maldives and approved by the Authority.

(ii) Other tests shall be conducted to confirm welder's skill in accordance with type of work.

(iii) Tack welding shall be carried out by the welder approved by the Authority.

(iv) Arc welding machine shall be alternate or direct current type, which provides sufficient and adequate current.

(v) Welding shall be done as much downward as possible using a jig such as Rotary frame.

(vi) Welding rod shall be always kept in a dry area and if necessary, dried by drying equipment.

(vii) Welding surface shall be free of water, scale or others injurious to welding work. Slag appeared on the created surface in the middle of welding shall be cleaned before

(viii) Welding edge shall be smoothed by automatic gas cutting or other proper finishes.

(ix) Surface of welds shall be as smooth as possible, and size and length of welds shall not be less than designed dimensions.

(x) Reinforcement of weld shall not exceed $0.1s + 1$ mm (s: Designated size) in fillet welds.

(xi) Welded parts shall be free of undercut, overlap, crack, blow hole, lack of welds, lack of weld settlement, rolled up slag or other defects.

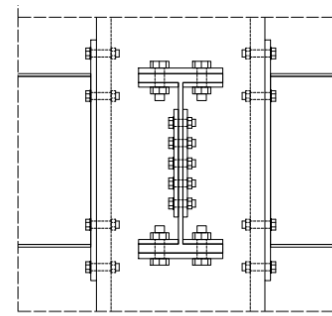
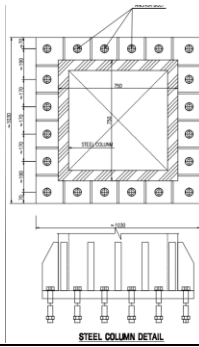
- (xii) Crater at the end of bead shall be carefully heaped up and slag, sputter, etc. shall be completely removed after welds.
- (xiii) Safe scaffoldings shall be provided for the field welds work.
- (xiv) Welding facilities shall be such that there shall be no electric leakage of electric shock. There also shall be sufficient protection for fire.
- (xv) Electric shock protection device shall be used and also care shall be taken not to get suffocated or intoxicated by gas when welding in small area.
- (xvi) Welding parts shall be inspected before, during and after welding in accordance with work schedule.

3.18.19 Erection and Field Painting

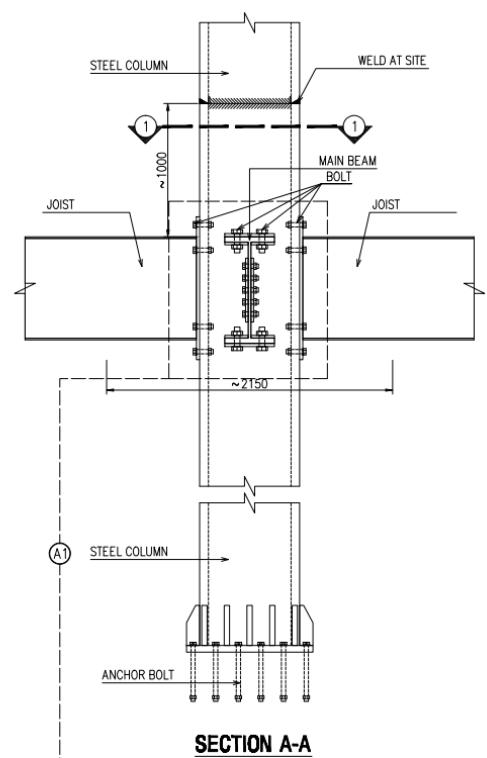
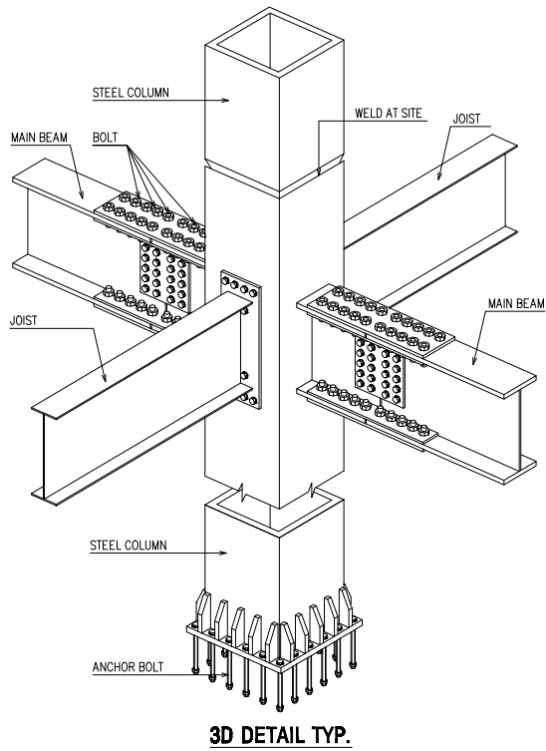
- (i) Erection procedure shall be prepared by the Concessionaire and needs to be reported and/or can be subject to approval by the Authority prior to the erection.
- (ii) Material shall be stored on flat surface in order not to get distortion, twist or other defects. Correction shall be made to those distortions or twisted before erection.
- (iii) Horizontal reinforcement and bracing shall be placed, and bolts are temporary tightened as trusses are put up.
- (iv) Connection of materials by bolts, etc. shall be made after distortion on plumb is thoroughly corrected.
- (v) Temporary bracing or other reinforcement shall be placed to resist wind pressure or erection of other loads.
- (vi) When heavy objects are placed on a horizontal element in the course of erection, they shall be reinforced with prior approval of the Authority.
- (vii) Care shall be taken on all facilities so that there is no accident.
- (viii) All steel work shall be delivered to site unprimed shall be cleaned of impurities, scrapped and wire brushed to remove rust and painted with one coat of priming paint applied by brush.
- (ix) Steelwork delivered to Site primed shall be cleaned of impurities and damage to the priming paint and made good with priming paint.
- (x) In case of Galvanized steelwork to be painted shall be cleaned of impurities. Where rusting has occurred, the rust shall be removed by wire brushing and made good with an approved rust inhibitor. The surfaces shall be coated with a mordant solution, washed with clean water and painted with two coats of priming paint applied by brush.
- (xi) Steelwork, which is to be concealed shall be prepared and primed as above and shall be painted with two priming coats and one finishing coat of paint applied by brush.

3.18.20 Anchor Bolt: Any standard methods for movable burying can be adopted by the Concessionaire, typical details for anchor bolt method to connect structural and non-structural elements to the concrete are detailed out in figures below (next pages).

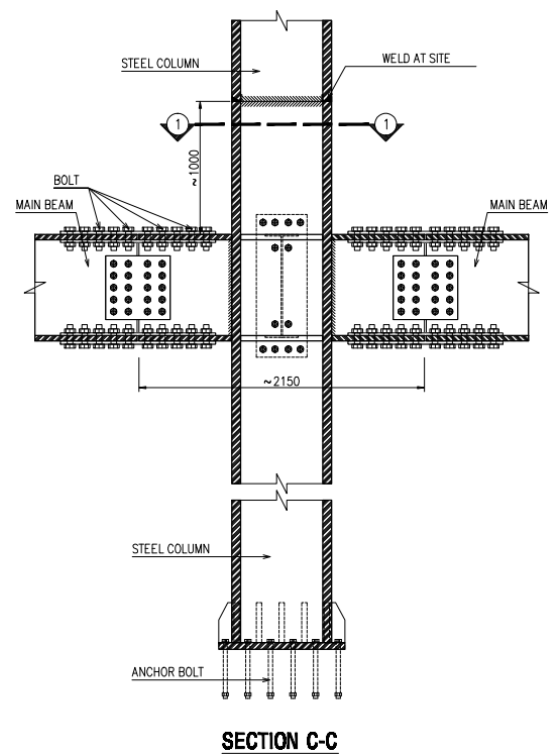
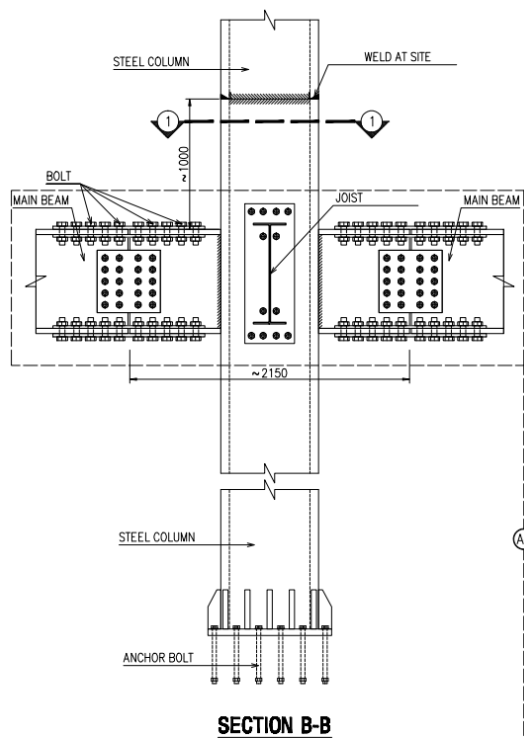
Typical Detail PEB steel column base for wet areas only



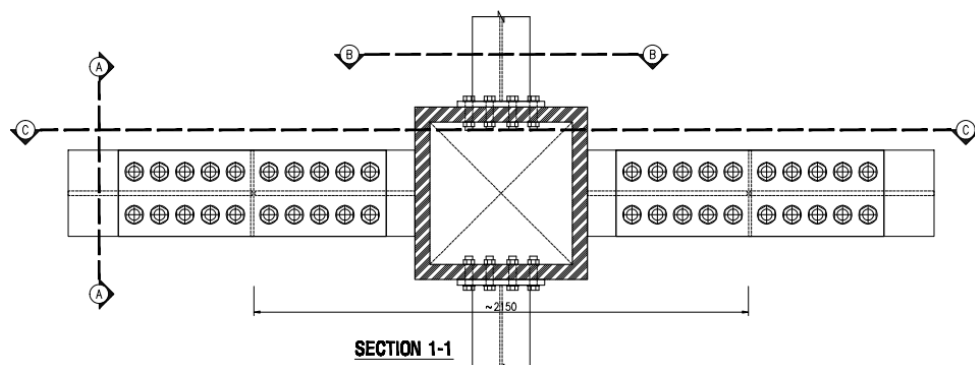
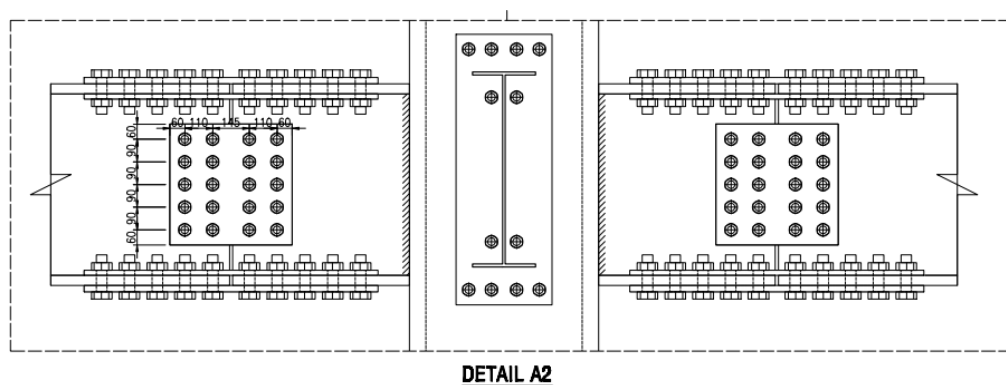
Typical Detail Practical Connection detail



Typical Detail Practical Connection detail



Typical Detail PEB steel column base for wet areas only



3.19 Masonry

3.19.1 Materials

- (i) Material used for masonry and plastering work shall conform to Section of CONCRETE WORKS.
- (ii) Masonry work shall be done with cement bricks or blocks of approved quality unless specified otherwise.
- (iii) The blocks shall be free from excessive amounts of salt or other impurities and shall be inspected and approved by the Authority

3.19.2 General

- (i) Work shall be complied with this specification unless otherwise stated on particular Specification or Drawings.
- (ii) Stake-board shall be provided at each 5m in length and shall be inspected by the Authority if required for the accuracy, firmness and secureness. However, suitable ruler, plumb bob and leveler shall be provided for minor performance of cement block and bricks.
- (iii) Care shall be taken for damage during transportation of materials and any defect of natural finished concrete blocks or bricks shall be rejected.
- (iv) Different size of material shall be stored separately and projected from dirt and other impurities.
- (v) Any shock or load shall not be applied until concrete mortar or other fills hardened. Corner, projection and top of cement block or brick work shall be protected from rain, dryness, cold, damage and stain by covering.
- (vi) Blocks or bricks shall not be intruded by rainwater.

3.20 Blockwork

3.20.1 Material

- (i) Blocks shall be of standard quality low permeability blocks with no defects and sample if required as per the agreed terms with Concessionaire and Authority shall be submitted for approval of the Authority
- (ii) Blocks shall be aerated hollow block 150 mm thick for external walls and 125 mm thick for internal walls. The average compression strength should be not less than 2.8N/mm² and shall comply with physical requirements of ISO6073:1981.

3.20.2 Horizontal reinforcement for concrete block wall

- (i) Horizontal reinforcement shall be provided at end of wall adjoining to concrete column. Reinforcing bar shall be anchored into end block and column.
- (ii) Horizontal reinforcing bar for block wall shall be 6 dia. @ 1000 mm.

3.20.3 Placing Blocks & Bricks

- (i) Cement blocks shall be saturated with water and joint shall be cleaned.
- (ii) Bonding mortar shall be used immediately after mix, and mixed mortar left for more than one hour shall be rejected.

- (iii) Vertical and horizontal joint of blocks shall be filled completely and suitable with mortar on-line shall not be moved or rearranged. Joint and surface of block of exposed finished block wall shall be cleaned immediately after joint is filled.
- (iv) In case concrete block wall is attached to structural concrete, block wall shall be placed before concreting structure.
- (v) Mortar for joint shall be touched with steel trowel before hardened and exposed joint shall be finished with uniform width and planned without roughness or cavity.
- (vi) Height for placing block per day shall be maximum 1.2 m unless otherwise specified.
- (vii) Blocks shall be placed with cavity side under.

3.20.4 Joints: The thickness of joints shall not exceed 10 mm and the joints shall be rated (13 mm dup.) when the mortar is still floor, so as to provide for proper bond for the plaster. Any mortar which falls on the floor from this joint or removed due to raking of joints shall not be reused.

3.20.5 Lintel: Lintel shall be reinforced concrete as approved by Authority and specified by the Concessionaire. Main reinforcing bar shall be anchored more than 40D (40 x diameter of the bar) at both end. In case lintel is prefabricated, shop drawing shall be submitted for approval of the Authority

3.20.6 Frame of Opening

- (i) In case frame is temporarily installed before placing of blocks, frame shall be firmly placed and joiner shall be bonded with mortar as placing each block at side and top of frame.
- (ii) In case frame is installed after placing of blocks, joiner shall be bonded with additional mortar at space or every two blocks or more.
- (iii) Back of frame shall be filled and compacted with mortar by providing shuttering board.
- (iv) Wood plug and anchor bolt shall be covered with mortar or concrete.

3.20.7 Piping

- (i) Principally, piping shall not be placed in block wall unless piping block is in use.
- (ii) In case electric conduit pipe is placed in cavity of concrete blocks, care shall be taken not to obstruct reinforcing bar, and cavity shall be completely filled.
- (iii) In case chipping and piping on face of blocks is unavoidable, performance shall confirm to appropriate standards
- (iv) Joiner and supporter for exposed piping shall be buried at joint which back is filled or otherwise approved by the Authority

3.21 Plastering

3.21.1 General

- (i) All masonry walls shall have smooth finished cement plaster on both sides with a surface setting coat of neat cement applied within an hour of the completion of rendering.
- (ii) Cement rendering to floor shall be same as above.

3.21.2 Materials and Storage

- (i) Plaster materials which are affected by moisture such as plaster and cement shall be stored properly
- (ii) Materials used for plastering shall conform to those of Section of Concrete Works. Grading of sand, however, shall be as in table below

Grading of sand	Mortar plastering	Plastering
5mm sifting thorough 100% 0.15mm sifting less than 10%	for first coat for finish coat	for first coat and dubbing out
2.5mm sifting through 100% 0.15mm sifting less than 10%	for finish coat	for second coat

- (iii) White cement or filler or similar shall confirm to the requirements of Portland cement, BS.12.
- (iv) The use of mixtures may be subjected to approval of Authority. The amount of admixture shall be such that it effects mortar strength very little.

3.21.3 Mixing ratio: Mixing volume ratio of mortar shall be as in table below:

Base	Area of application	First coat cement:sand	Dabbing out cement:sand	Finish coat cement:sand
Masonry blocks	Floor	-	-	1:4
	Interior wall	1:4	1:4	1:4
	Exterior wall	1:4	1:4	1:4

3.21.4 Thickness of Coating: Standard thickness of coating (mm): Thickness of coating shall be standard thickness of coating unless otherwise indicated on the Drawings.

Base	Area of application	First coat	Dubbing out	Second coat	Finish coat	Total
Masonry Block	Floor	-	-	-	as per dwg	as per dwg
	Interior wall	8	-	8	4	15
	Exterior wall	8	-	8	4	15

3.21.5 Finish: Type of finish and work schedule will be as follows:

Type	Work Schedule	Notes
1. Smooth Trowel finish	1. Shall be applied flat by metal trowel 2. Shall be finished by pressing with the trowel.	Before applying second coat, corner and edge shall be screed well.
2. Wooden float finish	Shall be applied by wooden float	

3.21.6 General Preparation

- (i) Remove efflorescence, laitance, dirt and other loose material by thoroughly dry brushing.

- (ii) Remove all traces of paint, grease, dirt and other materials incompatible with coating by scrubbing with water containing detergent and washing off with plenty applying coatings unless specified otherwise.
- (iii) In Situ Concrete Surfaces: Scrub with water containing detergents to ensure complete removal of mould oil, surface retarders and other materials incompatible with coating. Rinse with clean water and allow to dry unless specified otherwise.
- (iv) Organic Growths: Treat with fungicide to manufacturer's recommendations and bush off.
- (v) Hacking For Key: roughen specified surfaces thoroughly and evenly by removing the entire surface to a depth of 3mm by scabbing, bush hammering or abrasive blasting. Clean surfaces by washing and brushing.
- (vi) Smooth Concrete Surfaces: where no keying or mix or bonding agent is specified, wet smooth concrete surfaces immediately before plastering.

