No.

MINISTRY OF NATURAL
RESOURCES DEVELOPMENT
REPUBLIC OF KIRIBATI

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR
INTEGRATION OF FISHERIES
FOUNDATION
IN THE REPUBLIC OF KIRIBATI

JANUARY 2000

JAPAN INTERNATIONAL COOPERATION AGENCY
CRC OVERSEAS COOPERATION Inc.

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PREFACE

In response to a request from the Government of the Republic of Kiribati the Government of Japan decided to conduct a basic design study on the Project for Integration of Fisheries Foundation in the Republic of Kiribati and entrusted the study to the Japan International Cooperation Agency (JICA).

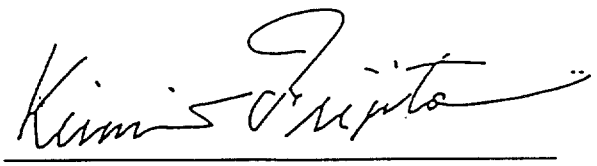
JICA sent to Kiribati a study team from August 1, 1999 to August 22, 1999.

The team held discussions with the officials concerned of the Government of Kiribati, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Kiribati in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Kiribati for their close cooperation extended to the teams.

January, 2000



Kimio Fujita
President
Japan International Cooperation Agency

January, 2000

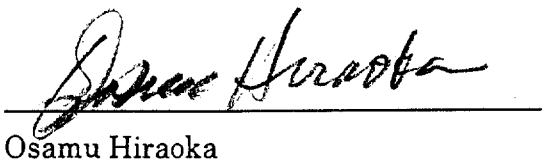
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Integration of Fisheries Foundation in the Republic of Kiribati.

This study was conducted by CRC Overseas Cooperation Inc., under a contract to JICA, during the period from July 27, 1999 to February 14, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Kiribati and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

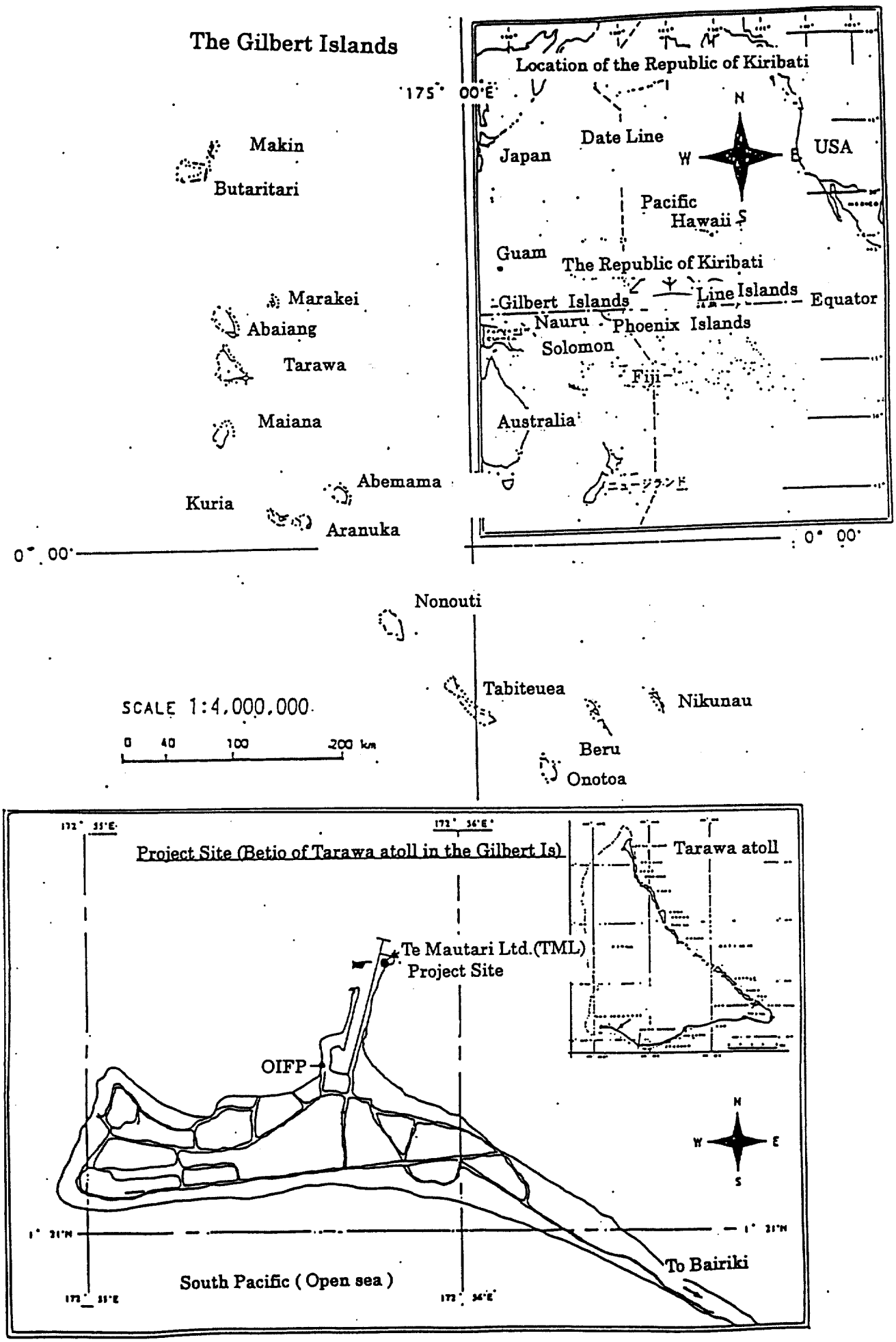
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Osamu Hiraoka
Project manager
Basic design study team on
The Project for Integration of Fisheries
Foundation in Kiribati
CRC Overseas Cooperation Inc.

Location Map



ABBREVIATIONS

Abbreviations	Formal Name
MNRD	Ministry of Natural Resources Development
MFEP	Ministry of Finance and Economic Planning
MOFA	Ministry of Foreign Affairs
TML	Te Mautari Limited
OIFP	Outer Islands Fisheries Project
KMEL	Kiritimati Marine Export Limited
FTC	Fisheries Training Center
MTC	Marine Training Center
OFCF	Overseas Fisheries Cooperation Foundation
EEZ	Exclusive Economic Zone
TCH	Tungal Central Hospital
FDAPIN	Fisheries Development Assistance For the Pacific Island Nations
ASC	Atoll Seaweed Company

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【Appendices】

Chapter 1

Background of the Project

Chapter 1 Background of the Request

The Republic of Kiribati is an island country in the Central Pacific, stretching some 4,000 km west to east and some 2,000 km north to south, crossing the equator and the 180 degree longitude, consisting of three main groups containing 33 small islands, the Gilbert, Phoenix, and Line Islands. The land area is 720 km^2 and the total population is about 81 thousand (1996) of which more than 95% are living at the Gilbert Islands, and its one third (about 28 thousand) concentrates at Tarawa, the capital of the country, at South Tarawa, which is the proposed project site. Though the land area is small, Kiribati has a vast Exclusive Economic Zone (EEZ), as much as 3.5 million km^2, some 5,000 times as large as the land area. The economy of the country has been heavily depended upon the exportation of phosphate rocks, but since 1979 when they has been exhausted, the main products for exportation consist of copra and fish products. The national economic power is weak due to the smaller land area, uneven distribution of the population, wider distance between remote islands, and coral land unsuitable for agriculture except copra. According to the Planning Office (1998), Gross Domestic Production (1995) was A$ 68.7 million and A$ 884 per capita. Economic structure is dual, consisting of monetary economy in the urban area in and around the capital and self-sufficient economy at remote islands, and a gap between the urban economy and rural economy is widening more and more, exerting an influence upon the social structure of the country, and in particular overpopulation of urban area caused by a heavy influx of people from outer islands is developing a serious social problem.

The fishery, the major development target since independence, is divided into two categories; the offshore fishery for abundant pelagic fishes and the coast fishery for reef fish at remote islands. The yearly catch is some 25 thousand tons, of which about 90% are landed from the coastal fishery.

The 8th National Development Plan (1996-1999), aiming at improvement of economic differentials between the National Capital region (South Tarawa) and remote islands, set the following basic policies.

① To achieve 5% yearly economic growth.

② To achieve self-reliance at major production sectors and to create employment opportunities.

③ To improve the living standard and welfare of the people

④ To establish the social infrastructure such as communication and transportation and to improve investment circumstances institutionally.
⑤ To restructure land, labor, and capital for effective utilization of resources.
⑥ To reform the governmental system with more efficient and effective bodies.

Based on the development plan above, the 8th Fisheries Development Plan (1996-1999) established the following basic policies.

① To develop new laws, regulations and programs for the conservation and management of marine resources.
② To rationalize the corporations for offshore/coastal fisheries and for aquiculture through amalgamation.
③ To foster fisheries-related industries through the introduction of proper projects and transfer of skills.
④ To strengthen the support for artisanal fishermen through research, training, and extension services provided by the Fisheries Division.
⑤ To secure food supply to the people.
⑥ To promote export of quality fish products.

Though being now formulated, the 9th National Development Plan and Fisheries Development Plan are to follow the contents of the previous plans. The development of fisheries will be pushed forward on the same way 2000 onward.
The Kiribati Government has regarded the fisheries development as the most important issue in the national development plan since independence in 1979, and has developed fisheries of the country with economic assistance from foreign governments and international assistance organizations such as Japan, UK, US, and EU. Under the national development plans beginning in 1980s, Kiribati established four fisheries corporations to develop the fisheries of the country; TML (Te Mautari Limited) for offshore fishery, OIFP (Outer Islands Fisheries Project) for coastal fisheries, KMEL (Kiritimati Marine Export Limited) to export fish products at Christmas Island, and ASC (Atoll Seaweed Company) to collect and export seaweed, and also aquiculture of milkfish and pearls were developed.
Japan extended 12 fisheries grant aid programes and sent 18 experts in line with their

fisheries development plans from 1979 to 1995. For the coastal fishery sector, Japan provided assistance in provision of facilities and equipment to OIFP and construction fisheries centers at remote islands (Kuria, Aranuka, and Maiana). Regarding offshore fisheries, Japan provided TML with two skipjack pole-and-line fishing boats (on which TML was established), ice-making plants, freezing facilities, a fishing mother ship, and cold storage facilities (about 200 tons in total), and also assisted the Government in constructing the fisheries training school.

With these grant aid programes and technical assistance from Japan the offshore skipjack fishery was resumed and recorded good catches of skipjack in 1980s (2,655 ton in 1989). Interring 1990s, however, the TML's business is slowing down due to an unusual change of sea conditions, changes of fishing grounds caused by higher sea temperature, and superannuated fishing boats (456 ton catches in 1995).

On the other hand, the coastal fishery has been traditionally operated in the subsistence form except at South Tarawa (86% of remote island households are engaged in the fishery), but the drift of population to South Tarawa has been accelerated since 1968, and the population of non-fishermen became larger than fishermen in South Tarawa where about 40% of the total population were living in 1995, resulting in a shortage of fish supply. In particular, fish products are always in short supply at such public institutions as hospitals and schools.

The major reason of this shortage of fish products at South Tarawa is lack of transportation means as well as the malfunction of OIFP responsible for distribution, processing, and marketing of fish products due to outworn facilities and equipment. To resolve this difficulty, the Government of Kiribati is now planning to establish a new corporation through amalgamation of 3 relevant fisheries corporations of TML, OIFP, and KMEL to reorganize the fisheries sector as well as to redevelop pelagic resources for offshore fisheries. Also for the coastal fishery sector a project was developed to improve distribution of fish products and to secure food supply to the people, and to activate the economy at remote islands. To be concrete, the plan aims at reduction of food import through increasing the supply of good protein by stable supply of fish products transported directly from remote islands to and processed properly at Tarawa to public institutions.