3.21.7 External Plastering

- (i) Dissimilar Solid Backgrounds for Plastering: where plaster is to be continued without break across joints between dissimilar solid backgrounds which are rigidly bonded together, cover the joints with a 200mm wide mesh strip (back grounds in the same plane) or with the corner mesh (internal angle) fixed at not more than 600mm centers along both edges, unless specified or otherwise.
- (ii) Dissimilar Solid Backgrounds for Plaster: where plaster is to be continued without break and without change of plane across the face of a 300mm and rigidly bonded to the background.
 - (a) Cover the face of the column /beam/ lintel with building paper extending 25 mm on the adjacent background.
 - (b) Over lay with expanded metal lathing extending 50mm beyond the edges of the paper and securely fixed with masonry nails at not less than 100mm centre to centre along both edges.
- (iii) Alternatively, an approved paper and mesh lathing may be used.
- (iv) Dissimilar Solid Backgrounds for Rendering: where rendering is to be continued without break across joints between dissimilar solid backgrounds which are in the same plan and rigidly bounded together, cover joints with a 150mm wide strip of building paper overlaid with 300mm wide metal lathing fixed at not more than 600mm centers along both edges unless specified otherwise.
- (v) Service Chases: cover with steel mesh strip fixed at not more than 600mm centers along both edges.
- (vi) Conduits bedded in under coat to be covered with 90mm wide jute scrim budded in finishing coat mix, pressed flat and trowelled in. Do not lap ends of scrim.

3.21.8 Internal Plastering

- (i) Accuracy of plaster 15mm thick or more: maximum permissible gap between an 1800mm straight edge and any point on the surface to be 3mm.
- (ii) Dubbing Out: if necessary, to correct inaccuracies, dub out in thickness of not more than 10mm in same mix as first coat. Allow each coat to set before the first is applied. Cross scratch surface of each dubbing out coat immediately after set.
- (iii) Metal Mesh Lathing: Work undercoat well into interstices to obtain maximum key.

- (iv) Under Coats: Generally, to be not less than 8mm with thickness greater than 16mm applied as two equal coats. Rule to an even surfaces and cross scratch - end coat to provide a key for the next hand applied coat.
- (v) Cement Based Under Coats: all to dry out thoroughly but not rapidly, to ensure that drying shrinkage is substantially complete before applying next coat.
- (vi) Dissimilar Backgrounds: where scrim or lathing or beads are not specified, cut through plaster with a fine blade in a neat, straight line at junctions of:
 - (a) Plastered rigid sheet and plastered solid backgrounds.
 - (b) Dissimilar solid backgrounds.
- (vii) Smooth Finish: trowel or float to product a tight matt, smooth surface with no hollows abrupt change of level or trowel marks. Do not use water brush and avoid excessive troweling and over polishing.

3.21.9 External Rendering

- (i) Dubbing Out: if necessary, to correct inaccuracies, dub out in thicknesses of not more than 10mm in same mix as first coat. Allow each coat to dry before the next is applied. Cross scratch surface of each dubbing out coat immediately after set.
- (ii) Under Coats for hand applied finishes: Apply first undercoat or dubbing out coat by throwing from a trowel.
- (iii) Coats to be no less than 8mm thick, with thickness greater than 16mm applied as two equal coats. On weak backgrounds first under coat to be not less than 10mm thick.
- (iv) Brush down each under coat to remove dust and loose particles and wet thoroughly before application of next coat.
- (v) Cross scratch under coat without penetrating the coat, to provide key for following coat(s).
- (vi) Drying: Keep each coat damp for the first three days by covering with polythene sheet and/or spraying with water. Thereafter prevent from drying out too rapidly. Work in shade whenever possible.
- (vii) Allow each coat to dry out thoroughly to ensure that drying shrinkage is substantially complete before applying next coat.
- (viii) Playing Floated Finish: Finish with wood or other suitably faced float to give an even texture.
- (ix) Do not draw excessive laitance to surfaces.

3.21.10 Metal Mesh Lathing / Reinforcement for Plastered/Coatings

- (i) Lathing to be provided as reinforcement for plastering in columns, walls or specified in drawings products.
- (ii) Products:
 - (a) Plain Expanded Metal Lathing: To B.S 1369 with a minimum weight of 1.9 kg/mm². Manufacturer to approval of the Authority.
 - (b) Wire Ties: Unless other specified, annealed iron, galvanized to B.S 443.
 - (c) Clout Nails: galvanized steel or stainless-steel nails to B.S 1202: Part 1, table 3.
 - (d) Staples: Galvanized steel wire staples to B.S 1494: Part 2.

(iii) Workmanship

- (a) Framing: fix securely and accurately to help ensure that coatings on lathing, when finished, are true to line and level, within specified tolerances and free from cracks, rippling, hollows, ridges and sudden changes of levels.
- (b) Runners/Bearers spanning between concrete beams/ribs: fix with 3mm wire ties twisted around 38mm X 10mm gauge screws driven well into fixing blocks or plugs in sides of beams/ribs.
- (c) Wire Ties: twisted ends tightly together, cut off surplus and bend ends of wire away from face of coating.
- (d) Plain Expanded Metal Lathing: Stretch lathing and fix securely in accordance with manufacturers recommendations to give a taut, firm base for plaster/ rendering; Fix with the long way of the mesh at right angles to supports and with all strands sloping in the same direction; Lap side edges not less than 25mm. Lap ends 50mm at supports and 75mm between supports. Laps must not occur within 100mm of angles or bends.

3.22 Carpentry and Joinery

3.22.1 Materials

- (i) Timber shall be in accordance with the requirements of BS 1186 'Quantity of Timber and Workmanship in Joinery', Part 1, 'Quality of Timber'.
- (ii) Timber and timber products shall be subject to the inspection and approval of the Authority
- (iii) Timber shall be seasoned to stable moisture content compatible with the finished use, straight and true and free from wind, warp and distortion and in lengths suitable for the members required.
- (iv) All timber shall be in long lengths and laps; scars or splices shall be over a bearing surface. Where obtainable, finishing timber exposed to view shall be in single lengths.

3.22.2 Preservation of Timber

- (i) All timber shall be treated for insect attack and is to be of the correct moisture content and free from surface moisture content and dirt.
- (ii) All rafters, purlins, framing scribe pieces, wall plates, and trusses etc. shall be treated for insect attack with approved timber preservative.
- (iii) Treatment shall be carried out after all cutting and shaping is completed.

3.22.3 Hardware: Hardware shall be standard quality and samples shall be submitted to the Authority for approval if required by the Authority. The dimensions and quality of hardware shall meet the requirements and shall not be rested, deformed or defective.

3.22.4 Dimensions and Finish

- (i) All dimensions of timber given are finished dimensions.
- (ii) All elements and others of structural nature, which are exposed, must be machine planed to a smooth finish. All unexposed timber shall be machine planed to a rough finish.
- (iii) All joinery work shall be dressed on all four sides and hand dressed where necessary and sanded to all exposed surfaces. All arises in any way accessible shall be sanded and smoothed off.

3.22.5 Workmanship

- (i) All connections whether nailed, screwed, glued, morticed or dove-tailed shall be accurately made and properly executed to provide sound, satisfactory connections for the class of work required. Timbers containing defects or distortions shall not be used.
- (ii) All joinery shall be manufactured by skilled tradesman with accurate tolerances and set out and with tools, jigs, machines and equipment appropriate for the work.
- (iii) Assembly of the joinery units and joinery frames, etc. shall be by means of glued connections appropriate to the work - mortice and tenon, housing and doweling, etc. where practicable including the use of glued blocks wherever required. Nailing, screwing shall only be used with prior approval of, corrugated fasteners shall not be used for effecting connections.

3.23 Aluminium works

3.23.1 Aluminium doors and windows

- (i) All windows and doors are to be constructed by approved specialist suppliers of medium section to the particular requirements noted on the drawings as to weight and profile. All sections shall generally conform to relevant British Standard Specifications.
- (ii) All frames should be made to fit the actual openings with a 3 mm clearance all around. Discrepancies in overall width or height exceeding 3mm will not be allowed and the frames will be rejected in such cases. Any small discrepancies shall have the gaps suitably backed and filled with gun-applied water repellant mastic sealant
- (iii) All sealants used in the assembly of, and in the fixing of cladding and window framing, shall be non-setting to allow thermal movement without detriment to those joint sealants used for peripheral caulking and shall be one-part silicone sealant and shall conform to BS 4245. All spliced joints between mullions should be sealed with an approved silicone product, compatible with other sealants and packings used.
- (iv) The auxiliary components in sashes as locks, pivots, sliding gear etc. shall comprise of stainless steel or resisting materials.
- (v) The tolerance is to be as follows:
 - (a) Inside width of frame - 3mm Maximum
 - (b) Inside height of frame - 3mm Maximum
 - (c) Depth of frame - 2mm Maximum
 - (e) Opposite side, Inside distance 2mm Maximum
- (vi) The performance - associated requirements are
 - (a) Strength (resistance to wind pressure and other forces applied in use)
 - (b) Air tightness or ability to cut out drafts.
 - (c) Water - tightness against rain or dew.
 - (d) Sound arresting effect to (shut off noise from outside as well as inside).
- (vii) All surfaces shall have an anodized protective surface layer of minimum 25 micron thickness.

- (viii) Glazing shall be done as specified by the Concessionaire in design and specifications and approved by the Authority. Glass shall be tinted, or as specified in the drawings. Thickness shall be according to the size of panels as given hereunder.

Not exceeding 1 sq. ft.	2mm
Exceeding 1 sq. ft. but not exceeding 2 sq. ft.	3mm
Exceeding 2 sq. ft. but not exceeding 4 sq. ft.	4mm
Exceeding 4 sq. ft. but not exceeding 6 sq. ft.	5mm
Exceeding 6 sq. ft.	6mm

- (ix) Prior to import and / or purchase of the Aluminium Doors and Windows, the relevant specification of the manufacturer, along with samples has to be submitted to the Authority for approval.
- (x) The fitting shall be done with utmost care not to spoil the finishes given by the manufactures, and any cleaning done shall be done with cleaners etc. as specified by the Manufactures.
- (xi) The Concessionaire shall provide all items, articles, materials, operations, mentioned, or scheduled on the drawings, including all the labour materials, including fixing devices, equipment and incidentals necessary as required for their completion.
- (xii) The Concessionaire shall submit shop drawings and/or samples of each type of doors, windows, railings and other items of metal work to the Authority for approval. The shop drawings shall show full size sections of doors and windows etc. thickness of metal, details of construction hardware as well as connection of windows, doors and other metal work to adjacent work.
- (xiii) Aluminium doors and shutters shall be manufactured by an approved manufacturer and shall be of sections, sizes combination and details shown on the drawings. The frame member shall be one piece, corners shall be electrically welded, ground smooth and true and glazing bare shall be threaded or interlocked.
- (xiv) Glazing for doors and windows shall be of specified thickness and of approved quality and shall conform to specification of glazing. Fixing for glazing shall be done with aluminium Snap-On beading as per detail drawing and instructions. Necessary continuous rubber gaskets of approved make shall be provided.
- (xv) Colour for doors and windows shall be designed by Concessionaire and agreed by Authority

3.23.2 Aluminium louvres

- (i) If required by the Authority, samples shall be submitted for approval.
- (ii) All metal louvres shall be installed according to manufacturer's instructions.
- (iii) All units shall be installed plum, well fitted and securely attached to supporting frames.

3.23.3 Top hung windows, ventilators and side hung doors

- (i) All windows and doors should be weather stripped. The weather protection should be achieved by a positive compressive action against the section and should not depend on external contact. At every contact between two profiles two weather stripping sections should be provided to complete weather protection.

- (ii) The bottom section for hinges must be capable of being adjusted vertically if necessary. The gap between section and the floor should be covered with a pair of special splay-tube sections.
- (iii) The shutter sections for both windows as well as doors shall be hollow section type and shall be overall size 57 x 45 mm and the door sections shall be overall size 81 x 45 mm (including flanges).
- (iv) The shutters of the windows and doors should be assembled with stainless steel pins and nylon washers. Handles shall be anodized aluminium finished to match the aluminium sections and mounted with self-lubricating nylon washers.
- (v) A mortice cylinder rim automatic deadlock of high quality with double pin tumbler shall be used.
- (vi) Windows shall have anodized aluminium handles, colour as framing and a latching mechanism securing the shutter to the frame both at the top and bottom.
- (vii) Required fittings- single action door closer concealed in the head bar of the outer frame and mounted on an adjacent pivot at the threshold and deadlock fitted, the left hand leaf of double doors with flush bolts at head and sill with deadlock fitted to the right hand leaf and escape doors to have panic bolts assembly with vertical elements concealed in the sill and door closer

3.23.4 Installation

- (i) Aluminium work shall be installed adjusted and glazed by experienced workmen all in accordance with the manufacturer's installation instructions and in full conformity with the approved shop drawings, samples and other submitted data. Under no circumstances shall materials be installed on surfaces that contain condensation, dirt, grease or other foreign encountered materials that would hinder or prevent proper installation and functioning for the use intended.
- (ii) Aluminium work shall be carefully and accurately assembled with proper and approved provision for contraction and expansion and set in correct locations as per approved detailed shop drawings, all level, square, plumb and aligned with other work. All joints between framing and structural building shall be sealed in order to be watertight and weatherproof and to satisfy all other quality and technical specifications as requisite
- (iii) Frames shall be designed and manufactured with a maximum 2.5mm tolerance around the opening in the structure. These joints are to be finished by applying an approved sealant into a polystyrene foam backing strip.
- (iv) All aluminium works are to be fully protected for the duration of the Concession Period from damage by other trades.
- (v) If for any reason final finishes become scratched, abraded or damaged during transport, delivery, storage or erection, it shall be the Concessionaire's responsibility to remove or repair those defective areas or components
- (vi) Repair work shall be identical to the manufacturer's applied finish with regard to gloss, finish and visual appearance. Field touch up of painted aluminium is permitted only when deem fit by Concessionaire and Authority. Where touch up is not an authorized means of repair the damaged materials must be replaced by new.
- (vii) Upon completion of work all protective coverings from all exposed surfaces shall be removed. All surfaces shall be cleaned using soap or detergents as recommended by

the aluminium manufacturers to remove sealants, discoloration and any other foreign material. Defection of any type shall be repaired at the Concessionaire's expense.

(viii) Extreme care shall be taken when cleaning the exterior portion to protect all other adjacent works.

3.23.5 Sealing joints

- (i) The Concessionaire shall ensure that joints are dry and remove all loose material, dust and grease.
- (ii) Joints shall be prepared in accordance with sealant manufacturer's recommendations using recommended solvents and primers where necessary.
- (iii) Adjoining surfaces which would be impossible to clean if smeared with sealant shall be masked.
- (iv) Backing strips shall be inserted in all joints to be pointed with sealant. When using backing strips, the Concessionaire shall not leave gaps and shall not reduce depth of joint for sealant to less than the minimum recommended by the manufacturer.
- (v) Cavities shall be filled and jointed with sealant in accordance with the manufacturer's recommendations. Sealant shall be tooled to form a smooth flat bead.
- (vi) Excess sealant shall be removed from adjoining surfaces using cleaning materials recommended by the sealant manufacture and shall be left clean.

3.23.6 Glass installation

- (i) Workmanship shall generally be in accordance with CP 152 and respective British Standards.
- (ii) The glass is to be delivered to the site with adequate protection to prevent damage and where possible it is to be fixed in position immediately after delivery. When fixed the Concessionaire is to take all necessary precautions to prevent damage during succeeding building operations and will be entirely responsible for the replacement of any broken or damaged glass at his own cost.
- (iii) Concessionaire is to be solely responsible for determining the exact sizes of glass required, including a tolerance of 2mm to each edge and he is recommended to check the necessary dimensions on site.
- (iv) No glazing is to be carried out until rebates have been painted with primer. Glazing beads as applicable are also to be primed before fixing.
- (v) All mastic is to be neatly struck off to agree exactly with site lines inside and out.
- (vi) Rates are to include for all necessary springs, clips, setting blocks, location blocks and distance pieces and for taking off and later re-fixing loose beads
- (vii) Glass apertures in timber doors are to be bedded in chamois leather glazing strip, black ribbon velvet or P.V.C. glazing strip as per requisite specifications.

3.24 Sheeting for roofing

3.24.1 Scope of work

- (i) Hatchery areas would require different roofing in respect to insulation, light and weatherproof cladding. Concessionaire shall design and select appropriate material for different facilities of the hatchery which may include:
 - (a) Profile sheets with separate insulation sheets

- (b) Steel roofing sheets with protective lining
- (c) Corrugated fiber cement sheets
- (d) Uninsulated roof panels
- (e) Panels
- (f) FRP/ Fiberglass sheet
- (g) Polycarbonate sheets
- (ii) As per the design requirements and facilities, heat insulation shall be provided as per technical specifications and norms
- (iii) This section details out steel profiled sheeting used as external weatherproof cladding of roofs and polycarbonate roofing sheets in areas where light is required.

3.24.2 Material and applicable code

- (i) Polycarbonate
 - (a) Marine grade polycarbonate sheet products are durable materials are designed for the most-demanding marine applications, and offer a clear, glass-like, wrinkle-free appearance.
 - (b) The sheets may be colored or colorless, and they may be transparent, translucent or opaque.
 - (c) The sheets may also have a special weather-protective layer on one or both surfaces
 - (d) The applicable codes would include:
 - BS EN ISO 11963:2019 - Plastics. Polycarbonate sheets: Types, dimensions and characteristics.
 - ISO 11963:2012 specifies the requirements for solid, flat extruded sheets of polycarbonate (PC) for general applications and applies only to thicknesses equal to or greater than 1.5mm.
- (ii) Profiled galvanized steel sheet
 - (a) The profiled sheeting shall be in galvanized sheet steel with a factory per finished protective PVC film with colour to approval.
 - (b) Applicable code would include:
 - BS 5427:2016+A1:2017- Code of practice for the use of profiled sheet for roof and wall cladding on buildings
 - BS EN 508-2:2019 - Roofing and cladding products from metal sheet. Specification for self-supporting products of steel, aluminium or stainless-steel sheet. Aluminium

3.24.3 Workmanship

- (i) Profiled galvanized steel sheet
 - (a) Accessories: Flashing, trims, filler pieces, spacers, tapes, sealant, etc. where not specified to be the types recommended by the sheet manufacturer.