The Government of Kiribati requested Japan to assist the implementation of the project, including the construction of a fish processing facility and the provision of an

ice-making/storage facility, an freezing facility, and relevant equipment and materials. On this request the Government of Japan, recognizing the necessity to review the conformation between the present conditions of previous grant aid projects and the contents of the request, decided to send a preliminary survey team to Kiribati between March 7 and 27, 1999. The results of the preliminary survey were as follows.

(1) The appropriateness of the project as a grant aid project are confirmed due to the public nature that fish products transported to Tarawa from remote islands are supplied to public institutions such as hospitals and schools.
(2) The current hygiene condition is very poor due to superannuated facilities and equipment. It is desirous to improve rapidly obsolete facilities and equipment to allow a stable supply of required quantities from the consumer side throughout the year.
(3) Both the existing TML site and OIFP site are nominated as the proposed project site. The OIFP site is unsuitable for food processing due to significant deterioration of facilities and equipment and a garbage pit at the backyard.
(4) From the viewpoint of common use of governmental sites and improvement of management system through merger of 2 corporations, it is worthwhile to consider the Kiribati plan that establishes the new corporation at the TML site to maximize its facilities.
Based on the results of the preliminary survey, the basic design study was conducted to review and determine the quantities and scales of the request, including rehabilitation, scrapping, reutilization, or reconstruction of the existing facilities and equipment.

Chapter 2

Contents of the Project

Chapter 2 Contents of the Project

2-1 Objectives of the Project

2-1-1 Background of the Project

The offshore fishery has grown in 1980s, increasing skipjack production (2,655 tons in 1989), but in 1990s the landing of skipjack has been decreased drastically (456 tons in 1995) due to an unusual sea conditions, changes of fishing grounds caused by higher sea temperature, and poor performance of fishing boats (four boats) because of deterioration, and the TML's business is slowing down. On the other hand, the coastal fishery has been traditionally operated in the subsistence form (86% of remote island households are engaged in the fishery), except at South Tarawa, where the percentage of non-fishermen (40% of the population) is higher than fishermen, resulting in a shortage of fish supply. In particular, fish products are always in short supply at such public institutions as hospitals and schools (according to the hearing survey, only 57 tons were supplied by OIFP against a demand of 174 tons in 1998). The major reason of this shortage of fish products at Tarawa is a lack of transportation means from remote islands as well as the malfunction of OIFP responsible for distribution, processing, and marketing of fish products due to superannuated facilities and equipment. In addition, fishes landed are not fully utilized in Tarawa. At the fish market on the roadside where vendors sell raw fish to the public ice is hardly used under the blazing sun, resulting in deterioration of quality. Fishes left unsold in the day are not marketable for the following day, and thus discarded. Kiribati is forced to import foodstuff of 1.7 times as much as the whole export. Fish products are essential for people's eating habits and the demand is very high.

2-1-2 Objectives of the Project

The Kiribati Government planned first planning to merger two corporations, TML and OIFP, with a view of reorganization of the corporations' management system to resolve this difficulty. Now the Government is developing a project to establish a new fisheries corporation through amalgamation of three corporations, TML and OIFP plus KMEL under the Ministry of Line and Phoenix Group (engaging in export of some 2 tons of fish products every two weeks to Hawaii) to improve fish production and

distribution.

The Project aims at a stable supply of fish products to the population at Tarawa without self-supporting capacity throughout the year through the construction and procurement of a processing facility, an ice-making plant, a freezing facility, and equipment and materials necessary for processing raw fish transported from remote islands.

The expected effects of the Project are as follows;

(1) Increasing processing capacity will allow processed fish products to meet the demand.

(2) Processing, freezing, and storing surplus landing during the high fishing season will allow fish products to distribute stably during the poor season.

(3) Activation of the economy of remote islands will be achieved through increasing income, improving living standard, and increasing employment opportunities.

2-2 Basic Concept of the Project

2-2-1 Basic Concept

(1) The Government of Kiribati has been striving to develop the fishery as the mainstay of the state economy since independence. At South Tarawa, however, where about 40% of the total population are living, the demand of fish products is not supplied to a lower proportion of non-fishermen than the fishermen and inadequate facilities and equipment for distribution, processing, and marketing.

The Project consists of the following components.

-To bring together the facilities and equipment of OIFP and TML at the TML premise so that the functions of two corporations may be rationalized.

-To scrap part of unserviceable facilities of TML so that a sufficient site area can be secured.

-To construct a processing plant with a production capacity of maximum 630 kg/day at the secured site.

-To construct also an ice-making plant, an ice bin, and a freezing facility.

-To provide the equipment and materials such as processing tables, cold preservation vehicle, etc. necessary for processing, distribution, and marketing by 15 staffs.

-To utilize the existing two cold stores, capacity of 50 tons each, for storing raw fish and

fish products.

The basic concept of the Project is to establish a stable supply of fish products to the public institutions and the general public at South Tarawa without a self-supplying capacity of fish.

(2) Investigation of the proposed project site

In implementing the requested “Integration of Fisheries Foundation Project”, the proposed Project site was investigated through a comparison between the existing facilities and the contents of the request.

The existing facilities to be investigated are the OIFP facilities provided in 1979 and the TML building with a brine freezing facility and an ice-making plant granted in 1992.

The former was constructed to foster the fishery at remote islands as well as to supply fish products to Tarawa, aiming at the same objectives of the present Project. It is now, however, operating a limited processing and distributing business due to superannuated facilities and equipment and unfavorable environment. The present condition of the facilities and equipment of OIFP and TML is not possible to meet the requirements of the project due to deterioration. It is judged that constructing a new integrated facility utilizing the existing foundation of TML building housing the brine freezing facility and ice-making plant with their structural materials repairing is most suitable.