- (b) Fastenings should be appropriately done to respond to wind speed, ground roughness, building height, size, loads etc as requisite for the material and facility.
 - (c) Quality of Work: Handle and store to preserve surface using clean dry gloves. Do not slide sheets over rough surface or each other. Packs of all sheet must be kept dry in transit and stored clear of the ground under cover to prevent water and /or condensation being trapped between adjacent surfaces. If packs become wet, sheets should be separated, wiped with a clean cloth without delay and placed so that air circulation completes the drying process.
 - (d) Structure: Check that structure is in a suitable state to receive sheets before commencing fixing. Concessionaire must confirm acceptance to Authority
 - (e) Do not fix profiled sheeting until final coats of paints have been applied to outer surfaces of supporting structure.
 - (f) Isolating Tape: Apply to those surfaces of supports which would otherwise be in contact with sheeting or accessories after fixing.
 - (g) Cutting and drilling should be done in clean sheets with power saw with abrasive cutting disc. Edges of openings to be reinforced post drilling/cutting. All burrs, drilling swarf, lubricant, dust and any other foreign matter should be removed before finally fixing sheets into position.
 - (h) Sealant should be installed as per manufacturers recommendations. Ideally to be positioned in straight, unbroken lines parallel to edges of sheets, placed into corrugations. Ensure continuity and effectiveness of seal, especially at corners of sheets and do not over compress.
- (ii) Polycarbonate Sheet
- (a) Polycarbonate sheet should be cut to appropriate size or drilled post 24 hour and would require cleaning before it can be sealed. Rough and sharp edges may be removed using a fine file or sandpaper. If the sheet has been cut using saw it will unavoidably produce dust and swarf in the cavities. This must be removed before sealing.
 - (b) The entire system will be designed in respect to wind loads, Dead & live loads, impact loads & deflection and other relevant parameters. Polycarbonate sheet may have aluminium profile framework and the M.S Tube structural support framework or any other as deemed fit by the Concessionaire and approved by the Authority
- (iii) Fittings and Features
- (a) Profile Fillers are to be used where specified and wherever necessary to close off corrugation cavities from the outside and inside of the building. Position on the line of, or above, fastening and ensuring a tight fit and leaving no gaps. Where sealed laps are specified bed profile fillers in sealant on top and bottom surface, but do not obstruct channels for ventilation or condensation drainage.
 - (b) All fittings for flashing / trim shall be as per manufacturers recommendation and lapped at joints as appropriate according to technical standards
 - (c) Gutter when provided to be fully supported at each joint and at intermediate position not more than 900mm apart. Fix with spigot ends up the slope and make

all the joints fully watertight. Position sheeting to leave a clear width across the gutter of not less than 230mm.

(iv) Insulation

- (a) The thermal performance of the roof cladding is important for marine hatchery and should be optimum in respect to various facilities. Insulation may be required, and appropriate material and sizing shall be designed by the Concessionaire.
- (b) The majority of site-assembled double skin roof constructions use mineral fibre (glass or rock) quilt insulation supplied in rolls. When unrolled on site the material expands to at least its required thickness and normally fills the cavity created by the spacer system between the liner and weather sheet.
- (c) Rigid mineral fibre insulation slabs are also used in some circumstances, but this is less deformable than the quilt and the roofing system has to be designed and installed with this in mind so that no gaps are left in the insulation layer
- (d) Minimum thickness of quilt insulation should be 50mm and comes in standard thickness of 50mm, 80mm, 100 mm etc. The same shall be considered by the Concessionaire and reported to the Authority.

3.25 Tilework

(i) General

- (a) Glazed Ceramic Tile shall comply with British Standard specification No. 1281 and shall be approved sizes as shown on Drawings and the product of a reputable manufacturers approved by the Authority
- (b) Ceramic Tile shall comply with the requirements of British Standard No.1286 and shall be of approved sizes as shown on the drawings and the product of a reputable manufacturer.

(ii) Ceramic and Vitreous Tile Materials

- (a) Ceramic and Vitreous clay Wall Tiles: All tiles for wall installation shall have cushion edge, impervious porcelain and highly glazed surface. Colours shall be as selected by the Concessionaire and shall include trimmers, corner pieces, bullnose and all other special shapes indicated or required. All this shall be free from flaws, cracks and crazing.
- (b) Floor Ceramic and Vitreous Tiles: Non-slip ceramic tile for shall be used on all floor locations. Floor tiles shall be specially prepared for floor use but shall have all the qualities of ceramic tiles listed above for wall use.

(iii) Mortar Materials

- (a) Standard brand of light grey or white Portland Cement as specified in drawings, conforming to current British Standard specifications shall be used.
- (b) Sand: shall be clean, sharp, river sand, conforming to British Standard Specifications and graded fine to coarse within the following limits: 100% passing 8 sieve, 90% to 100% passing 16 sieve, 60% to 90% passing 30 sieve, 25% to 55% passing 50 sieve and 0% to 15% passing 100 sieve.

(iv) Waterproofing: Floors of toilet areas, corridors and planter boxes shall be treated with an appropriate water proofing coating

(v) Installation Requirements

- (a) As far as possible, tile lay out work should be in such a way that no tile less than half size occurs.
- (b) Align joints in wall tile vertically and horizontally except where other patterns are shown or specified, align joints in floor tiles at right angles to each other straight with walls to conform to the patterns selected.
- (c) Verify locations of accessories before installing tiles. Work shall be coordinated with plumbing and other trades before starting of tile work.
- (d) Installation of ceramic and vitreous tile shall be in accordance with manufacturer's instructions.

(vi) Floor Tile Installation

- (a) All ceramic and vitreous clay tile floors shall be in Portland cement setting beds. Concrete surfaces shall be cleaned, and surface of concrete shall be wetted prior to placing of setting bed mortar. Tiles shall be immersed in water for minimum of 4 hours before laying.
- (b) Setting Bed Mortar Mix: shall consist of one (1) part Portland cement and two (2) parts dry sand, by volume, to which not more than 1/10 part of hydrated lime may be added.
- (c) When mixed with water, the mortar mix shall be of such consistency and workability as to produce maximum density. Determine consistency by stroking the mortar surface with a trowel. Whereof correct consistency, the trowled surface readily assumes a smoothed, slickened appearance.
- (d) Spread setting bed mortar and screed to provide smooth, dense beds with true planes pitched to drains. The thickness of bed shall be such that the floor tile will finish flush with adjacent finished flooring, but bedding shall have average thickness of 38mm.
- (e) After bed has set sufficiently to be worked over, trowel or brush a thin layer, 3mm in thickness, of neat Portland cement paste over the surface of the back of tile.
- (f) Do not prepare larger setting bed than can be covered with tile before the mortar sets. Press tile firmly into the bed tapping with wood blocks to obtain firm bedding of total tile area and a smooth top surface.
- (g) All tile shall be properly aligned with straight joints in even widths. Joints width shall be determined by spacers on ceramic tiles. Tamping shall be completed within one (1) hour after placing tile. Adjust work out of line within this period.
- (h) Tiles shall be fitted closely around pipes running through walls and floors. Pitch floors to drains.

(vii) Wall Tile Installation

- (a) Base Plaster 13mm thick applied to masonry wall shall be one-part Portland cement, three-parts of river sand by volume. Where additional thickness build-up is required to conform to indicated lines, apply as separate coat at no cost to employer.
- (b) Setting bed of tiles shall be done with cement slurry. The thickness of slurry bed shall be 3mm thick minimum for setting tiles and walls.
- (c) Installation of tiles shall be in accordance with standards and applicable requirements previously specified for floor tile.

- (d) Tiles shall be installed in perfect vertical plumb and as per the pattern and joints as shown on drawings

(viii) Grouting

- (a) Grouting shall not commence for at least 24 hours after placing of tiles.
 - (b) Grout for floor and wall ceramic and vitreous tiles shall be waterproof, neat white Portland cement with dry cement colour added as per design. If white grout is selected, cement shall be white.
 - (c) Grout mixed to a creamy consistency in accordance with manufacturer's directions shall be used for joint filling. Maximum width of joints shall be 3mm.
 - (d) Force maximum grout into the joints with trowel. Before grout sets, strike or tool joints to base of cushion and fill all skips and gaps. Do not permit setting bed materials to show through grouted joints.
 - (e) Cure grout joints by maintaining damp condition for three (3) days by sponging down, or other appropriate method. Allow floors to set 48 hours before permitting ordinary foot traffic.
- (ix) Defects in Tiles and Tile Laying: The surface of all tiled floors shall be perfectly in level and shall be executed by experienced workers in the field of tile laying. A sample panel of laid tiles of each type can be subjected to approval by the Authority before commencement of tile laying. Chipped or damaged tiles installed by the Concessionaire shall be rejected and shall have to be replaced by the Concessionaire at his own cost and risk.

3.26

Painting

(i) Material

- (a) All painting work shall be carried out in accordance with the paint manufacturer's specifications
- (b) Paint shall be ready mixed and all paints, varnishes, enamels, lacquer stains, paste fillers and similar materials shall be delivered to the site in the original containers with the seals unbroken and labels intact. Each container shall give the manufacturer's name, type of paint, colour of paint and instructions for reducing. Thinning shall be done only in accordance with the manufacturer's directions.
- (c) Use of product by the same manufacturer shall be a general rule in each stage of work in this Specification.
- (d) Colour, lustre, colour scheme, finish shall be decided by the Concessioner after checking sample paint test.
- (e) Where walls are specified to be painted, all columns arise, groove, rough surfaces, reveals, soffits and returns, etc. shall be included and no extra shall be payable.

(ii) Preparation of Paint

- (a) Mixing: Paint content with pigment shall be thoroughly stirred to make a uniform consistency.
- (b) Thinning: Portable water shall be used for thinning of emulsion paint and water-soluble paint. Proper thinner, product of the same manufacturer as paint, as a rule, shall be used for other types of painting. Percentage of thinning and viscosity shall

be conducted with direction of manufacturer or catalogue as they vary with the method of paint, temperature, type of material to be painted.

- (c) Allowable period of Use: Paint mixed with more than 2 types shall be used with direction of a manufacturer or catalogue as allowable period of use, mixing ratio and mixing method vary. The paint which has passed allowable period of use shall not be used.
- (d) All nail holes on veneer, board. etc., shall be covered with proper rust-proof paint before the subsequent painting is applied in accordance with this specification.
- (iii) Protection: Dangerous material such as paint, thinner, etc., excluding emulsion paint and water-soluble paint shall be kept in accordance with regulations concerned.
- (iv) Procedure of Painting: Exterior - Surface of Mortar, Plaster and Concrete: Synthetic resin emulsion paint.

Coating Process	No. of Coats	Type of Paint	Drying hour	Amount (kg/m ²)
1. Surface preparation		Dry, clean and free from impurities		
2. Surface sealing	1	Sealer for emulsion paint	longer than 4 hours	
3. Puttying		Putty for emulsion paint		
4. Grinding		Grind with proper grinding tool		
5. Spot painting		Synthetic resin emulsion paint		
6. Second coating	1	Synthetic resin emulsion paint	longer than 4 hours	0.10-0.13
7. Finish coating	2	Synthetic resin emulsion paint	longer than 4 hours	0.10-0.13

Notes:

- (a) Degree of dryness on the surface to be painted shall be kept under 6% in water content and below PH 9.5
- (b) Puttying and sanding process shall be allowed to omit depending on the conditions of the surface.
- (c) Drying time of putty shall be long enough for sanding to proceed.
- (d) Amount of sealer for surface sealing shall be adjusted as it varies with the surface conditions.

- (v) Exterior - Iron Products in General: Synthetic resin mix paint

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
1. Surface preparation	Completely remove rust, moisture, oil and other impurities by sander, cleaner and surface.			
2. First Coating 24 hours	1	Rust proof oil paint	longer than 24 hours	0.13-0.15
3. Touch-up	Touch-up rustproof oil paint			
4. First Coating	1	Rustproof oil paint	longer than 24 hours	0.13-0.15
5. Second coating	1	Synthetic resin mix paint	longer than 15 hours	0.11-0.15
6. Finish coating	1	Synthetic resin mix paint	longer than 15 hours	0.11-0.15

Note: Paint for touch-up painting shall be the same as used for first coat in process No. 2

(vi) Exterior – Wood, use of Synthetic resin mix paint finish

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
1. Surface preparation	Clean and sand to plane surface			
2. Knot treatment	1-2	Lacquer varnish	longer than 24 hours	
3. First coating	1	First coat paint of oil mix paint	longer than 15 hours	0.13-0.15
4. Second Coating	1	Oil mix paint	longer than 15 hours	0.11-0.13
5. Finish coating	1	Oil mix paint	longer than 15 hours	0.11-0.13

Note: Puttying and sanding shall be done after process No.2 when there are cracks, etc. on the surface putty shall be oil-putty, but drying time shall vary depending on conditions.

(vii) Interior - Mortar, board, etc.: Polyvinyl acetate resin emulsion paint finish

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
1. Surface preparation	Dry, clean and free from impurities			
2. Surface sealing	1	Sealer for emulsion paint	Longer than 4 hours	
3. Puttying		Putty for emulsion paint		
4. Grinding		Grind with proper grinding tool		
5. Spot painting	Second coating paint of polyvinyl acetate resin emulsion paint			
6. Second Coating	2	Polyvinyl acetate resin emulsion paint	longer than 4 hours	1.11-0.13
7. Finish Coating	1	Polyvinyl acetate resin emulsion paint for stipple-finish	longer than 4 hours	0.25-0.35

Notes:

- Degree of dryness on the surface to be painted shall be kept under 6% in water content and below pH 9.5.
- Puttying and sanding process shall be allowed to omit depending on the conditions of the surface.
- Drying time of putty shall be long enough for sanding to proceed.
- Amount of sealer for surface sealing shall be adjusted as it varies with the surface conditions.

(viii) Interior - Mortar, plaster, concrete, etc.: Solvent - Polyvinyl chloride resin paint finish

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
1. Surface preparation	Dry, clean and free from impurities			
2. Surface sealing	1	Sealer for emulsion paint	Longer than 2 hours	
3. Puttying	Putty for polyvinyl chloride resin paint			
4. Grinding	Grind with proper grinding tool			
5. Spot painting	Solvent-polyvinyl chloride resin enamel emulsion paint			
6. Second Coating	1	Solvent-polyvinyl chloride resin enamel emulsion paint	Longer than 4 hours	0.11-0.14

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
7. Finish Coating	2	Solvent-polyvinyl chloride resin enamel emulsion paint	Longer than 4 hours	0.11-0.14

Notes:

- Degree of dryness on the surface to be painted shall be kept under 6% in water content and below PH 9.5
- Puttying and sanding process shall be allowed to omit depending on the conditions of the surface.
- Drying time of putty shall be long enough for sanding to proceed.
- Amount of sealer for surface sealing shall be adjusted as it varies with the surface conditions.

(ix) Interior - Mortar, plaster, concrete, etc.: Polyvinyl acetate resin emulsion paint finish

Coating Process	No. of Coats	Type of Paint	Drying hour	Amount (kg/m ²)
1. Surface preparation	Dry, clean and free from impurities			
2. Surface sealing	1	Sealer for emulsion paint	Longer than 4 hours	
3. Puttying	Putty for emulsion paint			
4. Grinding	Grind with proper grinding tool			
5. Spot painting	Polyvinyl acetate resin emulsion paint			
6. Second Coating	1	Polyvinyl acetate resin emulsion paint	Longer than 4 hours	0.11-0.13
7. Finish Coating	1	Polyvinyl acetate resin emulsion paint	Longer than 4 hours	0.11-0.13

Notes:

- Degree of dryness on the surface to be painted shall be kept under 6% in water content and below pH 9.5.
- Puttying and sanding process shall be allowed to omit depending on the conditions of the surface.
- Drying time of putty shall be long enough for sanding to proceed.
- Amount of sealer for surface sealing shall be adjusted as it varies with the surface conditions.

(x) Interiors – Concrete tanks/ steel tanks/FRP/GRP tanks painted with food-grade marine epoxy paint

Coating Process	No. of Coats	Type of Paint	Drying Hour	Amount (kg/m ²)
1. Surface preparation	Remove grease, oil and other contaminants by sand blasting, manual chipping and wire brushing			
2. First Coating	1	Stir the base thoroughly, Mix 3 parts of base and 1 part of catalyst by volume to uniform consistency. Let the mixture mature for 30 minutes. Stir it again before and during application	Touch - 2-3 hours Handle- 6-8 hours Hard - Overnight	0.18-0.22 0.13-0.15
Type: Two Pack cured with Polyamide Composition: Suitable pigmented catalyzed epoxy resin Mixing Ratio: Base: Catalyst: 3:1 by volume Pot Life: 4 to 6 hours Application: Brush, rollers, airless or conventional spray Recommended DFT: 40-50 microns per coat Corresponding WFT: 81-85 microns per coat				

Theoretical Spreading Rate: 5-6 square meter per liter
Curing Time: 6-7 Days
Over coating Interval: Minimum - Overnight / Maximum - 5 days

(xi) Interior - Iron products, steel: Synthetic resin mix paint

Coating Process	No. of Coats	Type of Paint	Drying hour	Amount (kg/m ²)
1. Surface preparation	Completely remove rust, moisture, oil and other impurities by sander, cleaner and surface			
2. First Coating	1	Synthetic resin rust-proof. Red lead-type, lead compound-type	Longer than 24 hours	0.18-0.22 0.13-0.15
3. Touch-up	Touch-up rust proof paint			
4. First Coating	1	Synthetic resin rust-proof paint. Red lead-type, Lead compound-type	Longer than 24 hours	0.18-0.22 0.13-0.15
5. Second Coating	1	Synthetic resin mix paint	Longer than 15 hours	0.11-0.13
6. Finish Coating	1	Synthetic resin mix paint	Longer than 15 hours	0.11-0.13

Notes:

- Paint for touch-up painting shall be the same as used for first coat in process No.2
- When oil rust-proof paint is used instead of synthetic resin rust proof, its specification shall conform to No. 5 and No.6.

(xii) Floor - Concrete and Mortar Epoxy resin paint finish

Coating Process	No. of Coats	Type of Paint	Drying Hour
1. Surface treatment	Dry, clean and free from impurities		
2. First coating	1	First coating paint for epoxy	Longer than 24 hours
3. Finish Coating	2	Epoxy resin paint	Longer than 24 hours

Notes:

- Degree of dryness on the surface to be painted shall be kept under 6% in water content and below PH 9.5.
- Amount of paint and number of paint shall be adjusted as they vary with the conditions of surface and required thickness of coating.
- Painted surface shall be kept out of use for more than 7 days after application of final coat.

3.27 Electrical Installations

- 3.27.1 Electrical Power Supply: Demand depends strongly on pumping requirements and operational procedures. Main pumps and other heavy loads are best operated with 3 phase power at 220 or 440 kVA. Along with this, the Concessionaire shall also make arrangement for a back-up propane or diesel fueled motor generator.

NOTE 1: There are already diesel generators installed within the Ancillary Facilities that would be handed over to the Concessionaire. The Authority has no objection if part of this power generation capacity is utilized for the elements of multispecies hatchery equipment and provide such use/utilization is proposed as part of the detailed designs and approved.

NOTE 2: Over a period of time, the Authority will encourage the Concessionaire to generate as much solar power as is possible in the facility and replace use of diesel or propane fuel as much as possible.

3.27.2 General

- (i) The work shall be carried out strictly in accordance with the standard specifications and shall also conform to the requirements of Electricity Rules in force in Male', Republic of Maldives.
- (ii) All the conduits shall be continuously earthed. Check nuts shall be provided at the point where the conduct enter the I.C. box and junction box.
- (iii) The Concessionaire shall arrange for the inspection of all Medium Pressure Installation by the Electrical inspector of the local electric supply authority from where the electricity connections have to be obtained and see that they are passed by him.
- (iv) The Concessionaire shall be responsible for all necessary permits, approvals, fees, deposits etc., required to complete the Electrical works in accordance with the Concession Agreement.

3.27.3 Scope of work: The work consists of furnishing all tools, plants, labour, materials and equipment and performing the internal electrical Works comprising of: (a) light and power wiring, (b) fans and fixtures, (c) wires and cables, (d) telephone system, (e) sub-station equipment, (f) distribution fuse gear, (g) earthing system, (h) lightening protection system, (i) fire alarm system, (j) air conditioning system, and, (k) computer network cabling outlet work.

3.27.4 Pre-qualification-The Electrification Work shall be carried out only by a licensed contractor authorized to undertake such work under the Maldives Electricity Bureau.

3.27.5 Rules and Regulations: Installation in general shall be carried out in conformity with the Electricity Rules, 1937 (UK), and the latest edition of the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers, London (I.E.). However, in case of conflict between these Specifications and the I.E. Regulations, these Specifications shall be followed.

3.27.6 Standards: The latest relevant British Specifications, and I.E. recommendations shall be applicable and be followed for the equipment specified herein.

3.27.7 Climatic Conditions: All equipment supplied shall withstand, without developing any defect, the following climatic conditions:

- (i) Maximum Ambient Temperature = 113° F or 45° C
- (ii) Minimum Ambient Temperature = 28° F or - 2.2°C
- (iii) Humidity = 98%

3.27.8 Specifications

- (i) The Concessionaire shall furnish all material and equipment at site, confirming fully to the specifications given herein and to the accepted standards, the Institution of Electrical Engineers, London, and the Maldives Energy Resource Unit. It is not the intent of these Specifications to include all details of design and construction of various material and equipment to be supplied under this Concession Agreement.
- (ii) The Concessionaire shall supply and install all material and equipment specified herein and also all installation and small material such as nuts, bolts, washers, shims

angles, levelling material, insulation, tape, solder, etc. and all such required for complete installation as intended by the Specifications.

- (iii) All material and equipment supplied by the Concessionaire shall be new and, in all respects, conforming to the high standard of engineering design and workmanship.
- (iv) All material and equipment will be inspected if required by the Authority.

3.27.9 Submittal, drawings and data

- (i) The Concessionaire, after the award of work, shall submit for approval of the Authority all drawings and cuts of equipment, appliances, fixtures and accessories. Cuts, catalogues and drawings shall be clearly marked to indicate, the items furnished.
- (ii) Concessionaire shall provide detailed electrical drawings, shop drawings wire diagrams, etc. for all electrical switchgear, fuse gear and all other systems etc. for the Authority to review and approval.
- (iii) Concessionaire shall also prepare as built drawings and share the same with the Authority

3.27.10 Spare Parts list and Guarantee

- (i) When handing over beyond the lease period, the Concessionaire shall prepare a list of spare parts required for the one year's operation of each equipment where deemed necessary together with unit price of each part, shall be supplied by Concessionaire.
- (ii) The Concessionaire shall furnish written guarantee in triplicate of the manufacturer for successful performance of each equipment. Such guarantee shall be for replacement which may be found defective in material or workmanship.
- (iii) The guarantee shall cover a minimum period of 12 months effective from the date of completion certificate.

3.27.11 Test Reports: The Concessionaire shall be responsible for the submitting the test reports/certificates and get the installation inspected passed by the Maldives Electricity Bureau.

3.27.12 Conduit and Conduit Accessories

- (i) Conduit Pipe: The conduit for the wiring of lights, socket outlets and other systems shall be made of PVC confirming to BSS 3505/1968 Class-D. The conduit shall have following wall thickness and standard weights:

Pipe Size	Wt/100Rft.	Wall thickness
20mm diameter	3.4 kg	0.04 to 0.05
25mm diameter	4.5 kg	0.045 to 0.055

- (ii) Steel conduit shall conform to BSS 31/latest. The conduit shall be enameled with good quality non- cracking and non-flaking black paint.
- (iii) Conduit Accessories- The use of factory-made round PVC junction boxes shall be done and should have nipples to receive PVC pipe with force fit, shall be used for ceiling outlets. The wall type junction box shall also be PVC. Each junction box shall be provided with one-piece cover which shall be fitted on the box with screws.
- (iv) Manufactured smooth bends shall be used where conduit changes direction. Bending of Conduit by heating or otherwise shall be allowed only at special situations with the permission of the Consultant. Use of sharp 90 degrees bends and tees is prohibited.

- (v) Bends shall have enlarged ends to receive the conduit without any reduction in the internal diameter of the PVC pipe.
- (vi) All accessories e.g. boxes, coupling, bends, solid plugs, bushes, reducers, check-nuts etc. shall be equal in quality to the specified conduit.
- (vii) The entire conduit system shall be essentially completed before the wiring pulling is taken in hand. Each conduit run shall be tested for continuity and obstructions. All obstructions shall be cleared in an approved manner. Water and moisture that has entered any section of the conduit installation must be dried with suitable swabs
- (viii) Adequate expansion joints shall be provided in all conduit runs passing across the expansion joints in the concrete slab of the buildings.
- (ix) All the free ends of conduit shall be solidly plugged till such time as final and proper terminations are made.

3.27.13 Wires, Cables and Cords

- (i) The wires & cords for the conduit wiring shall be single core, made of stranded copper conductors, PVC insulated, tested to B.S. 6004, 1975. The voltage grade shall be 300/500 volts or 450/750 V unless otherwise specified on Drawings and Bills of Quantities.
- (ii) All the wire and cables shall be of the approved standard of Maldives Electricity Bureau.
 - (a) For light or fan point wiring with 1.5 mm square or as deem fit by Concessionaire and/or Authority
 - (b) For light circuit wiring with 2.5 mm square or as deem fit by Concessionaire and/or Authority
 - (c) For power plug 15A wiring with 4mm square or as deem fit by Concessionaire and/or Authority
- (iii) All wiring shall be continuous between terminations and use of connectors or joints is not be allowed. Spur and tee connections are strictly prohibited.
- (iv) Manufacturers recommended lubricant shall be allowed to facilitate pulling of wires. Use of any kind of oil and soap is prohibited.

3.27.14 Wiring Accessories

- (i) Switches- Indoor switches controlling lights and fans shall be single pole, 5A, one or two way, suitable for 250V, 50 Hz. The body of the switches shall be made of moulded plastic, one, two, three or four gang with integral built in moulded plastic face plate. Weather-proof switches shall conform to B.S. standard.
- (ii) Switch Socket Outlet Units- Switch & socket units shall be single, pole, 3 pin rated 5A, 15A or 20A, 250V, 50 Hz. These shall be moulded plastic type with white integral built-in face plate. Each socket shall have its control switch by the side of it on a common face plate.
- (iii) Fans- All fans shall be capacitor type Deluxe models or equivalent and suitable for operation on 200/220 volts, 50 Hz, A.C Supply. All ceilings fans shall have five speed dimmers. The air displacement shall be 10,000 c.f.m for 48" (1219 mm) Sweep and 12,000 c.f.m. for 56" (1423 mm) Sweep at maximum speed. The fan motor shall be capacitor type and bearings shall be groove type to give noiseless and quiet operation.

The noise level relative to a frequency of range 1000 Hz should be within the limits of +3 dB.

- (iv) The dimmer shall be recessed type as required.
- (v) The fan hook shall be made of 12 dia. mild 5/5 steel rod bent to shape of approved design. It should be in the form of a loop about 3-1/4" (87.5 mm) long and about 2" (50 mm) wide. The rod shall be bent to have at least 8" (200 mm) extension on both sides for tying to the reinforcement steel of the slab. All ceiling fan shall be of one make only. The fan hook shall be installed in the RCC slab of the ceiling at the time of pouring concrete.

3.27.15 Light Fixtures

(i) General

- (a) The determination of quality is based on certified photometric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.
- (b) The Concessionaire shall submit samples of each and every lighting fixture specified.

(ii) LED lighting fixture and System

- (a) For aquaculture operations, Concessionaire shall use appropriate LED lighting which can provide variable light intensity and wavelength, along with variable photoperiod as required.
- (b) The light fixtures can stimulate natural environmental conditions.
- (c) Appropriate fixtures to be used inside tanks and outside tanks/ overhead.
- (d) The fixture would usually come in die-cast metal casing and a durable powder coated finish.
- (e) The manufacture shall be called upon to guarantee a trouble-free life of 3 years, effective from the date of completion certificate.
- (f) Installation may be done by experienced supplier.

(iii) Incandescent Light Fixture

- (a) The glass globes/ shades/ diffusers of the incandescent light fixtures shall be first class quality glass free from any air bubbles or voids. The glass shall generally be of opal white colour unless otherwise specified. The shape of the glass may be spherical, hemispherical, flattened bottom or tablet shaped as required.
- (b) Surface mounted fixture shall have stove enameled sheet steel body. It may also be satin brass or aluminium anodized finish as required. The fixing holes shall match the outlet box. Wall bracket light fixtures shall have back plates with matching holes of the outlet box and decorative finish as required.
- (c) All the lighting fixtures shall be suitable for local climatic conditions.

(iv) Fluorescent Light Fixture

- (a) Appropriate marine light fixtures and switch gears to be used
- (b) All the light fixtures shall have lamps and electronic ballasts of the wattage specified. The fluorescent lamp shall be either 2 ft - 18 watts or 4 - 35 watts and the colour shall generally be day light, cool day light in the order of preference or

as mentioned specifically. The new generation of 26mm diameter 18 watts and 36 watts energy efficient lamps shall be preferred.

- (c) The ballast shall be totally enclosed electronic type suitable for operation on 220 V, 50 Hz, single phase supply, a wiring diagram, wattage, voltage and current ratings shall be printed on the body of the ballasts. The power loss shall not more than 10 watts for 36 watts ballast. The ballast shall be noiseless in operation without any whistling sound.
- (d) The manufacture shall be called upon to guarantee a trouble-free life of 3 years, effective from the date of completion certificate. The starters shall have radio-interference suppressers.
- (e) The internal wiring of the light fixtures shall be carried out at manufacturers factory with heat resistance wires of size not less than 1.5 mm square.
- (f) louvers of light fixtures shall be made of anodized aluminium and/or moulded plastic. The diffusers shall be made of acrylic perspex.
- (g) All the lighting fixtures shall be suitable for local climatic conditions.
- (v) Installation Instructions
 - (a) The light fitting shall be installed according to manufacturer's recommendations.
 - (b) Flexible connecting wires from outlet box to the fixture shall be provided; connector made of porcelain thermoplastic material shall be provided and installed in the outlet boxes for connecting flexible wires to the point wires.
 - (c) Outlet boxes or any openings in the ceilings and walls shall be covered with appropriately fabricated accessories to provide an architectural entity to conceal them.

3.27.16 Main L.T. Switchboard

- (i) The L.T. switchboard shall be indoor type, free standing, free supporting, floor mounted, totally enclosed, sheet clad, dust and suitable for operation on 3 phase 4 wire system, 415 v, 50 Hz, AC supply.
- (ii) The switchboard shall be suitable for installation back to the wall and capable of front attendance. The switch board shall be designed to suit service conditions and ensure security and safety during operation, inspection, operation, cleaning and maintenance.
- (iii) The switchboard shall be designed and tested to IEC recommendations. Each panel shall withstand strain of 2000 volts insulation level for one-minute power frequency test.
- (iv) The L.T. switchboard shall consist of the following:
 - (a) Maldives Energy Resource Unit incoming panel.
 - (b) KWh meters (to be approved and checked by the Maldives Electricity Bureau)
 - (c) Outgoing distribution feeders.
- (v) Distribution Feeder Panel: Single line diagram of the L.T. switch board shall be reported to the Authority and approved by the Maldives Electricity Bureau before placing order for the switch board.
- (v) Earthing: The switchboard shall be effectively earth by means of a copper strip of 25mm x 3mm (1" x 1/8") cross -section bolted to connections near the bottom of the switchboard.

- (vi) Accessories: Designations labels, lifting lugs, foundation bolts, interconnecting nuts blots, and washers, thimbles, lugs, levelling shims cable glands and/or cable end box for all the sizes of incoming and outgoing cable shall be supplied with the switchboard.
- (vii) Testing: The following tests shall be conducted on each completed switchboard.
 - (a) Temperature rise test
 - (b) Mechanical endurance test
 - (c) Breaking Capacity test
 - (d) Routing Test
 - (e) High Voltage test
- (viii) The Switchboard shall be tested to British/Electricity Council Standard 41-5. Preference shall, however, be given to Switchboards fabricated from all components manufactured by only one manufacturer.
- (ix) Installation Instruction
 - (a) All labour, equipment, tools and plants required to complete the installation shall be provided by the Concessionaire. The Switchboard shall be fixed firmly on the floor in perfect line, plumb and level position.
 - (b) All incoming and outgoing cable connections shall be made from the bottom including Earth connections.

3.27.17 Distribution Board: The distribution boards shall be either free standing, cubical type or wall mounting type suitable for recessed mounting. Each distribution board shall be tropical in design, fully dust and vermin proof and liquid repellent.

3.28 Telephone System

3.28.1 General

- (i) Concessionaire shall prepare shop drawings and obtain prior approval of the Authority. Three prints of each shop drawings shall be submitted for obtaining approval before commencement of work.
- (ii) No piece of work shall be allowed to be executed at site without the availability of these approved shops drawings. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.
- (iii) The Concessionaire shall furnish and install the type of Telephone outlets approved by Telecom operator with openable cover for easy access.
- (iv) Both ends of each set of conductors shall be properly identified with durable tags with the same identifications of both ends, at the outlet and the telephone terminal cabinets to facilitate the installations of the telephone instrument in the future and for trouble shooting purposes. Cable used shall be twisted and shielded 3 cables in the office area and the rest as shown in the drawing.

3.29 LED Decoration for Building Outdoor Lighting

- (i) The LED for outdoor decoration has to be designed follow design and installed by experienced supplier.

- (ii) Concessionaire need to submit presentation of the LED. decoration Lighting for concept approval before proceed to procurement process
- (iii) Concessionaire need to prepare all spec and working prototype to demonstrate to consultant for approval before final production.
- (iv) All materials to be used in the Works shall be of standard make and shall bear the certification marks from Manufacture.

330 Plumbing, water supply systems, aeration, wastewater and waste management

3.30.1 General

- (i) The materials used and workmanship shall be of highest quality and grade unless otherwise specified shall conform to the latest specifications of British Standards and Codes of Practice for “ Water Supply “Sanitary, Pipe Work “Building Drainage “ Surface Water and Sub- Soil Drainage” and applicable to details and work indicated on the Drawing submitted by the Concessionaire and approved by the Authority.
- (ii) The work shall be executed strictly in accordance with the rules and regulations set by the relevant local authority of the Maldives.
- (iii) The Concessionaire shall be responsible for obtaining the necessary approvals and test certificates from the concerned departments of Maldives.
- (iv) Plumbing work shall be carried out by licensed plumbers and shall produce the copy of the license along with the tenders, or approved by the Authority
- (v) Any damage done by the Concessionaire to any existing work during the course of execution of his work, shall be made good by him at his own cost.
- (vi) The Concessionaire shall be responsible to connect the drainage and water supply to the mains and to obtain the necessary approvals and certificates from the relevant authorities of the Maldives.
- (vii) Three sets of operating and maintenance instruction covering completely the operation and maintenance of all plumbing equipment, controls, heaters, pumps and the like shall be furnished to the Authority, by the Concessionaire.

3.30.2 Drawings, calculations

- (i) The Concessionaire shall submit shop drawing for the entire installation including installation details for all items required or asked for approval of the Authority
- (ii) Approval by the Authority - shop drawing for any material, apparatus, devices and layout, shall not relieve the Concessionaire from the responsibility of furnishing same of proper dimension, size, quantity and all performance characteristic to efficiently perform the requirements and intent of the Concession Agreement. Such approval shall not relieve the Concessionaire from responsibility for errors of any sort in the shop drawing.
- (iii) At the start of the Project the Concessionaire shall periodically and thereafter submit to the Authority list of all shop drawings which will be submitted in the course of the project. The list shall show the disposition of each item including date of submission approval etc. The list shall be kept up to date through the entire course of construction.
- (iv) During Construction the Concessionaire shall keep an accurate record of all deviations between the work as shown on the Drawings and that which is actually installed.

- (v) The Concessionaire shall make a complete record of all changes and revisions in the original design which exist in the completed work.
- (vi) Concessionaire shall mark down with red pencil on two sets of plumbing plans all the revisions, omissions and/or additions to the various plumbing installation drawings as the construction progress. One set of the plans as marked shall be submitted to the Authority after completion of the work.
- (vii) The Concessionaire shall submit to the Authority, all As-Built Drawings incorporating the changes made and noted in the marked plans retained. The As-Built Drawings shall be prepared on reproducible form.