The location of the site is between the existing cold store and the TML office building, and has the condition suitable for the function of an integrated fisheries facility.

The north side and the west side of the wharf on which the site is located are protected with steel sheet piles, and there found several piles with rusty holes of 150-200 mm dia. However, since the wharf itself is located at the lagoon side of Tarawa atoll under calm sea conditions, and its foundation is of coral sand, its back filling for sheet piles becoming solider with water, and the 50 ton cold store is situated some 15 m inside the sheet piles, there is no immediate possibility of adverse effect by these rusty sheet piles. A repair will be necessary in future with the auspice of the Kiribati side.

2-2-2 Basic policy of the Project

Based on the contents of the request and the necessity of the each component, the following facilities, equipment and materials shall be involved in the Project. The details of each component and their necessity and basic policy are as follows.

(1) Facility

The Integration of Fisheries Foundation shall provide a processing space, an ice-making/storage facility, a freezing facility, a preparation room, a fish retail shop, a machinery room, a maintenance room, and an office room, which will be constructed after the existing ice-making plant, freezing system, ice bin, etc. were removed.

(2) Equipment and materials

1) Ice-making facility

Ice is essential at every stage of processing, distribution, and fishing activities, and the required capacity of the ice-making facility shall be determined in accordance with the volume of fish to be processed, the volume of distribution, and the number of fishing boats.

2) Ice bin

An ice bin is necessary to store produced ice for forwarding due to a constant production of an ice-making plant. Its capacity shall be matched the production capacity of the ice-making plant.

3) Freezing facility

The Project plans to reserve fish caught in the high fishing season for maximum 7 months to supply them in the poor season, which intention requires a freezing facility.

4) Preparation room

A preparation room shall be provided with a view of preservation of raw fish until processing, pre-cooling of processed products, extracting work of products from pans and so on.

5) Cold storage facility

The existing 50 ton cold storage facility (-5 C) will be utilized, with a newly-constructed preparation room adjoining the freezing system.

6) Desalinating system

Fresh water is essential for a processing facility. The Project requires fresh water of 12 tons a day. A desalinating system shall be introduced to avoid a standstill of operation due to a drought.

7) Freshwater tank

The existing freshwater tank will be utilized and a 3 ton elevated water tank shall be

constructed for convenience.

8) Generating system

There is a power plant, 30 years old, with 5 generating sets of which only 2 sets are now operating, resulting in frequent power failure and fluctuation of voltage. TML has 3 generating sets of 75KVA each granted from Japan in 1988 and continuously running 10 years. A stable power supply is essential for the Project, so these 3 generating sets shall be overhauled and a new generating system shall be provided a stand-by set.

9) Air-conditioning system

Decomposition of fish products makes rather fast progress at Tarawa with higher air temperature of 28 to 30℃. Hygiene is very important for the Project which supplies fish products to such public institutions as hospitals and schools. An air-conditioning system shall be provided to control working conditions and freshness.

(3) Equipment and materials

1) Processing table

A processing table capable of placing a 1 m long fish on is necessary. Three tables shall be provided.

2) Wrapping table

Wrapping is necessary to handle frozen processed products as foodstuffs.

3) Wrapping machine

The provision of a wrapping machine shorten the working hours for wrapping.

4) Band saw

A band saw of salt-resistant specifications shall be provided for cutting frozen fish.

5) Conveying equipment

Three barrows shall be provided to carry fish, ice, and fish boxes respectively.

6) Forklift

A forklift capable of carrying 3 columns of a bucket stored 300 kg processed fish is necessary. The forklift is used for carrying other heavy goods such as raw fish, products, fish boxes, etc.

7) Truck crane

It is necessary to unload a some 1,200 kg fish box on board fishing boat. The crane is used for lifting other weight cargo such as fuel oil drum and fishing gear.

8) Cold preservation vehicle

A cold preservation vehicle is necessary to delivery fish products to such institutional customers as hospitals and schools.

9) Chest freezer

A chest freezer shall be provided in the newly constructed retail shop for selling of frozen loins and fillets.

10) Scale weighing machine

All of the existing weighing machines are obsolete and rusty. New machines of salt-resistant specifications must be provided.

11) Insulated box and fish box

Required number of boxes shall be provided for conveying fresh fish, freezing fish, reserving/delivering products, stacking products, and washing raw fish.

12) High pressure washing machine

A high pressure washing machine shall be introduced for washing fish boxes, processing tables, and the floor of the processing space, aiming at cost-saving and improving work efficiency.

13) Computer and printer

The existing computer is too old (1982 model) to use for accounting or analyzing data. A new one is necessary with a printer for preparation of bills, notices, reports and other documents.

14) Showcase

As a model case of fish retail shop, the newly constructed retail shop requires a showcase for demonstration and selling of fresh/processed fish.

15) Lobster live well

A live well shall be installed for preservation of live lobster transported from outer island. An aeration system shall be attached.

16) Ultraviolet sterilizing lamp

Required number of ultraviolet sterilizing lamps shall be provided for sanitation.

With the provision of the above-mentioned facilities, equipment and materials the Project aims at a stable supply of fish products at South Tarawa, the Capital region of the Republic of Kiribati, through transportation of fish from outer islands, processing, and distribution, in particular, during the poor season which is in short supply of fish products.

2-3 Basic design

2-3-1 Design concept

The facilities, equipment and materials shall be designed under the following construction policy and design conditions. The construction policy consists of five components, that is, Management Plan, Layout Plan, Facility plan, Implementation Plan, and Local Conditions.

(1) Management Plan

The responsible body of the Project is a new fisheries corporation to be established under the Ministry of Natural Resources and Development (MNRD). The new corporation is formed through the amalgamation of TML (responsible for the offshore fishery) and OIFP (responsible for the coastal fishery at remote islands and processing).

The corporation requires a good management and proper facilities and equipment to supply quality fish products stably for the people at Tarawa. A stable supply of fish products requires a reliable water/power supplying system to secure a sound operation of facilities and equipment. At the same time the system should be cost-saving for a good management.