3.30.3 Tests

- (i) The entire system of drains, waste and vent piping inside and outside the building shall be tested by the Concessionaire under a water test, which shall include the entire system from the lowest point to the highest pipes above the roof.
- (ii) The water test shall be made in accordance with all local requirement. Every portion of the system shall be tested to a hydrostatic pressure equivalent to latest 15 feet head of water. After filling, the Concessionaire shall shut off water supply and shall allow it to stand 2 hours under test during which time there shall be no loss or leakage.
- (iii) The Concessionaire shall furnish and pay for device, material supplies, labor and power require for all tests. All tests may be made in the presence and to the satisfaction of Authority
- (iv) Defects disclosed by the test shall be repaired or if required defective work shall be replaced with new work without any extra charge. Test shall be operated as directed until the work is proved satisfactory.
- (v) Fixture shall be tested for soundness, stability of support and satisfactory operation.
- (vi) The Concessionaire shall notify the Authority at least one week in advance of making the required test, so that arrangements may be made for their presence to witness the test.
- (vii) Equipment shall be tested in service and the Concessionaire shall demonstrate that the equipment performs the work intended for it and that it complies with the requirement of these specification for such equipment, to the satisfaction of Authority

3.30.4 Work in Common Piping

- (i) Materials
 - (a) Piping and fitting material shall be uPVC, Hard Impact PVC or High Temperature PVC and approved
 - (b) Piping material shall comply with requirements of water supply and sewerage and other relevant authorities.
 - (c) Materials for the piping and service requirements shall basically conform to the service pressures encountered.
- (ii) Providing Drawings and Manuals
 - (a) The Concessionaire shall submit one set of originals and further two copies of layout drawings to the Authority after completion of the Works. These drawings must give the following information:
 - (i) Run of all piping and diameter on all floors and the vertical stacks.

- (ii) Location and sizes of all control valves, access panels and other equipment.
 - (iii) Location of all manholes and their sizes.
- (b) No completion certificate will be issued until the drawings are submitted.
- (c) The Concessionaire shall submit to the Authority for approval, samples, shop drawings, manufacturer's drawings, equipment characteristics and capacity data etc. of all equipment, accessories devices etc. that are proposed to be used in the installation.
- (d) The works shall be done in conformity with the plans and within the requirements of the general architectural, electrical and structural plans. This work shall be properly coordinated with the work of the other trades. Hangers and sleeves shall be furnished in time for their installation as other work proceeds.
- (e) The plumbing drawings are diagrammatic but shall be followed as closely as actual construction. All deviations from drawings required to conform to the building construction shall be made by the Concessionaire at his own expense.
- (f) The architectural drawings shall take precedence over the plumbing drawings as to all dimensions.
- (g) Large size details shall take precedence over small size drawings. The special dimensions in the specifications or instructions of the Authority shall supersede the drawings. The Concessionaire shall verify all dimensions at site.
- (h) The recommend position of the fittings, fixtures, control valves, tanks etc. as shown on the drawings will be adhered to as far as practicable.
- (i) Should there be any discrepancy due to incomplete description ambiguity or omission in the drawings and other documents, whether original or supplementary, either found on completion or during the currency of the installations work, the Concessionaire shall immediately, on discovering the same, draw the attention of the Authority
- (iii) Samples: The Concessionaire shall provide samples of all sanitary fittings, pipes and specials man-hole cover and frames, gratings and water supply pipes and fittings etc. to Authority if required as per terms (which will be returned to the Concessionaire at the completion of the Works) and shall obtain approval from the Independent Engineer before using in the Works. Any material rejected by the Independent Engineer shall be removed from the site within 24 hours of rejection.
- (iv) Existing pipes: The site shall be examined for field drains and those, when found, shall be either entirely removed or diverted, trenches filled with dry earth in 200mm to 300mm layers and consolidated.
- (v) Spare Parts: Necessary spare parts of the plumbing equipment for at least one (1) year of operation shall always be maintained by the Concessionaire at the site.
- (vi) Excavation
 - (a) All excavations shall be timbered to the satisfaction of the Independent Engineer and the type of timber shall be suitable to the kind of earth encountered. Fixing of timber and removal after completion of work shall be done as per requisite technical standards
 - (b) Should any water accumulated in the trenches, headings or other excavation, the Concessionaire shall do such work as may be necessary to drain away the

accumulated water and shall install pumps as may be required to keep the excavation and trenches dry. The Concessionaire shall ensure that the flow water in trenches or excavation does not injure or remove cement or aggregate of any concrete that has not set. No subsoil water shall be discharged into open drains or sewer at the site.

- (c) In refilling trenches after excavation this should be done in layers of 150mm after consolidating each layer. Special care shall be to see that the earth is packed uniformly and no injury to the pipe.
- (d) Excavation should include for backfilling in consolidated layers where necessary.

(vii) Piping

- (a) The Concessionaire shall, as soon as possible prepare and submit to the Authority for approval, working drawings showing exact locations and pipe runs for all pipework, the layout and setting up of equipment and the connection of piping to the equipment. Such drawings shall include details and methods of supports, anchors and sleeves etc.
- (b) Pipe runs shown in the drawings are approximate and intended to indicate the general run and locations only. The exact locations of all pipework shall be determined on Site.
- (c) All pipes, fittings etc. shall be kept closed against moisture and foreign matters when stored at site and during installation.
- (d) All pipes shall be fixed clear of one another and be so arranged as to provide easy access for maintenance and repair.
- (e) All plumbing work shall be carried out by suitably qualified plumbers in accordance with the British Code of Practice and Regulations and requirements of related Authorities.
- (f) Materials for the piping and service requirements shall basically conform to the service pressures encountered.
- (g) Each part of the installation of the plumbing work shall be completed in all details as shown in the drawings or as specified and provided with all necessary control valves, etc. that will be necessary for their satisfactory operation.
- (h) All piping shall be run plumb, and straight and parallel to walls, except drain line which shall pitch 6mm per 300mm in the direction of flow.
- (i) Pockets, unnecessary traps, turns and offsets shall be avoided. When traps or pockets are unavoidable, they shall be valve drains.
- (j) Piping installed on the concrete slab shall be firmly fixed or anchored to the floor with packing to prevent damage to pipes. Pipes shall not be bent with bender where cross with another pipe or change to upward.
- (k) Where pipes are to be laid directly in the ground, bed shall be sufficiently compacted, necessary protection for piping shall be taken.
- (l) Backfill shall be done in such a manner not to damage the pipeline and shall be restored to the original stage.
- (m) Where pipes penetrate through waterproof part or fire partition or fire wall, pipe sleeves shall be provided and clearance between pipe sleeve and pipe shall be filled with caulking material

- (n) Pipes, fittings, valves and accessories shall be thoroughly cleaned, both internally and externally before installation and shall be cleaned before putting into service.
- (o) Plumbing work shall be completed in accordance with the details shown on the Drawings or as specified and provided with all necessary control valves, etc. that will be necessary for their satisfactory operation.
- (p) All pipes shall be cut square and true to the pipe axis by means of suitable tools without reducing pipe diameter and cut ends shall be finished smooth. Before making connections, chips, dirt and other foreign matter shall be removed from inside interior of each pipe. Fixing of hangars and embedding of pipe sleeves shall be carried out without delay along with the progress of the work where required.
- (q) Pipe connections for the water supply system shall be by uPVC high pressure. Jointing shall be generally by means of solvent cement according to manufacturer's instructions
- (r) Vertical pipe shall be braced at more than 2 point in every story

3.31 Water Supply and Filtration

3.31.1 General

- (i) Concessionaire shall design and get approval from the Authority on a sound seawater supply system which shall include components of seawater intake, pumping station, network connecting pumping station and hatchery, first water treatment system (coarse filtration up to 100mm), internal distribution network, secondary water treatment system (fine filtration up to 1mm), discharge system that includes the drainage network, the wastewater treatment and the outlet.
- (ii) The Concessionaire may adopt a recirculation water supply system which would require to treat the water continuously to remove the waste products excreted by the fish, and to add oxygen to keep the fish alive and well.
- (iii) The technologies that support tank-based culture must address five key issues; clarification, biofiltration, circulation, aerations, and degassing. Solids must be removed from the recirculating system through a clarification process. Dissolved organics and ammonia are then removed through a biofiltration process. The system must provide for circulation between the tank and filtration components. And finally, dissolved gases (oxygen and carbon dioxide) must be brought back into balance by aeration and degasification processes.
- (iv) In the recirculation system, the Concessionaire as required by the design, shall include other facilities such as oxygenation with pure oxygen, ultraviolet light or ozone disinfection, automatic pH regulation, heat exchanging, denitrification, etc. depending on the exact requirements.
- (v) Concessionaire may adopt relevant system for seawater intake, through direct pumping or wells and the same shall be approved by the Authority. Concessionaire shall ensure a well-designed system, in terms of piping and proper choice of adequate pumps and ancillary technical equipment. Peak water flow requirements of the hatchery must be calculated to design properly the entire system. Future developments and system maintenance should also be taken into consideration.
- (vi) Proper mechanism for seawater filtration and storage would be designed by Concessionaire and approved by Authority. Storage would include sumps and overhead tanks. The exact size and capacity of the various filters is dependent upon the water capacity of the facility, the flow rates and the expected biological load.

- (vii) Manufacturer's or supplier's literature should be consulted to ensure that filters of sufficient capacity are purchased.
- (viii) Pumping station with air blower room should be appropriately designed. The size and capacity of the pumps have to be calculated according to the water requirement. The number of pumps has to be decided according to the yield of water from each bore well. Three common type of pumping systems are centrifugal, axial flow and airlift pumps.
- (ix) Concessionaire will plan for appropriate piping system for sea water intake - for piping outdoors could the Concessionaire may select protected steel, concrete and fiberglass, while polyethylene (PE) and polyvinyl chloride (PVC) may be used for piping inside the hatchery or any other material as per national and European or British standards.
- (x) For inside hatchery flow, the Concessionaire may select PE or PVC pipes or other materials as per requisite standards. These are usually of small diameter (31 to 200mm), assembled by solvent welding or threaded sockets, or fast joints.
- (xi) Concessionaire shall plan for appropriate chiller/heaters for the water supply system along with requisite pumps and plumbing
- (xii) Provision for adequate Seawater UV and Cartridge Sterilization Filters with corrosion free Gauges and Valves / Fittings to be done by the Concessionaire. All Influent seawater shall be filtered to a level that is acceptable to the operational requirements of the hatchery
- (xiii) Concessionaire if required may also design and plan for High Pressure Force Cleaning Water System which should work with the Brackish or low salinity water, should be a portable system to adopt and tolerate the pressure and be made of Non-corrosive materials.

3.31.2 Materials

- (i) Pipes, joints and fittings for water supply work shall be high pressure uPVC.
- (ii) Materials and workmanship shall comply with the local water supply authority requirements.

3.31.3 Water Pumps for Hatchery and Associated Systems

- (i) The specification herein stated are basic guides only. Other items not so indicated but which are obviously necessary for the proper operation of the system as intended shall be supplied and installed, in accordance with accepted standard.
- (ii) Manuals of operation and maintenance and list of spare parts shall be supplied together with the equipment.
- (iii) The Concessionaire shall submit at least four copies of pump performance curves showing among others, the pump rating and efficiency, properly marked out.
- (iv) A metal name plate indication in indelible letters for the correct specification of the pump and motor shall be properly attached to the assembly at a location such that the information written thereon can be conveniently read by all concerned.
- (v) Well water pump and Fresh water pump:
 - (a) Flow rate = 60L/min, Head = 70m,
 - (b) Type: End suction Hydro pneumatic pump, 220/440V, 3-Phase, 50 Hz. Alternate and parallel operation.

- (c) Fire pump: 50L/min, 70m head, vertical multistage pump with alternative operations.

(vi) Spacing of supports: Support spacing for uPVC pipes shall be as follows

Nominal Diameter	Up to 40mm	More than 50mm
Space	1.2m	1.5m

(vii) Aeration Systems

- (a) The air blower capacity has to be calculated according to the aeration requirement in each section. The blower room shall be covered completely to reduce the entry of dirt into the blowers. Similar covering blower room would provide sufficient proof to avoid sound pollution.
- (b) When adopting the recirculation system, Concessionaire has to appropriately design the aeration system. Under high loads, the aeration system must be capable of replacing all oxygen in the system every 20 to 30 minutes at peak feeding rates.
- (c) Aeration backup system is requisite in the form of a backup electrical generator, liquid oxygen tanks, or a mechanical blower and would be planned for by the Concessionaire and agreed upon by the Authority.
- (d) Alarm systems with auto-dialers supplement the backup system. Response times for re-establishing power or blower capacity need to be less than 20 minutes.
- (e) system should also plan for removal of carbon dioxide. Carbon dioxide is usually removed by blown air or by unpressurized packed columns

3.32 Drainage Works

3.32.1 Drainage for Hatchery and Associated Systems specifically, and for General Application

- (i) All hatchery components require adequate drainage from the floors. Should also be able to drain all tanks with an adequate speed when required to empty the hatchery components.
- (b) Concessionaire shall plan for appropriate drainage system that shall include secondary channel/ gutters that convey the effluents from various tanks to main drainage canal. The internal gutter network shall be made of appropriate material such as concrete, light PVC and would be covered with removable slabs/units that can be of reinforced concrete, wooden or metal slabs coated for protection against corrosion.
- (c) The drainage should also be sized to be able to drain the daily flow from hatchery components at a speed as outlined in the hatchery design provided by the Concessionaire.
- (d) It is recommended that High Pressure uPVC pipe and fittings shall be used for all drainage work including vent pipes. While HDPE pipes of minimum diameter shall be 12mm for all outfall pipes
- (e) Joints shall be made by the cold-jointing method, and the pipe interior shall have not offset at the joint interfering with the flow. Joint adhesive shall be good quality and shall not be affected by heat and shock.
- (f) Where horizontal drain branch joints the main, such branch shall be connected to the main in a substantially horizontal position and at an acute angle of not more than 45 degree to the main in all cases.

3.32.2 Vent stack pipes

- (i) Vent pipe shall be vertically branched out upward from a horizontal drain branch pipe or other appropriate point. Horizontal branching of the vent pipe shall be done on appropriate standards and approval of Authority.
- (ii) Where vent pipes on each floor are to be connected to the vent stack, all connections shall be made at least 150mm above the respective overflow edges of fixture on that floor.
- (iii) The provision of the preceding item shall also apply to the connection of vent stack vent pipe. Vent stack shall be connected to the waste stack or soil stack at the lowest part to stack pipe.
- (iv) Where vent pipe is to be connected to the horizontal drainpipe, such angle shall be more than 45 degree to upward. Vent stack shall be extended 600 mm from the top of the roof or lead to the wall and top of pipe shall be covered with vent cap.

3.32.3 Laying of Pipes: The pipes shall be laid to proper lines and levels as per plans prepared and provided by the Concessionaire and approved by the Authority, as the main is laid, the front pipes in the trench shall always be closed with a plug either of iron or wood and security fastened. The plug shall not be removed except when pipe laying is resumed or for purposes of testing.

3.33 Sewerage

3.33.1 Laying of sewer water Mains if required

- (i) All mains shall be laid on a good solid, bottom to prevent subsidence and consequent fracture. Running under buildings, if unavoidable, shall be completely surrounded by 150mm of concrete. In case of mains passing through a well, the weight of the latter shall be carried by a lintel or a suitable relieving arch.
- (ii) All rising mains shall be properly plugged to all wall brackets at regular intervals as given in the drawings.
- (iii) All mains shall be concealed inside wall as far as possible except for vertical sewer mains, cleaning doors shall be provided in the walls whenever necessary

3.33.2 Sewers if required: After the cement has had time to set, the pipes shall be tested in length between manholes in following manner.

- (i) In the lowest manhole/intercepting trap as the case may be, a plug shall be inserted in the pipe. The disc in the pipe at the upper manhole shall be fitted with a filling pipe with a right-angled bend and an air cock.
- (ii) The pipeline shall then be filled with water by means of the pipe connection on the upper disc. The air cock on the upper disc shall be kept open while the pipeline is being filled to permit the escape of air.
- (iii) When the pipes are filled with water and air excluded, the air cock shall be shut and the water shall be poured into conical filler, attached to the filling pipe until the water remains in the filter.
- (iv) The filling pipe shall then be raised and fastened so that the height of surface of the water in the filler above the invert of the pipe is 1828 mm which will be usual test pressure for S.W pipes.
- (v) the water level does not fall more than 16mm (12mm) in a length of 91.4m the test may be considered satisfactory.

3.33.3 uPVC Pipes

- (i) Manufacturer's instruction should be followed in pipes to be used for water mains. Where specified, pipes shall have integral rubber ring joints and where solvent cement joints are specified, a sufficient number of expansion/contraction joints shall be incorporated in the length of mains to allow for variation of temperature to the recommendation of the pipe manufacturers.
- (ii) These pipes shall be effectively protected from the direct rays of sun immediately after they are laid and Final connection at a fixed point shall be deemed unto the majority of the length of the pipe line has been covered by backfill in order to reduce the effect of expansion and contraction caused by temperature variations.

3.33.4 Bends and other Specials: In fixing bends care shall be taken to see that the axis of the bend is truly vertical or horizontal as the case may be and the spigot of the bend is well in the socket of the pipe with which a joint has to be formed. The Concessionaire shall be called on to replace any faulty work at his own expense.

3.33.5 Flanged Joints: All flanged joints shall be made by painting the faces of the flanged with red lead freely and bolting the flanges evenly on all sides. A thin fiber of lead wool may be used in making the joints watertight when facing of the flanges is not true. Rubber insertions may be used with approval. Sewage resistant rubber insertion to be used for sewer lines.

3.33.6 Support for uPVC Pipes

- (i) When U.P.V.C pipe lines incorporate metal valves or other heavy fittings, it is essential to support the valves directly rather than allowing their weight to be carried by the uPVC pipe and support shall be placed on either side of the fittings mentioned above. Moulded plastic fitting also should be supported.
- (ii) Maximum allowable horizontal support distance for uPVC are given below.

Nominal bore	12 mm (1/2")	18 mm (3/8")	25 mm (1")	32 mm (1 1/4")	38 mm (1 1/2")	50 mm (2")
Support distance	533 mm (1'9")	616 mm (2'0")	686 mm (2'3")	764mm (2'6")	840 mm (2'9")	915 mm (3'0")
Nominal bore	75 mm (3")	100 mm (4")				
Support distance	1220 mm (4'0")	1290 mm (4'6")				

For vertical installation supports, distances shall be doubled.

3.33.7 Sewer pipes: All 'P', 'S', 'I' junctions bends etc. required shall be furnished and set without extra charge and shall confirm to the pipe specifications as to quality.

3.33.8 Air Valves: These valves to be fitted as per drawings and Bill of Quantities shall be tested and accompanied by a certifying their efficiency. The floating ball in the valve shall be suitable metal or vulcanite or rubber specially manufactured for tropical conditions.

3.33.9 Scour Washout Valve

- (i) These shall be provided at portions shown in place and shall contain in one unit a flanged scour valve with short connection pieces, cast iron bend and T pieces for connection to main pipe.

- (ii) The rate shall also provide for short length of straight pipe to a convenient as per details complete with covers and surface boxes
- 3.33.10 Foot valves and Strainers: Foot valve and strainers should be of reputable manufacture and shall be fitted with flushing lever attachment where specified.
- 3.33.11 Pressure Reducers: Pressure reducing valves shall be of the equilibrium type of approved manufacture and capable of reducing the pressure to the valve required as per plan
- 3.33.12 Water Meter: The water meters shall be from a reputed manufacture and shall be approved by the Authority before installation.
- 3.33.13 Equilibrium Ball Valves: These should be of reputable manufacture approved by the Authority and be of the angle pattern with gun metal valve seats guide bush, copper float with wrought iron lever and links with bronze pins.
- 3.33.14 Fittings
 - (a) All sanitary pipes, gullies, water closets/bidets, squatting basins, sinks bath tubs etc. to be of approved design and to be obtained from approved Manufacture and to be of the best stoneware, glazed inside and outside, with burnt hard and sound, free from flaws, blisters, cracks and other imperfections and best quality commonly called 'Firsts'.
 - (ii) All pipes, fittings, flushing cisterns, valves, stop cocks, taps, tanks, surface boxes etc. to be of the best of their kinds and in addition to complying with previous clauses to be from approved Manufacturers and all taps, cocks, valves etc. to be screwed down pipe. Taps to be of brass/nickel coated and valves to be of gun metal. All tanks to be made fly-proof and as per approved standard
- 3.33.15 Manholes, Manhole covers and Frames
 - (i) Concrete cover slabs or top rings of manholes shall provide a suitable seating for a rectangular cover.
 - (ii) The frame shall have a clear opening of 0.61m x 0.61m or alternatively a circular or double triangular cover depending on the type of cast iron manhole cover to be used. The rate for manholes shall allow for such provision.
 - (iii) Where the supply of cast iron manhole cover and frames is payable separately the cost of setting, surrounding, painting and materials for same shall be allowed for in the rate for manholes.
 - (iv) Suitable lifting rings, hooks or brackets shall be provided in the precast manhole sections. Box holes shall be separately grouted with 1:2 cement mortar.
 - (v) The Concessionaire shall supply two manhole keys for each pattern of cover without additional charge over the rate for covers (or manholes).
 - (vi) Heavy duty (Grade A) cast iron manhole cover and frames shall be of the double triangular type to bs and having a clear opening of 550mm dia.
 - (vii) Medium duty (Grade B) cast iron manhole covers and frames shall be of the circular type having a clear opening of 550mm dia or the rectangular type having a clear opening of 0.61m x 0.61m and conform to bs. They shall be of the single seal type, the weight of cover frame being approximately 127.00 kgs.
 - (viii) Light duty (Grade C) cast iron manhole cover and frames shall be of the double seal flat type having a clear opening of 0.61m x 0.61m conforming to bs. Weight of cover and frame approximately 50.75kgs.

- (ix) All manhole covers and frames shall be supplied, coated with a black bituminous composition and be given two coats of bituminous paint after bedding.
- (x) In drop manholes where the difference in level between the incoming drains and the sewer does not exceed 0.610m in 75mm and there is sufficient room in the manhole, the connecting pipe may be brought directly through the manhole wall, and the fall accommodated by constructing a ramp in the benching of the manhole. The ramp shall be of concrete and finished equal to that of the benches. No extra rate is payable.

3.32.19 **Interceptor Manhole:** All gravity sewer lines should be, connected through an intercepting inspection chamber before connecting to the main sewer line, and the dimensions of the manhole and trap to be in conformity with the Maldives Water and Sanitation Authority.

3.32.20 **Miscellaneous**

- (i) Throughout the construction period, open ends of all installed pipelines shall be kept closed by temporary plugs. Drainage lines shall not be used to conduct dirty construction wash-washer, especially, those with cement, to avoid possible clogging.
- (ii) A temporary fire protection system at each building shall be provided by the Concessionaire during the construction period. This shall be of sufficient capacity to put out any fire that may break out at any of the building floors due to construction period. This in addition to temporary fire extinguishers required.
- (iii) A temporary potable water supply shall be available to construction workers at each building floor as construction work progresses.
- (iv) A temporary human Excrete Disposal System shall be provided by the Concessionaire to serve the workers during the construction period.

3.34 **Waste disposal and Incineration**

- (i) Concessionaire shall also design appropriate method for solid removal in respect to different solid categories such as a clarification device place upstream of the biofilter to remove organically rich suspended solids.
- (ii) Concessionaire shall develop system for filtration and choose appropriate filters to remove or to separate materials like suspended solids, ammonia, chemicals, etc., from liquids or gases. Such as mechanical, biological and chemical filters
- (iii) Incinerator shall be installed by the Concessionaire for disposal of fallen stock in sustainable fashion. The requisite EC- No 142/2011 and pass international standards for Animal by-product regulations should be complied to.

3.35 **Height of Fixture Installation:** Height of fixture shall be as follows unless otherwise specified on the Drawings

Fixture	Particulars	Height (mm)
Wash Basin	Floor finish to front top edge - Male	700
	Floor finish to top of mirror - Male	1675
	- Female	1660
Lavatory	Floor finish to front top edge	760
Shelf	Floor finish to top of shelf - Male	1005
	- Female	990

Fixture	Particulars	Height (mm)
Cistern	Floor finish to bottom of cistern	
	Floor mounted Japanese type	500
	Western type	550
Drinking fountain	Floor to front top edge	765
Flush valve, WC	Floor to center of valve	600
Paper holder	Floor to center of holder - Japanese type	400
	- Western type	750
Faucets		
- Sink	Sink floor to top of faucet	300
- Lavatory	Lav. top to top of faucet	150
- Bathroom	Floor finish to top faucet	300

SCHEDULE-E

(See Clause 4.1.3 of Concession Agreement)

APPLICABLE PERMITS

1 Applicable Permits

- 1.1 The Concessionaire shall obtain, as required under the Applicable Laws, the following Applicable Permits on or before the Appointed Date, save and except to the extent of a waiver granted by the Authority in accordance with Clause 4.1.3 of the Agreement:
 - (a) Permission of the Government or Atoll Council for drawing water from the sea;
 - (b) Permission of Government for cutting of palm trees; and
 - (c) Any other permits or clearances required under Applicable Laws.
- 1.2 Applicable Permits, as required, relating to environmental protection and conservation shall have been procured by the Authority as a Condition Precedent. In the event, after reviewing the plans and designs proposed by the Concessionaire, if there is a need to revise the Environmental Impact Assessment Report and the Environmental Management Plan, and to procure a revised/renewed permit related to environmental protection and conservation from the relevant national regulator, the Authority shall procure such permits.

SCHEDULE-F

(See Clause 9.1 of Concession Agreement)

PERFORMANCE SECURITY

To

**Ministry of Fisheries, Marine Resources and Agriculture,
Republic of Maldives
Malé**

WHEREAS:

(A) (the “Concessionaire”) and the Ministry of Fisheries, Marine Resources and Agriculture (the “Authority”) have entered into a Concession Agreement dated(the “Agreement”) whereby the Authority has agreed to the Concessionaire undertaking to set up Multi-Species Hatchery and Allied Facilities on Design, Build, Finance, Operate, Maintain and Transfer (“DBFOT”) basis, subject to and in accordance with the provisions of the Agreement.

(B) The Agreement requires the Concessionaire to furnish a Performance Security to the Authority in a sum of Maldivian Rufiyaa 4.3 million (MVR four point three million only) or US\$ 280,000 (US dollar two hundred eighty thousand only), (the “Guarantee Amount”) as security for due and faithful performance of its obligations, under and in accordance with the Agreement, valid until one hundred eighty (180) days beyond the Concession Period (as defined in the Agreement).

(C) We, through our Branch at (the “Bank”) have agreed to furnish this Bank Guarantee by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Concessionaire’s obligations during the Concession Period, under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Concessionaire, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an Officer not below the rank of Project Director in the Ministry of Fisheries, Marine Resources and Agriculture, that the Concessionaire has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Concessionaire is in default in due and faithful performance of its obligations during the Construction Period under the Agreement and its decision that the Concessionaire is in default shall be final, and binding on the Bank, notwithstanding any differences between the Authority and the Concessionaire, or any dispute between them pending before any court,

tribunal, arbitrators or any other authority or body, or by the discharge of the Concessionaire for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Concessionaire and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Concessionaire before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/ or performance of all or any of the obligations of the Concessionaire contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Concessionaire, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Concessionaire or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfilment, compliance and/or performance of all or any of the obligations of the Concessionaire under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force until one hundred eighty (180) days beyond the Concession Period defined in the Agreement and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee, no later than 6 (six) months from the date of expiry of this Guarantee, all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred Branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This Guarantee shall come into force with immediate effect and shall remain in force and effect for a period of one hundred eighty (180) days beyond the Concession Period of

twenty one (21) years which period commences from the Appointed Date as defined in the Agreement, or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

11. This Guarantee shall also be operable at our _____ branch at Malé from whom, confirmation regarding the issue of this guarantee or extension/ renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed. The said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

12. This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

Signed and sealed this day of, 2020 at

SIGNED, SEALED AND DELIVERED

For and on behalf of the BANK by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.
- (ii) The address, telephone number and other details of the Head Office of the Bank as well as of issuing Branch should be mentioned on the covering letter of issuing Branch.

SCHEDULE-F (continued)

(See Clause 9.1 of Concession Agreement)

Environmental, Social, Health and Safety (ESHS) Performance Security

[Guarantor letterhead or SWIFT identifier code]

To

Ministry of Fisheries, Marine Resources and Agriculture,

Republic of Maldives

Malé

Date: _____ *[Insert date of issue]*

ESHS PERFORMANCE GUARANTEE No.: _____ *[Insert guarantee reference number]*

Guarantor: _____

[Insert name and address of place of issue, unless indicated in the letterhead]

1. We have been informed that _____ (hereinafter called “the Applicant”) has entered into Concession Agreement No. _____ dated _____ with the Beneficiary, for the execution of _____ (hereinafter called “the Contract”).
2. Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.
3. At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of sum of Maldivian Rufiyaa 1.1 million (MVR one point one million only) or US\$ 70,000 (US dollar seventy thousand only), upon receipt by us of the Beneficiary’s complying demand supported by the Beneficiary’s statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its Environmental, Social, Health and Safety (ESHS) obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.
4. This guarantee shall remain valid until one hundred eighty (180) days beyond the Concession Period (as defined in the Agreement), and any demand for payment under it must be received by us at this office on or before that date.

5. This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

SCHEDULE-F (continued)

(See Clause 9.1.3 of Concession Agreement)

ADDITIONAL PERFORMANCE SECURITY

To

Ministry of Fisheries, Marine Resources and Agriculture,

Republic of Maldives

Malé

WHEREAS:

(A) (the “Concessionaire”) and the Ministry of Fisheries, Marine Resources and Agriculture (the “Authority”) have entered into a Concession Agreement dated(the “Agreement”) whereby the Authority has agreed to the Concessionaire undertaking to set up Multi-Species Hatchery and Allied Facilities on Design, Build, Operate, Maintain and Transfer (“DBFOT”) basis, subject to and in accordance with the provisions of the Agreement.

(B) The Agreement requires the Concessionaire to furnish a Performance Security to the Authority in a sum of Maldivian Rufiyaa 10.8 million (MVR ten point eight million only) or US\$ 700,000 (US dollar seven hundred thousand only)², (the “Guarantee Amount”) as security for due and faithful performance of its obligations, under and in accordance with the Agreement, valid until 24 (twenty four) months beyond the Commercial Operation Date (as defined in the Agreement).

(C) We, through our Branch at (the “Bank”) have agreed to furnish this Bank Guarantee by way of Additional Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Concessionaire’s obligations, under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Concessionaire, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an Officer not below the rank of Project Director in the Ministry of Fisheries, Marine Resources and Agriculture, that the Concessionaire has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and

² NOTE: Replace the amounts by “amount equal to 20 (twenty) percent of the Grant amount, in the event such amount is less than Maldivian Rufiyaa 10.8 million (MVR ten point eight million) or US\$ 700,000 (US dollar seven hundred thousand).

binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Concessionaire is in default in due and faithful performance of its obligations during the Construction Period under the Agreement and its decision that the Concessionaire is in default shall be final, and binding on the Bank, notwithstanding any differences between the Authority and the Concessionaire, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Concessionaire for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Concessionaire and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Concessionaire before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/ or performance of all or any of the obligations of the Concessionaire contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Concessionaire, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Concessionaire or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfilment, compliance and/or performance of all or any of the obligations of the Concessionaire under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force until 24 (twenty four) months beyond the Commercial Operation Date defined in the Agreement and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee, no later than 30 (thirty) days from the date of expiry of this Guarantee, all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred Branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due

course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This Guarantee shall come into force with immediate effect and shall remain in force and effect for a period of 24 (twenty four) months beyond the Commercial Operation Date as defined in the Agreement, or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

11. This Guarantee shall also be operable at our _____branch at Malé, from whom, confirmation regarding the issue of this guarantee or extension/ renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed. The said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

12. This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

Signed and sealed this day of, 2020 at

SIGNED, SEALED AND DELIVERED

For and on behalf of the BANK by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.
- (j) The address, telephone number and other details of the Head Office of the Bank as well as of issuing Branch should be mentioned on the covering letter of issuing Branch.

SCHEDULE-G

(See Clause 14.1.2 of Concession Agreement)

TESTS

1 Schedule for Tests

- 1.1 The Concessionaire shall, no later than 30 (thirty) days prior to the likely completion of construction of the multispecies hatchery, notify the Independent Engineer and the Authority of its intent to subject the Hatchery and its allied components to Tests, and no later than 7 (seven) days prior to the actual date of Tests, furnish to the Independent Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of the Hatchery.

The concessionaire shall, no later than 7 (seven) days prior to the general tests during the construction phase of the project, shall notify the Independent Engineer and the Authority of its intent to subject the construction components to tests, with particulars of all testing to be conducted

- 1.2 The Concessionaire shall notify the Independent Engineer of its readiness to subject the works, installations and equipment to Tests at any time after 7 (seven) days from the date of such notice, and upon receipt of such notice, the Independent Engineer shall, in consultation with the Concessionaire, determine the date and time for each Test and notify the same to the Authority who may designate its representative to witness the Tests. The Independent Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 14 and the Schedule-G.

2 Tests

- 2.1 The Concessionaire, or the assigned sub-contractor shall conduct tests for quality control toward ensuring that the construction meets all standards outlined in the technical specifications produced by the Concessionaire and approved by the Authority at the design stage.
- 2.2 The Concessionaire, or the assigned sub-contractor shall verify that the required water flow rates in accordance with calculations provided at the design stage. This includes influent water flow as well as effluent.
- 2.3 The concessionaire, or the assigned sub-contractor shall verify that water and air circulation achieve the adequate mixing and does not create dead spots.
- 2.4 The Concessionaire, or the assigned sub-contractor shall verify the aeration systems meet the required aeration levels in accordance with calculations provided during the design phase.
- 2.5 The Concessionaire, or the assigned sub-contractor shall verify that all components of the water filtration systems are operational.
- 2.6 The Concessionaire, or its assigned sub-contractor shall verify that the water sterilization systems meet the sterilization standards.
- 2.7 The Concessionaire, or its assigned sub-contractor shall verify that all electrical items including sockets are operational.

3 Agency for conducting Tests

All Tests set forth in this Schedule-G shall be conducted by the Engineer or such other agency or person as the Engineer may specify in consultation with the Authority.

4 Completion/Provisional Certificate

Upon successful completion of Tests, the Engineer shall issue the Completion Certificate or the Provisional Certificate, as the case may be, in accordance with the provisions of Article 14.

SCHEDULE-H

(See Clauses 14.2 of Concession Agreement)

COMPLETION CERTIFICATE

1 I, (Name of the Independent Engineer), acting as Independent Engineer, under and in accordance with the Concession Agreement dated (the “Agreement”), for establishing Multi-Species Hatchery and Allied Facilities (the “Project”) on design, build, finance, operate, maintain and transfer (DBFOT) basis, through (Name of Concessionaire), hereby certify that the Tests specified in Article 14 and Schedule-G of the Agreement have been successfully undertaken to determine compliance of the Project with the provisions of the Agreement, and I am satisfied that the Project can be safely and reliably placed in commercial service.

2 It is certified that, in terms of the aforesaid Agreement, all works forming part of Multi-Species Hatchery and Allied Facilities have been completed, and the Project is hereby declared fit for entry into commercial operation on this the day of 20.....

SIGNED, SEALED AND DELIVERED

For and on behalf of
the ENGINEER by:

(Signature)

(Name)

(Designation)

(Address)

SCHEDULE-I

(See Clause 20.1 of Concession Agreement)

SELECTION OF INDEPENDENT ENGINEER

1 Selection of Independent Engineer

- 1.1 The World Bank's Standard Procurement Document (Standard RFP) will be used for inviting Proposals for Consulting Services from short-listed Consultants, following the procedure laid down in the Bank's Procurement Regulations for IPF Borrowers, July 2016, Revised November 2017 and August 2018.
- 1.2 The Authority shall invite expressions of interest from consulting firms to undertake and perform the duties and functions set forth in Schedule-J and prepare a shortlist of five to eight qualified firms in accordance with pre-determined criteria.
- 1.3 The Authority shall invite the aforesaid short-listed firms to submit their respective technical and financial offers, each in a separate sealed cover.
- 1.4 The Authority shall follow the selection process specified in the Standard RFP and Procurement Regulations for selection of the Consultant.