(2) Layout Plan

The proposed Project site is located in the TML premise, between the cold store and the office building, at the end of the Betio wharf. At present the brine freezing/ice-making facility exists here. The reclaiming and wharf construction work for a new Betio harbor, being expected to complete in April 2000, is now in progress at the east side of the proposed site, and a ferry-terminal has been already constructed close by the site. The Project facility shall be laid out so as not to disturb the existing traffic line on the front road stretching to the jetty, coordinating the traffic lines around the new harbor and the ferry terminal.

(3) Facility Plan

The Project Facility to be newly constructed accommodates a fish handling-processing facility, ice-making facility, and a freezing facility. Also a cold store is on the north of the Facility and a office building on the south. The Facility shall be designed to allow

its function to display completely.

A handling space at which landing, sorting, weighing, and recording fish from remote islands are conducted shall be provided on the front road close to the existing cold store, leading to a processing space. An ice bin shall be placed close to the handling space. A preparation room, a freezing system, and materials store are placed around the processing space, which has an opening to the ice bin so that ice can be taken out from the inside. A tub for water to wash workers' feet shall be installed at the entrance of the processing space from the viewpoint of hygiene. An office room shall be provided on these traffic lines to make the management and selling activities easy. A fish retail shop shall be installed facing the front road. A space for changing clothes, showering, and resting for workers shall be provided. All the equipment and apparatuses for these facilities above shall be stout, easy-maintenance, and energy-saving.

(4) Implementation Plan

Preparation of the Implementation Plan requires all-out co-operation of the Kiribati side. The share burden of the prerequisites such as safety measures, securing a lot for temporary work, relocation of the existing maintenance shop, and so on shall be made clear. The Project shall be in principle completed for one fiscal year.

(5) Local conditions

1) Natural conditions

a) Special care shall be taken in ventilation, lighting and shading from the standpoint of hot and humid climate.

b) The proposed site, facing the sea, is subject to constant easterly sea breeze. Salt-resistant equipment and materials, then, shall be used, and openings of the east side of the building shall be protected fully against rain.

c) The front of the site faces a calm lagoon area in Tarawa Atoll. Sewage and waste water from the facilities shall be treated in a septic tank before percolating downward through the soil to avoid pollution on the coastal area.

d) South Tarawa as 2,100 mm rainfall a year and people depend greatly upon rainwater, and, like other countries belong to marine climate, experiences sometimes water famine, no rainy day lasting more than one month. To secure water supply is essential at the facilities and hence a desalinating system shall be introduced.

2) Environmental care

a) Since the site is situated on the wharf leading to the existing jetty, lots of flow lines of service activities to vessels become complicated on the front road. Newly constructed facilities shall be arranged properly so as not to disturb the present activities. Also special care shall be used in safety supervision during construction period.

b) Materials, color, and shape of the building shall be carefully selected so that the appearance of it may match with surroundings.

c) It is expected that women's participation in processing operation will increase at the facilities. Working environment favorable for women shall be considered.

3) Construction situation

a) Kiribati has no regulations and standards concerning building except durability against a wind with a speed of 60 m/sec. Also no earthquake is experienced in Kiribati. In designing, 1/2 of coefficient of Japan Standard regarding the seismic force, and the durability against 60 m/sec regarding wind force shall be applied.

b) Construction firms in Kiribati have only a few skilled engineers, in particular, refrigeration system engineers. All works concerning refrigeration system in the past were carried out by engineers sent from Japan.

Since apparatuses common to the existing equipment are to be applied from the standpoint of interchangeability of parts and maintenance tools, necessary engineers are to be also sent in this Project. At the same time, apparatuses to allow for local engineers to give maintenance shall be selected.

c) Sand, cement, piping materials and part of electric materials are available locally but steel bar and special electric materials subject to import are no sufficient in quality, kind, and quantity. Though locally available materials shall be use as much as possible, materials which are difficult to obtain within the country will be brought from Japan or the third countries depending upon comparing costs.

d) Course of utilization of local construction firms and local materials

Local construction firms are working in public works, but firms given credit for being a general contractor are only two, and the remainings are suppliers or firms for installation of equipment. Utilization of local firms as subcontractor as well as positive employment of local workers will be considered.

2-3-2 Examination of design conditions

The production scale was planned on the basis of production capacity at remote islands and forwarding to Tarawa.

Details are given below, and, at the site survey it was estimated that the yearly landing at the OIFP fisheries centres at remote islands is 245.4 tons and the yearly forwarding to the Project from remote islands is 113 tons fresh fish and 7 tons fillet (23.2 tons of raw fish).

Also it was confirmed that the public institutions such as hospitals and schools are short of fish products and that they are forced to use imported canned corn beef to make up for shortage.

The Project plans to receive the forwarding from remote islands plus 45 tons from local fishermen at Tarawa, totalling 174.2 tons a year, and to supply 43.4 tons loin, 15.9 tons fillet, and 12.7 tons fresh fish (72 tons in total) for institutional consumers.

(1) Current conditions of OIFP

1) The followings are fishing activities between 1996 and 1999 July at outer islands.

Table 2-1 Fishing activities between 1996 and 1999 July at outer islands

Items	Unit	Abaiang	Maiana	Kuria	Aranuka
Number of working months	Month	23	39	20	25
Total working months	Month	46	46	30	30
Working ratio	%	50.0%	84.8%	66.7%	83.3%
Average catch per month	Kg/month	516.5	1,115.9	680.5	334.2
Average catch per working month	Kg/month	1,033.0	1,370.5	1,020.7	402.5
Maximum catch per working month	Kg/month	2,580.2	3,554.6	3,277.9	1,558.1
Minimum catch per working month	Kg/month	9.5	124.8	130.0	5.0

Source: OIFP (The further details are referred appendices 5. A-18.)