2 Fee and expenses

- 2.1 In determining the nature and quantum of duties and services to be performed by the Independent Engineer during the Concession Period, the Authority shall endeavour that payments to the Independent Engineer on account of fee and expenses do not exceed 2% (two per cent) of the Total Project Cost. Payments not exceeding such 2% (two per cent) shall be borne equally by the Authority and the Concessionaire in accordance with the provisions of this Agreement and any payments in excess thereof shall be borne entirely by the Authority.
- 2.2 The nature and quantum of duties and services to be performed by the Independent Engineer during the Operation Period shall be determined by the Authority in conformity with the provisions of this Agreement and with due regard for economy in expenditure. All payments made to the Independent Engineer on account of fee and expenses during the Operation Period, shall be borne equally by the Authority and the Concessionaire.

3 Constitution of fresh panel

No later than 3 (three) years from the date of this Agreement, and every 3 (three) years thereafter, the Authority shall prepare a fresh panel of firms in accordance with the criteria set forth in this Schedule-I; provided that the Authority may, at any time, prepare a fresh panel with prior written consent of the Concessionaire.

4 Appointment of government entity as Independent Engineer

Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Independent Engineer; provided that such entity shall be a body corporate having as one of its primary function the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government-owned entity which is owned or controlled by the Authority shall not be eligible for appointment as Independent Engineer.

SCHEDULE-J

(See Clause 20.2 of Concession Agreement)

TERMS OF REFERENCE FOR INDEPENDENT ENGINEER

1 Scope

- 1.1 These Terms of Reference for the Independent Engineer (the “TOR”) are being specified pursuant to the Concession Agreement dated (the “Agreement”), which has been entered into between the Authority and (the “Concessionaire”) for on the design, build, finance, operate, maintain and transfer (DBFOT) of a multispecies hatchery facility to be established in the Island of *Maanagala, Gaafu Alif* Atoll, Republic of Maldives.
- 1.2 This TOR shall apply to construction, operation and maintenance of the Multispecies Hatchery and associated facilities to be established in the Island of *Maanagala, Gaafu Alif* Atoll, Republic of Maldives.

2 Definitions and interpretation

- 2.1 The words and expressions beginning with or in capital letters used in this TOR and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.
- 2.2 References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.
- 2.3 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, *mutatis mutandis*, to this TOR.

3 Role and functions of the Independent Engineer

- 3.1 The role and functions of the Independent Engineer shall include the following:
- (i) review of the Drawings and Documents as set forth in Paragraph 4;
 - (ii) review, inspection and monitoring of Construction Works as set forth in Paragraph 5;
 - (iii) conducting Tests on completion of construction and issuing Completion as set forth in Paragraph 5;
 - (iv) review, inspection and monitoring of O&M as set forth in Paragraph 6;
 - (v) review, inspection and monitoring of Divestment Requirements as set forth in Paragraph 7;
 - (vi) determining, as required under the Agreement, the costs of any works or services and/or their reasonableness;
 - (vii) determining, as required under the Agreement, the period or any extension thereof, for performing any duty or obligation;
 - (viii) assisting the Parties in resolution of disputes as set forth in Paragraph 9; and
 - (ix) undertaking all other duties and functions in accordance with the Agreement.

- 3.2 The Independent Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

4 Services of the Independent Engineer during the Design Period

- 4.1 During the Design Period, the Independent Engineer shall undertake a detailed review of the Design Package including Site Plan, Designs, Design Calculations and Drawings to be furnished by the Concessionaire along with supporting data, including the geo-technical investigation data; standards and specifications for works, installations and equipment. The Independent Engineer shall complete such review and send its comments/observations to the Authority and the Concessionaire within 15 (fifteen) days of receipt of such Design Package. In particular, such comments shall specify the conformity or otherwise of such Drawings with the Scope of the Project and Specifications and Standards.
- 4.2 The Independent Engineer shall review any modified Design package or part thereof sent to it by the Concessionaire and furnish its comments within 7 (seven) days of receiving such Drawings or Documents.

5 Services of the Independent Engineer during the Construction Period

- 5.1 In respect of the Drawings, Documents and Safety Report received by the Independent Engineer for its review and comments during the Construction Period, the provisions of Paragraph 4 shall apply, mutatis mutandis.
- 5.2 The Independent Engineer shall review the monthly progress report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report.
- 5.3 The Independent Engineer shall inspect the Construction Works and the Site once every month, preferably after receipt of the monthly progress report from the Concessionaire, but before the 20th (twentieth) day of each month in any case, and make out a report of such inspection (the "Inspection Report") setting forth an overview of the status, progress, quality and safety of construction, including the work methodology adopted, the materials used and their sources, and conformity of the Works with the Scope of the Project and the Specifications and Standards. In a separate section of the Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in the construction of the multispecies hatchery. The Inspection Report shall also contain a review of the maintenance of the existing Ancillary Facilities in conformity with the provisions of the Agreement. The Independent Engineer shall send a copy of its Inspection Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.
- 5.4 The Independent Engineer may inspect the Site including all ongoing or completed works, installations and equipment more than once in a month if any lapses, defects or deficiencies require such inspections.
- 5.5 For determining that the Construction Works conform to Specifications and Standards, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests on a sample basis, to be specified by the Independent Engineer in accordance with Good Industry Practice for quality assurance. For purposes of this Paragraph 5.5, the tests specified in the national construction codes of Maldives or as may be applicable, the codes, standards and specifications for installation of all parts of the multispecies hatchery and associated facilities from countries in Europe or North America as proposed by the Concessionaire at the Design stage (together called the "Quality Control Manuals") or any

modification/substitution thereof shall be deemed to be tests conforming to Good Industry Practice for quality assurance. The Independent Engineer shall issue necessary directions to the Concessionaire for ensuring that the tests are conducted in a fair and efficient manner and shall monitor and review the results thereof.

- 5.6 The sample size of the tests, to be specified by the Independent Engineer under Paragraph 5.5, shall comprise 10% (ten per cent) of the quantity or number of tests prescribed for each category or type of tests in the Quality Control Manuals; provided that the Independent Engineer may, for reasons to be recorded in writing, increase the aforesaid sample size by up to 10% (ten per cent) for certain categories or types of tests.
- 5.7 The timing of tests referred to in Paragraph 5.5, and the criteria for acceptance/ rejection of their results shall be determined by the Independent Engineer in accordance with the Quality Control Manuals. The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Concessionaire for its own quality assurance in accordance with Good Industry Practice.
- 5.8 In the event that the Concessionaire carries out any remedial works for removal or rectification of any defects or deficiencies, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests to determine that such remedial works have brought the Works, Installations and Equipment into conformity with the Specifications and Standards, and the provisions of this Paragraph 5 shall apply to such tests.
- 5.9 In the event that the Concessionaire fails to achieve any of the Project Milestones, the Independent Engineer shall undertake a review of the progress of construction and installation and identify potential delays, if any. If the Independent Engineer shall determine that completion of the Multispecies Hatchery and associated facilities as per the Agreement is not feasible within the time specified in the Agreement, it shall require the Concessionaire to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which the Completion Date for “Design-Build” stage shall be achieved. Upon receipt of a report from the Concessionaire, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire forthwith.
- 5.10 If at any time during the Construction Period, the Independent Engineer determines that the Concessionaire has not made adequate arrangements for the safety of workers or that any work is being carried out in a manner that threatens the safety of the workers, it shall make a recommendation to the Authority forthwith, identifying the whole or part of the Construction Works and/or Installations that should be suspended for ensuring safety in respect thereof.
- 5.11 In the event that the Concessionaire carries out any remedial measures to secure the safety of suspended works and Users, it may, by notice in writing, require the Independent Engineer to inspect such works or installations, and within 3 (three) days of receiving such notice, the Independent Engineer shall inspect the suspended works and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.
- 5.12 If suspension of Construction Works or Installations is for reasons not attributable to the Concessionaire, the Independent Engineer shall determine the extension of dates set forth in the Project Completion Schedule, to which the Concessionaire is reasonably entitled, and shall notify the Authority and the Concessionaire of the same.
- 5.13 The Independent Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-G and issue a Completion Certificate or Provisional Certificate, as the case

may be. For carrying out its functions under this Paragraph 5.13 and all matters incidental thereto, the Independent Engineer shall act under and in accordance with the provisions of Article 14 and Schedule-G.

- 5.14 The Independent Engineer shall aid and advise the Concessionaire in preparing the Maintenance Manual.

6 Services of the Independent Engineer during the Operation Period

- 6.1 In respect of the Drawings, Documents and Safety Report received by the Independent Engineer for its review and comments during the Operation Period, the provisions of Paragraph 4 shall apply, *mutatis mutandis*.
- 6.2 The Independent Engineer shall review the annual Maintenance Programme furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 15 (fifteen) days of receipt of the Maintenance Programme.
- 6.3 The Independent Engineer shall review the monthly status report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report.
- 6.4 The Independent Engineer shall inspect the Site including the works, installations and equipment once every quarter, preferably after receipt of the quarterly status report from the Concessionaire, but before the 20th (twentieth) day of each quarter in any case, and make out an O&M Inspection Report setting forth an overview of the status, quality and safety of O&M including its conformity with the Maintenance Requirements and Safety Requirements. In a separate section of the O&M Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in O&M of the entire set of buildings, works, installations and equipment including the Ancillary Facilities handed over by the Authority. The Independent Engineer shall send a copy of its O&M Inspection Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.
- 6.5 The Independent Engineer may inspect the Multispecies Hatchery Project more than once in a quarter, if any lapses, defects or deficiencies require such inspections.
- 6.6 The Independent Engineer shall in its O&M Inspection Report specify the tests, if any, that the Concessionaire shall carry out, or cause to be carried out, for the purpose of determining that the entire Multispecies Hatchery including associated and Ancillary Facilities is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Concessionaire in this behalf.
- 6.7 In respect of any defect or deficiency observed, the Independent Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.
- 6.8 The Independent Engineer shall determine if any delay has occurred in completion of repair or remedial works in accordance with the Agreement, and shall also determine the Damages, if any, payable by the Concessionaire to the Authority for such delay.
- 6.9 The Independent Engineer shall obtain or cause to be obtained from the Concessionaire, details of production as may be necessary to evaluate the Concessionaire's performance during the Operational Phase and provide advice to the Concessionaire on improving the hatchery operation.

- 6.10 In the event that the Concessionaire proposes to start breeding additional species, the Independent Engineer shall, in communication with the Authority shall evaluate such proposals on the technical and economic viability of such efforts and advise the Concessionaire of the result of the evaluation. The Independent Engineer shall obtain or cause to be obtained all relevant documentation from the Concessionaire, as may be required for such evaluations.
- 6.11 In the event that the Concessionaire notifies the Independent Engineer of any modifications that it proposes to make to the Multispecies Hatchery including associated and Ancillary Facilities, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire within 15 (fifteen) days of receiving the proposal.
- 6.12 The Independent Engineer shall undertake conduct any sampling as and when required by the Authority to ensure environmental compliance with project operation.

7 Services of the Independent Engineer in the event of Termination of Concession Agreement

- 7.1 At any time, not earlier than 90 (ninety) days prior to Termination but not later than 15 (fifteen) days prior to such Termination, the Independent Engineer shall, in the presence of a representative of the Concessionaire, inspect the Site, works, installations and equipment of Multispecies Hatchery for determining compliance by the Concessionaire with the Divestment Requirements set forth in Clause 38.1 and, if required, cause tests to be carried out at the Concessionaire's cost for determining such compliance. If the Independent Engineer determines that the status of the Multispecies Hatchery including associated and Ancillary Facilities is such that its repair and rectification would require a larger amount than the sum set forth in Clause 39.2, it shall recommend retention of the required amount in the Escrow Account and the period of retention thereof.
- 7.2 The Independent Engineer shall inspect the Multispecies Hatchery including associated and Ancillary Facilities once in every 15 (fifteen) days during a period of 90 (ninety) days after Termination for determining the liability of the Concessionaire under Article 39, in respect of the defects or deficiencies specified therein. If any such defect or deficiency is found by the Independent Engineer, it shall make a report in reasonable detail and send it forthwith to the Authority and the Concessionaire.

8 Determination of time

- 8.1 The Independent Engineer shall determine the period, or any extension thereof, that is required to be determined by it under the Agreement.

9 Assistance in Dispute resolution

- 9.1 When called upon by either Party in the event of any Dispute, the Independent Engineer shall mediate and assist the Parties in arriving at an amicable settlement.
- 9.2 In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the Agreement, the Independent Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

10 Other duties and functions of Independent Engineer

The Independent Engineer shall perform all other duties and functions specified in the Agreement.

11 Confidentiality of Information

- 11.1 The Independent Engineer including its employees, contractors, consultants and agents, shall hold in confidence all documents and other information whether technical or commercial supplied to it by or on behalf of the Authority or the Concessionaire relating to their services or obtained otherwise and shall not publish or otherwise disclose or use the same for unless agreed in writing by both Authority and the Concessionaire. This shall not apply to information:
- (a) already in the public domain otherwise than by breach of this Agreement; or,
 - (b) obtained from a third party who is free to divulge the same and which was not obtained under any obligation of confidentiality.
- 11.2 The above obligations shall survive even after the termination or expiration of this Agreement.

12 Miscellaneous

- 12.1 The Independent Engineer shall notify its programme of inspection to the Authority and to the Concessionaire, who may, in their discretion, depute their respective representatives to be present during the inspection.
- 12.2 A copy of all communications, comments, instructions, Drawings or Documents sent by the Independent Engineer to the Concessionaire pursuant to this TOR, and a copy of all the test results with comments of the Independent Engineer thereon shall be furnished by the Independent Engineer to the Authority forthwith.
- 12.3 The Independent Engineer shall obtain, and the Concessionaire shall furnish in two copies thereof, all communications and reports required to be submitted, under this Agreement, by the Concessionaire to the Independent Engineer, whereupon the Independent Engineer shall send one of the copies to the Authority along with its comments thereon.
- 12.4 The Independent Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody.
- 12.5 Upon completion of its assignment hereunder, the Independent Engineer shall duly classify and list all Drawings, Documents, results of tests and other relevant records, and hand them over to the Authority or such other person as the Authority may specify and obtain written receipt thereof. Two copies of the said documents shall also be furnished in microfilm form or in such other medium as may be acceptable to the Authority.

SCHEDULE-K

(See Clause 25.2.1 of Concession Agreement)

PANEL OF CHARTERED ACCOUNTANTS

1 Panel of Chartered Accountants

Pursuant to the provisions of Clause 25.2.1 of the Agreement, the Authority and the Concessionaire shall prepare a mutually agreed panel an agreed number of reputable firms of auditors approved by the Maldives Inland Revenue Authority and having their registered offices in Maldives (the “Panel of Chartered Accountants”). The criteria for preparing such Panel and the procedure to be adopted in this behalf shall be as set forth in this Schedule-K.

2 Invitation for empanelment

2.1 The Authority shall invite offers from all reputable firms of Chartered Accountants who fulfil the following eligibility criteria, namely:

- (a) the firm should have valid registration with the Maldives Inland Revenue Authority.
- (b) the firm should have conducted statutory audit of the annual accounts of at least ten companies registered under the Companies Act of The Republic of Maldives, 1996;
- (b) the firm should have at least 3 (three) practising Chartered Accountants on its rolls, each with a minimum experience of five years in the profession;
- (c) the firm or any of its partners should not have been disqualified or black-listed by any Regulatory or the Government Agency; and
- (d) the firm should have an office in Maldives with at least 2 (two) practising Chartered Accountants on its rolls.

2.2 Interested firms meeting the eligibility criteria shall be required to submit a statement of their capability including the biodata of all the practising Chartered Accountants on its rolls. In particular, each firm shall be required to furnish year- wise information relating to the names of all the companies with an annual turnover exceeding US\$ 2 (two) million whose annual accounts were audited by such firm in any of the preceding 5 (five) Accounting Years.

3 Evaluation and selection

3.1 The information furnished by each firm shall be scrutinised and evaluated by the Authority and 1 (one) point shall be awarded for each annual audit of the companies specified in Paragraph 2.2 above. (For the avoidance of doubt, a firm which has conducted audit of the annual accounts of any such company for five years shall be awarded five points).

3.2 The Authority shall prepare a list of all the eligible firms along with the points scored by each such firm and agreed number of firms (minimum three) firms scoring the highest points shall be identified and included in the draft Panel of Chartered Accountants.

4 Consultation with the Concessionaire

The Authority shall convey the aforesaid panel of firms to the Concessionaire for scrutiny and comments, if any. The Concessionaire shall be entitled to scrutinise the relevant records of the Authority to ascertain whether the selection of firms has been undertaken in

accordance with the prescribed procedure and it shall send its comments, if any, to the Authority within 15 (fifteen) days of receiving the aforesaid panel.

5 Mutually agreed panel

- 5.1 The Authority shall, after considering all relevant factors including the comments, if any, of the Concessionaire, finalize and constitute a panel of 10 (ten) firms which shall be deemed to be the mutually agreed Panel of Chartered Accountants.
- 5.2 After completion of every five years from the date of preparing the mutually agreed Panel of Chartered Accountants, or such earlier period as may be agreed between the Authority and the Concessionaire, a new panel shall be prepared in accordance with the provisions of this Schedule-K.

SCHEDULE-L

(See Clause 30.4 of Concession Agreement)

VESTING CERTIFICATE

- 1 The Project Director of Ministry of Fisheries, Marine Resources and Agriculture (the “**Authority**”) refers to the Concession Agreement dated, 2020 (the “**Agreement**”) entered into between the Authority and (the “**Concessionaire**”) for establishing Multi-Species Hatchery and Allied Facilities (the “**Project**”) on design, build, finance, operate, maintain and transfer (“**DBFOT**”) basis.
- 2 The Authority hereby acknowledges compliance and fulfilment by the Concessionaire of the Divestment Requirements set forth in Clause 30.1 of the Agreement on the basis that upon issue of this Vesting Certificate, the Authority shall be deemed to have acquired, and all title and interest of the Concessionaire in or about the Project shall be deemed to have vested unto the Authority, free from any encumbrances, charges and liens whatsoever.
- 3 Notwithstanding anything to the contrary contained hereinabove, it shall be a condition of this Vesting Certificate that nothing contained herein shall be construed or interpreted as waiving the obligation of the Concessionaire to rectify and remedy any defect or deficiency in any of the Divestment Requirements and/or relieving the Concessionaire in any manner of the same.

Signed this day of, 20..... At Malé

AGREED, ACCEPTED AND SIGNED

For and
on behalf of
CONCESSIONAIRE

by:

(Signature)

(Name)

(Designation)

(Address)

SIGNED, SEALED AND

For and on behalf of Ministry of
Fisheries, Marine Resources and
Agriculture

by:

(Signature)

(Name)

(Designation)

(Address)

In the presence of:

1.

2.

SCHEDULE-M

(See Clause 32.3.1 of Concession Agreement)

SUBSTITUTION AGREEMENT

THIS SUBSTITUTION AGREEMENT is entered into on this the day of 20....

AMONGST

- 1 Ministry of Fisheries, Marine Resources and Agriculture, represented by its Project Director and having its principal offices at Malé (hereinafter referred to as the “Authority” which expression shall unless repugnant to the context or meaning thereof include its administrators, successors and assigns);
- 2 LIMITED, a company incorporated under the provisions of the Companies Act of The Republic of Maldives, 1996, and having its registered office at, (hereinafter referred to as the “**Concessionaire**” which expression shall unless repugnant to the context or meaning thereof include its successors and permitted assigns and substitutes);
- 3name and particulars of Lenders’ Representative and having its registered office at, acting for and on behalf of the Senior Lenders as their duly authorised agent with regard to matters arising out of or in relation to this Agreement (hereinafter referred to as the “**Lenders’ Representative**”, which expression shall unless repugnant to the context or meaning thereof include its successors and substitutes);

WHEREAS:

- (A) The Authority has entered into a Concession Agreement dated with the Concessionaire (the “**Concession Agreement**”) for establishing Multi-Species Hatchery and Allied Facilities (the “**Project**”) on design, build, finance, operate, maintain and transfer basis (DBFOT), and a copy of which is annexed hereto and marked as Annex-A to form part of this Agreement.
- (B) Senior Lenders have agreed to finance the Project in accordance with the terms and conditions set forth in the Financing Agreements.
- (C) Senior Lenders have requested the Authority to enter into this Substitution Agreement for securing their interests through assignment, transfer and substitution of the Concession to a Nominated Company in accordance with the provisions of this Agreement and the Concession Agreement.
- (D) In order to enable implementation of the Project including its financing, construction, operation and maintenance, the Authority has agreed and undertaken to transfer and assign the Concession to a Nominated Company in accordance with the terms and conditions set forth in this Agreement and the Concession Agreement.

NOW, THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

1 DEFINITIONS AND INTERPRETATION

1.1 Definitions

In this Substitution Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them:

“Agreement” means this Substitution Agreement and any amendment thereto made in accordance with the provisions contained in this Agreement;

“Financial Default” means occurrence of a material breach of the terms and conditions of the Financing Agreements or a continuous default in Debt Service by the Concessionaire for a minimum period of 3 (three) months;

“Lenders’ Representative” means the person referred to as the Lenders’ Representative in the foregoing Recitals;

“Nominated Company” means a company, incorporated under the provisions of the Companies Act of The Republic of Maldives, 1996, selected by the Lenders’ Representative, on behalf of Senior Lenders, and proposed to the Authority for assignment/transfer of the Concession as provided in this Agreement;

“Notice of Financial Default” shall have the meaning ascribed thereto in Clause 3.2.1; and

“Parties” means the parties to this Agreement collectively and “Party” shall mean any of the Parties to this Agreement individually.

1.2 Interpretation

1.2.1 References to Lenders’ Representative shall, unless repugnant to the context or meaning thereof, mean references to the Lenders’ Representative, acting for and on behalf of Senior Lenders.

1.2.2 References to Clauses are, unless stated otherwise, references to Clauses of this Agreement.

1.2.3 The words and expressions beginning with capital letters and defined in this Agreement shall have the meaning ascribed thereto herein, and the words and expressions used in this Agreement and not defined herein but defined in the Concession Agreement shall, unless repugnant to the context, have the meaning ascribed thereto in the Concession Agreement.

1.2.4 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Concession Agreement shall apply, *mutatis mutandis*, to this Agreement.

2 ASSIGNMENT

2.1 Assignment of rights and title

The Concessionaire hereby agrees to assign the rights, title and interest in the Concession to, and in favour of, the Lenders’ Representative pursuant to and in accordance with the provisions of this Agreement and the Concession Agreement by way of security in respect of financing by the Senior Lenders under the Financing Agreements.

3 SUBSTITUTION OF THE CONCESSIONAIRE

3.1 Rights of substitution

3.1.1 Pursuant to the rights, title and interest assigned under Clause 2.1, the Lenders’ Representative shall be entitled to substitute the Concessionaire by a Nominated Company

under and in accordance with the provisions of this Agreement and the Concession Agreement.

- 3.1.2 The Authority hereby agrees to substitute the Concessionaire by endorsement on the Concession Agreement in favour of the Nominated Company selected by the Lenders' Representative in accordance with this Agreement. (For the avoidance of doubt, the Senior Lenders or the Lenders' Representative shall not be entitled to operate and maintain the Project as Concessionaire either individually or collectively).

3.2 Substitution upon occurrence of Financial Default

- 3.2.1 Upon occurrence of a Financial Default, the Lenders' Representative may issue a notice to the Concessionaire (the "**Notice of Financial Default**") along with particulars thereof and send a copy to the Authority for its information and record. A Notice of Financial Default under this Clause 3 shall be conclusive evidence of such Financial Default and it shall be final and binding upon the Concessionaire for the purposes of this Agreement.
- 3.2.2 Upon issue of a Notice of Financial Default hereunder, the Lenders' Representative may, without prejudice to any of its rights or remedies under this Agreement or the Financing Agreements, substitute the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement.
- 3.2.3 At any time after the Lenders' Representative has issued a Notice of Financial Default, it may by notice require the Authority to suspend all the rights of the Concessionaire and undertake the operation and maintenance of the Project in accordance with the provisions of Article 28 of the Concession Agreement, and upon receipt of such notice, the Authority shall undertake Suspension under and in accordance with the provisions of the Concession Agreement. The aforesaid Suspension shall be revoked upon substitution of the Concessionaire by a Nominated Company, and in the event such substitution is not completed within 180 (one hundred and eighty) days from the date of such Suspension, the Authority may terminate the Concession Agreement forthwith by issuing a Termination Notice in accordance with the provisions of the Concession Agreement; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority may extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days. For the avoidance of doubt, the Authority expressly agrees and undertakes to terminate the Concession Agreement forthwith, upon receipt of a written request from the Lenders' Representative at any time after 240 (two hundred and forty) days from the date of Suspension hereunder.

3.3 Substitution upon occurrence of Concessionaire Default

- 3.3.1 Upon occurrence of a Concessionaire Default, the Authority shall by a notice inform the Lenders' Representative of its intention to issue a Termination Notice and grant 15 (fifteen) days' time to the Lenders' Representative to make a representation, stating the intention to substitute the Concessionaire by a Nominated Company.
- 3.3.2 In the event that the Lenders' Representative makes a representation to the Authority within the period of 15 (fifteen) days specified in Clause 3.3.1, stating that it intends to substitute the Concessionaire by a Nominated Company, the Lenders' Representative shall be entitled to undertake and complete the substitution of the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement within a period of 180 (one hundred and eighty) days from the date of such representation, and the Authority shall either withhold Termination or undertake Suspension for the aforesaid period of 180 (one hundred and eighty) days; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority shall extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days.

3.4 **Procedure for substitution**

- 3.4.1 The Authority and the Concessionaire hereby agree that on or after the date of Notice of Financial Default or the date of representation to the Authority under Clause 3.3.2, as the case may be, the Lenders' Representative may, without prejudice to any of the other rights or remedies of the Senior Lenders, invite, negotiate and procure offers, either by private negotiations or public auction or tenders for the take over and transfer of the Project Highway including the Concession to the Nominated Company upon such Nominated Company's assumption of the liabilities and obligations of the Concessionaire towards the Authority under the Concession Agreement and towards the Senior Lenders under the Financing Agreements.
- 3.4.2 To be eligible for substitution in place of the Concessionaire, the Nominated Company shall be required to fulfil the eligibility criteria that were laid down by the Authority for shortlisting the Proposers for award of the Concession; provided that the Lenders' Representative may represent to the Authority that all or any of such criteria may be waived in the interest of the Project, and if the Authority determines that such waiver shall not have any material adverse effect on the Project, it may waive all or any of such eligibility criteria.
- 3.4.3 Upon selection of a Nominated Company, the Lenders' Representative shall request the Authority to:
- (a) accede to transfer to the Nominated Company the right to construct, operate and maintain the Project Highway in accordance with the provisions of the Concession Agreement;
 - (b) endorse and transfer the Concession to the Nominated Company, on the same terms and conditions, for the residual Concession Period; and
 - (c) enter into a Substitution Agreement with the Lenders' Representative and the Nominated Company on the same terms as are contained in this Agreement.
- 3.4.4 If the Authority has any objection to the transfer of Concession in favour of the Nominated Company in accordance with this Agreement, it shall within 15 (fifteen) days from the date of proposal made by the Lenders' Representative, give a reasoned order after hearing the Lenders' Representative. If no such objection is raised by the Authority, the Nominated Company shall be deemed to have been accepted. The Authority thereupon shall transfer and endorse the Concession within 15 (fifteen) days of its acceptance/deemed acceptance of the Nominated Company; provided that in the event of such objection by the Authority, the Lenders' Representative may propose another Nominated Company whereupon the procedure set forth in this Clause 3.4 shall be followed for substitution of such Nominated Company in place of the Concessionaire.

3.5 **Selection to be binding**

The decision of the Lenders' Representative and the Authority in selection of the Nominated Company shall be final and binding on the Concessionaire. The Concessionaire irrevocably agrees and waives any right to challenge the actions of the Lenders' Representative or the Senior Lenders or the Authority taken pursuant to this Agreement including the transfer/assignment of the Concession in favour of the Nominated Company. The Concessionaire agrees and confirms that it shall not have any right to seek revaluation of assets of the Project or the Concessionaire's shares. It is hereby acknowledged by the Parties that the rights of the Lenders' Representative are irrevocable and shall not be contested in any proceedings before any court or Authority and the Concessionaire shall have no right or remedy to prevent, obstruct or restrain the Authority or the Lenders'

Representative from effecting or causing the transfer by substitution and endorsement of the Concession as requested by the Lenders' Representative.

4 PROJECT AGREEMENTS

4.1 Substitution of Nominated Company in Project Agreements

The Concessionaire shall ensure and procure that each Project Agreement contains provisions that entitle the Nominated Company to step into such Project Agreement, in its discretion, in place and substitution of the Concessionaire in the event of such Nominated Company's assumption of the liabilities and obligations of the Concessionaire under the Concession Agreement.

5 TERMINATION OF CONCESSION AGREEMENT

5.1 Termination upon occurrence of Financial Default

At any time after issue of a Notice of Financial Default, the Lenders' Representative may by a notice in writing require the Authority to terminate the Concession Agreement forthwith, and upon receipt of such notice, the Authority shall undertake Termination under and in accordance with the provisions of Article 37 of the Concession Agreement.

5.2 Termination when no Nominated Company is selected

In the event that no Nominated Company acceptable to the Authority is selected and recommended by the Lenders' Representative within the period of 180 (one hundred and eighty) days or any extension thereof as set forth in Clause 3.3.2, the Authority may terminate the Concession Agreement forthwith in accordance with the provisions thereof.

5.3 Realisation of Debt Due

The Authority and the Concessionaire hereby acknowledge and agree that, without prejudice to their any other right or remedy, the Lenders' Representative is entitled to receive from the Concessionaire, without any further reference to or consent of the Concessionaire, the Debt Due upon Termination of the Concession Agreement. For realisation of the Debt Due, the Lenders' Representative shall be entitled to make its claim from the Escrow Account in accordance with the provisions of the Concession Agreement and the Escrow Agreement.

6 DURATION OF THE AGREEMENT

6.1 Duration of the Agreement

This Agreement shall come into force from the date hereof and shall expire at the earliest to occur of the following events:

- (a) Termination of the Agreement; or
- (b) no sum remains to be advanced, or is outstanding to the Senior Lenders, under the Financing Agreements.

7 INDEMNITY

7.1 General indemnity

- 7.1.1 The Concessionaire will indemnify, defend and hold the Authority and the Lenders' Representative harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense of whatever kind and nature arising out of any breach by the Concessionaire of any of its obligations under this Agreement or on account of failure of the Concessionaire to comply with Applicable Laws and Applicable Permits.

- 7.1.2 The Authority will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Authority to fulfil any of its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement or this Agreement, other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Authority, its officers, servants and agents.
- 7.1.3 The Lenders' Representative will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Lenders' Representative to fulfil its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement, other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Lenders' Representative, its officers, servants and agents.

7.2 **Notice and contest of claims**

In the event that any Party hereto receives a claim from a third party in respect of which it is entitled to the benefit of an indemnity under Clause 7.1 or in respect of which it is entitled to reimbursement (the "**Indemnified Party**"), it shall notify the other Party responsible for indemnifying such claim hereunder (the "**Indemnifying Party**") within 15 (fifteen) days of receipt of the claim and shall not settle or pay the claim without the prior approval of the Indemnifying Party, such approval not to be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim, it may conduct the proceedings in the name of the Indemnified Party and shall bear all costs involved in contesting the same. The Indemnified Party shall provide all cooperation and assistance in contesting any claim and shall sign all such writings and documents as the Indemnifying Party may reasonably require.

8 DISPUTE RESOLUTION

8.1 **Dispute resolution**

- 8.1.1 Any dispute, difference or claim arising out of or in connection with this Agreement which is not resolved amicably shall be decided by reference to arbitration to a Board of Arbitrators comprising one nominee each of the Authority, Concessionaire and the Lenders' Representative. Such arbitration shall be held in accordance with the United Nations Commission on International Trade Law (UNCITRAL) Arbitration Rules as at present in force.
- 8.1.2 The Arbitrators shall issue a reasoned award and such award shall be final and binding on the Parties. The venue of arbitration shall be Delhi and the language of arbitration shall be English.

9 MISCELLANEOUS PROVISIONS

9.1 **Governing law and jurisdiction**

This Agreement shall be construed and interpreted in accordance with and governed by the laws of the Republic of Maldives, and the Courts at Male shall have jurisdiction over all matters arising out of or relating to this Agreement.

9.2 **Waiver of sovereign immunity**

The Authority unconditionally and irrevocably:

- (a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;
- (b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Authority with respect to its assets;
- (c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and
- (d) consents generally in respect of the enforcement of any judgement or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgement that may be made or given in connection therewith).

9.3 **Priority of agreements**

In the event of any conflict between the Concession Agreement and this Agreement, the provisions contained in the Concession Agreement shall prevail over this Agreement.

9.4 **Alteration of terms**

All additions, amendments, modifications and variations to this Agreement shall be effectual and binding only if in writing and signed by the duly authorised representatives of the Parties.

9.5 **Waiver**

9.5.1 **Waiver by any Party of a default by another Party in the observance and performance of any provision of or obligations under this Agreement:**

- (a) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;
- (b) shall not be effective unless it is in writing and executed by a duly authorised representative of the Party; and
- (c) shall not affect the validity or enforceability of this Agreement in any manner.

9.5.2 **Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by a Party to another Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.**

9.6 **No third-party beneficiaries**

This Agreement is solely for the benefit of the Parties and no other person or entity shall have any rights hereunder.

9.7 **Survival**

9.7.1 **Termination of this Agreement:**

- (a) shall not relieve the Parties of any obligations hereunder which expressly or by implication survive termination hereof; and

(b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

9.7.2 All obligations surviving the cancellation, expiration or termination of this Agreement shall only survive for a period of 3 (three) years following the date of such termination or expiry of this Agreement.

9.8 **Severability**

If for any reason whatever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to dispute resolution under Clause 8 of this Agreement or otherwise.

9.9 **Successors and assigns**

This Agreement shall be binding on and shall inure to the benefit of the Parties and their respective successors and permitted assigns.

9.10 **Notices**

All notices or other communications to be given or made under this Agreement shall be in writing, shall either be delivered personally or sent by courier or registered post with an additional copy to be sent by facsimile or e-mail. The address for service of each Party, its facsimile number and e-mail address are set out under its name on the signing pages hereto. A notice shall be effective upon actual receipt thereof, save that where it is received after 5.30 (five thirty) p.m. on any day, or on a day that is a public holiday, the notice shall be deemed to be received on the first working day following the date of actual receipt. Without prejudice to the foregoing, a Party giving or making a notice or communication by facsimile or e-mail shall promptly deliver a copy thereof personally or send it by courier or registered post to the addressee of such notice or communication. It is hereby agreed and acknowledged that any Party may by notice change the address to which such notices and communications to it are to be delivered or mailed. Such change shall be effective when all the Parties have notice of it.

9.11 **Language**

All notices, certificates, correspondence and proceedings under or in connection with this Agreement shall be in English.

9.12 **Authorised representatives**

Each of the Parties shall by notice in writing designate their respective authorised representatives through whom only all communications shall be made. A Party hereto shall be entitled to remove and/or substitute or make fresh appointment of such authorised representative by similar notice.

9.13 **Original Document**

This Agreement may be executed in three counterparts, each of which when executed and delivered shall constitute an original of this Agreement.

IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

THE COMMON SEAL OF CONCESSIONAIRE has been affixed pursuant to the resolution passed by the Board of Directors of the Concessionaire at its meeting held on the day of 20..... hereunto affixed in the presence of, Director, who has signed these presents in token thereof and, Company Secretary / Authorised Officer who

SIGNED, SEALED
AND DELIVERED

For and on behalf of

MINISTRY OF FISHERIES, MARINE
RESOURCES & AGRICULTURE by:

(Signature)

(Name)

(Designation)

(Address)

SIGNED, SEALED AND
DELIVERED

For and on behalf of

SENIOR LENDERS by the Lenders' Representative:

(Signature)

(Name)

(Designation)

(Address)

(Fax)

(e-mail address)

In the presence of:

1.

2.

^{\$} To be affixed in accordance with the articles of association of the Concessionaire.