Table above shows that average catch of working month at each island is 1.0 t at Abaiang (maximum 2.5 t), 1.3 t at Maiana (maximum 3.5 t), 1.0 t at Kuria (maxumum 3.2 t), and 0.4 t at Aranuka (maximum 1.5 t). Average of all islands is about 400 kg.

The reason why the efficiency of Abaiang facility is lower is because the ice-making plant and the generator granted by UK in 1988 have been out of order since 1997. OFCF is planning to provide an ice plant (1 ton type) to Abaiang through COFDAS (Coastal Fisheries Development Assistance) Project, and part of equipment of materials are now being procured.

The current conditions of facilities of each centre are as follows.

Table 2-2 The current conditions of facilities of each centre

Name of centre	Ice-making plant	Cold store	Insulated box	Training boat	Stuff
Abaiang	Broken	-	20 boxes	Non	1
Maiana	220kg block ice	-	20 boxes	Non	1
Kuria	220kg block ice	-	20 boxes	1 boat	1
Aranuka	220kg block ice	-	20 boxes	1boat	1

2) Transportation between outer islands and Tarawa

The distance and frequency of transportation between Tarawa and each island are as follows.

Table 2-3 The distance and frequency of transportation between Tarawa and each island

Island	Distance from Tarawa	Transportation by boat with outboard motor	Small inter-island boat	Large inter-island boat	Air flight
Maiana	46km	Possible	Once a week (non-regular)	Non regular	Not operating, bad air strip
Abaiang	57km	Possible	Twice a week (non-regular)	Non regular	Once a week
Kuria	129km	Impossible	Impossible	Non regular	Once a week
Aranuka	141km	Impossible	Impossible	Non regular	Once a week

Since transportation by a boat with outboard motor is possible between Tarawa and Maiana/Abaiang, the canoe operated by Island Council and OIFP's boat will be used for transportation twice a week. The reason why OIFP needs the transportation boat is that the operation of Island Council's boat is irregular. OIFP must carry row fish necessary for their operation by their own boat.

Regarding Kuria and Aranuka, forwarding of fresh fish is not difficult due to non regular service of interisland boat. COFDAS Project is planning to transport catch by air after filleting. No fresh will be arrived from Kuria and Aranuka.

3) Selling price and buying price

OIFP's current prices of selling and buying are as follows.

Table 2-4 **OIFP's current prices of selling and buying** **(A$ /kg)**

Items	Buying price		Selling price	
	At outer islands	at Tarawa	At outer islands	at Tarawa
Reef fish	1.10 (only Kria & Aranuka) 0.95	1.75	(Other)1.55 (Kuria)1.45	2.10
Pelagic fish	1.10	1.75	(Other)1.55 (Kuria)1.45	2.10
Loin	-	-	-	(School Hospital) 5.90 (General) 6.00
Fillet	-	-	-	7.70
Lobster	4.50	4.50	-	11.50
Octopus	0.50～0.90	0.50～0.90	-	1.80
Giant Clam	0.50/spit	0.50/spit	-	1.00/spit

Source: OIFP

4) Demand

Table below shows a performance of purchase of institutional buyers of OIFP in 1998. Data were collected through accounting boos or interviews.

Table 2-5 **Distribution of fish products in 1998** **(unit: ton)**

	OIFP	Local	Total	OIFP %	Local %	Volume desired	Remarks
TCH (Tungal Central Hospital)	18.5	45.4	63.9	29.0%	71.0%	95.2	1836kg/week 52 weeks/year 900 plates/day 5 times/week
Schools							
KG5 (King George V and Elaine Bernacchi High schools)	4.90	10.40	15.30	32.0%	68.0%	40.0	1025 kg/Week 39 Weeks/Year 800 Plates/Day 3 Times/Week
Moroni (High school)	0.04	2.40	2.44	1.6%	98.4%	2.5	64 kg/Week 39 Weeks/Year 240食/日 1 Time/Week
KTC (Kiribati Teacher's College)	12.30	0.00	12.30	100.0%	0.0%	14.4	365 kg/Week 39 Weeks/Year 600 Plates /Day 3 Times/Week
FTC (Fisheries Training centre)	0.08	3.92	4.00	2.0%	98.0%	7.0	175kg/Week 40 Weeks/Year 216 Plates /Day 5 Times/Week
MTC (Maritime Training Centre)	1.00	9.00	10.00	10.0%	90.0%	20.8	300kg/Week 52 Weeks/Year 510 Plate/Day 5 Times/Week
Restaurant & Hotel							
Amm's	0.26	0.00	0.26	100.0%	0.0%	1.7	Open Nov. 1999
Betio Motel	0.05	1.20	1.25	4.0%	96.0%	1.6	By Interview
Mary's	0.78	0.96	1.74	44.8%	55.2%	1.9	By Interview
Matarena's	0.00	0.96	0.96	0.0%	100.0%	1.6	By Interview
Beru Caffe	0.00	1.14	1.14	0.0%	100.0%	1.3	By Interview
Fish & Chips	0.00	9.00	9.00	0.0%	100.0%	9.5	By Interview
Buchery's	0.10	8.90	9.00	1.1%	98.9%	9.0	By Interview
Local	0.51	4200.00	4200.51	0.0%	100.0%		28,000 persons x 150 kg/year (assumption in 1991)
Total	38.52	4293.28	4331.80	0.9%	99.1%		

Source : OIFP Sales note & account note to Hospital & schools

TCH buys average 226 kg fish a day in the high fishing season, but they cannot only 108 kg fish a day, half of the purchase in the high season (Appendices 5.A-19). The hospital side wants to serve the patients with healthy fish every day instead of such salty and fatty meals as corn beef and sausages, but unavailable in the poor fishing season.

The schools also desire to serve pupils with fish as possible, but they cannot purchase fish intentionally, resulting in provision of meals using food materials available in the day. The restaurants have lots of guests during the poor season when fish caught by local fishermen is in short supply. Also hotels and restaurants having many foreign visitors want to be stably supplied white fish unavailable sufficiently in Tarawa by OIFP throughout the year.

Sufficient supply of fish products in the poor fishing season is much wanted by various circles.

The followings are the results of interview survey.

Schools and hospital

- A stable supply of fish products. Direct purchase from fishermen stable will be reduced when a supply from OIFP is stabilised.
- Accounting business with OIFP is easier due to bill settlement.
- Supplying loins and fillets is desirous to save cooking hours.
- No overtime work of cooks is useful for cost-saving.
- OIFP's fish products are more reliable than the ones of local fishermen using no ice.
- The cheaper the better. Our budget is limited.
- Best quality and best hygiene condition are desired.

Restaurants

- Purchase will be increased on improvement of price and freshness.
- Reducing price of fillet more is desired.
-Best quality and best hygiene condition are desired.

Customers

- Stable supply.
- Stable supply of loin and fillet.
- More hygiene sales room.

(2) Determination of designed supply

1) Supply to each establishment

Demand of various circles including public institutions and restaurants was surveyed. The Project, however, has no intention to cover demand from all these circles, but determines a supply plan not to disturb activities of Tarawa fishermen. Table below shows the conditions to determine the supply plan and its result is tabulated to 2).

Name of Customer	Number of meals	Number of cooks	Purchase	Purchase desired	Meal-serving weeks	Number of meals of fish desired per week	Conditions	Total demand
TCH	900	3	63 t/Year 358kg/day (Max.1998, AUG. Average)	1830kg/Week	52weeks	6	The peak of demand was 358 kg/day in August. Yearly demand corresponds to 130 tons. Purchase desired of 95.2 tons is judged to be reasonable. OIFP supplies 59.2 t except 36 t from local middlemen.	95.2t
KG5	800	12	15.3 t/Year 200kg～500kg/day	1025kg/Week	39weeks	3	The school wants to buy fish 3 times a week, 500 kg a time in the high season. Purchase desired of 40 t a year is judged to be reasonable, being supplied wholly by the OIFP.	40.0t
Moroni	240	3	2.44t/ Yaer (1998)	64kg/Week	39weeks	7	Among 21 meals in a week 7 meals are fish. Generally the suppliers are Mormons, but the school wants to buy from OIFP at the weekend and poor fishing day. Purchase of 1998 of 2.5 t will be maintained. OIFP sells 0.9 t except the supplies from Mormons	2.5t
KTC	600	3	12.3 t/Yaer(1998)	365kg/Week	39weeks	3	Fillets and loins of 600 kg/month are desired. The demand is 13.5 t in raw fish equivalent. They want to buy the whole quantity from OIFP.	13.5t
FTC	216	2	4.0 t/Yaer(1998年)	175kg/Week	40weeks	6	The budget is enough to buy fish of 175 kg a week, but only 4 t, half of budget, was available in 1998. OIFP supplies 5.3 t except the supplies from fishermen.	7.0t
MTC	510	3	10.0t /Year(1998年)	300kg/Week	52weeks	6	Purchases of 300 kg/week are desired. Yearly demand of 15.6 t is judged to be reasonable. OIFP sells 14.6 t.	15.6t
Amm's	10	4	0.26 t /Year(1998)	32kg/Week	52weeks	7	This Government owned shop was opened November 1998, and wants to buy the whole quantity from OIFP. OIFP supplies 32 kg/week, totalling 1.7 t a year.	1.7t
Betio Motel	30	4	1.25 t /Year(1998)	24kg/Week	52weeks	7	The purchases in 1998 were 1.25 t, of which only 50 kg were bought from OIFP. OIFP sells 400 kg in the poor season	1.6t
Mary ' s	30	4	1.74 t /Year(1998)	33kg/Week	52weeks	7	Mainly fillets were bought from OIFP in 1998. OIFP sells 0.9 t including marine fish	1.9t
Matarrena's	10	4	0.78 t /Year(1998)	18kg/Week	52weeks	7	No purchase from OIFP in 1998, they wants to by a shortage in the poor season from OIFP. The shortage is estimated at 600 kg a year.	1.6t
Beru Café	10	2	1.14 t /Year(1998)	22kg/Week	52weeks	6	OIFP will supply 200 kg, shortage in the poor season	1.3t
Fish&Chips	-	2	9.0 t/year(1998)	173kg/Week	52weeks	6	One to two tuna fishes (20 to 40 kg) are consumed every day. Loins of 50 kg/week are desired. OIFP will supply 4.5 to a year	9.5t
Tarawa Buchery	-	2	-	173kg/Week	52weeks		Purchase of 200 kg/week was made in 1999. A continued supply from OIFP is desired, and OIFP will sell 13.5 t of total demand of 18.5 t.	18.5t
Otintaai Hotel	-	15	9.0 t/year(1998)	173kg/Week	52weeks	7	Fillets and loins are mainly purchased. They want to buy a half of total demand of 9.0 from OIFP.	9.0t

2) Table of results

Table 2-7 Demand of fish (Unit: ton converted into raw fish)

	OIFP	Local	Total	OIFP %	Local %	Remarks
TCH	59.2	36.0	95.2	62.18%	37.82%	Loins and fillets are desired
KG 5 high school;	39.9	0.1	40.0	99.75%	0.25%	Fish is served at 3 meals a week. 800 meals a day, loins and fillets are desired
Mononi High school	0.9	1.6	2.5	36.00%	64.00%	Fish is served at 6 meals a week. 240 meals a day.
KTC	13.5	0.0	13.5	100.00%	0.00%	400 kg/week are consumed in 36 weeks. Fish is served at 3 meals a week. 600 meals a day. Fillets are favourable.
FTC	5.3	1.7	7.0	75.71%	24.29%	175 kg/week are consumed in 40 weeks. Fish is served at 6 meals a week. 240 meals a day. Marine fish is favourable.
MTC	14.2	1.4	15.6	91.03%	8.97%	300 kg/week are consumed in 52 weeks. Fish is served at 6 meals a week. 510 meals a day. Fillets are desired
Hotel & Restaurant						
Amm's	1.7	0.0	1.7	100.00%	0.00%	Government owned
Betio Motel	0.4	1.2	1.6	25.00%	75.00%	Fillets and loins
Mary's	0.9	1.0	1.9	47.37%	52.63%	Mainly fillets
Matarrena'	0.6	1.0	1.6	37.50%	62.50%	Mainly in the poor season
Beru Café	0.2	1.1	1.3	15.38%	84.62%	Mainly in the poor season
Fish & Chips	5.4	4.1	9.5	56.84%	43.16%	
Tarawa Butchery	13.5	5.0	18.5	72.97%	27.03%	
Otintaai Hotel	4.3	4.7	9.0	47.78%	52.22%	State-owned
General customers	14.2	4200.0	4214.2	0.34%	99.66%	Calculated as total population of Tarawa is 28,000, per capita consumption is 150 kg/year.
合計	174.2	4267.2	4441.4	3.92%	96.08%	

3) Supply of fish

1 Number of fishing boats

The number of fishing boats of the area covered by the Project is as follows

Fishing boats with outboard motor. ( ) is OIFP's fishing boats

Abaiang	80(0)boats	Maiana	35(13)boats
Kuria	25(9) boats	Aranuka	32(9) boats
Kiribati government will be implement the following boats by 2000			
Abaiang	15 boats(2001)	Maiana	13 boats
Kuria	6 boats	Aranuka	6 boats

Conditions

Number of fishing boats increased by the implementation plan of Kiribati government. The fishing weeks a year are 27 weeks in the high season (May to November with fine days) and 19 weeks (stormy December to April), totalling 46 weeks. According to interview survey, they sail out fishing 3 days a week in the high season and 3 days for 2 weeks (1.5 days a week) in the poor season. Fishing is made in one day trip, catching average 40 kg fish. There is little difference of catch between seasons. Number of fishing days affects catch.

Fish caught off Kuria and Aranuka are processed at islands, and then transported by air. Catch is collected from 3 days before a flight. Fishing days thus are calculated at half of the ones of Maiana and Abaiang.

Catch of each island in each season

Table 2-8 Catch of each island in each season

Islands	OIFP fishing boat	Fishing season	Number of fishing weeks	Fishing days per week	Catch per boat for each season (kg/boat)	Catch for each season	Total catch (kg)
	①		②	③	④= ②×③×40kg	⑤= ④×①	
Abaiang	15	High season	27	3	3,240	48,600	65,700
		Poor season	19	1.5	1,140	17,100	
Miana	26	High season	27	3	3,240	84,240	113,880
		Poor season	19	1.5	1,140	29,640	
Kuria	15	High season	27	1.5	1,620	24,300	32,850
		Poor season	19	0.75	570	8,550	
Aranuka	15	High season	27	1.5	1,620	24,300	32,850
		Poor season	19	0.75	570	8,550	

2 Receipt at Tarawa

The Project will process 60% of fillets transported from Kuria and Aranuka, but in the beginning period, 36 % of arrival will be processed at a rate of 30% and the rest will be for local distribution.

At Maiana and Abaiang 40% of catch will be consumed locally (this tendency was confirmed at a hearing survey). Receipt at Tarawa from each island is as follows.

Table 2-9 Receipt from each island **(unit: ton)**

Island	Fishing season	Catch ①	Local consumption ②	Forwarding of fresh fish ③= ①-②	Forwarding of fillet ④= (①×36%)×30%
Abaiang	High season	48.6	19.9	**28.7**	-
	Poor season	17.1	7.0	**10.1**	
	Total	65.7	26.9	**38.8**	
Miana	High season	84.3	34.5	**49.8**	-
	Poor season	29.6	12.2	**17.4**	
	Total	113.9	46.7	**67.2**	
Kuria	High season	24.3	15.6	**0**	**2.6**
	Poor season	8.6	5.5	**0**	**0.9**
	Total	32.9	13.2	**0**	**3.5**
Aranuka	High season	24.3	15.6	**0**	**2.6**
	Poor season	8.6	5.5	**0**	**0.9**
	Total	32.9	13.2	**0**	**3.5**
Ground Total	High season			**78.5**	**5.2**
	Poor season			**27.5**	**1.8**
	Total			**106.0**	**7.0 (23.3 t/converted into raw fish)**

Note: In the high season 180 days are applied to processing, while 80 day in the poor season.

When the receipt from outer islands is in short supply, the shortage is covered by TML's by-catch of commercial fisheries and purchases from local Tarawa fishermen. The purchases from Tarawa fishermen are mainly tuna caught outside Lagoon, which are processed to loins. The 1998 landing at Tarawa was 3,607 tons according to the authority.

Based on the data above, the Project shall receive the following volume of fish.

3 Working day and handling volume

The governmental establishments adopt a five-day working week system, while private corporations and Labour Law are on a six-day week in Kiribati. The Project shall be

on a six-day week, operating for full 6 days in the high season due to lots of handling volume and using Friday and Saturday for maintenance during the poor season.
Processing work shall be done for 180 days (30 weeks x 6 days/week) in the high season, while 80 days (21 weeks x 4 days/week) in the poor season, totalling 260 days.

The following volume of fish is handled in the Project.

Table 2-10 Volume of fish is handled in the Project **(Unit: kg/day)**

Suppliers	180 working days in high season	80 working days in poor season	260 working days in total	Remarks
Outer island	436	344	408	①
Tarawa	194	125	173	②
Total	**630**	**469**	**581**	③

Besides, arrival of lobsters, some 400 kg/month, can be expected. Lobsters shall be kept in the live well alive until selling.

(3) Processing plan

1) Kind of processing

A. Loin

After removed head, skin, bone, and bloody muscle, marine fish is cut to 1kg blocks, wrapped with vinyl wrapper, and frozen to restrain the propagation of bacteria and autolysis. Products frozen at about +10℃ is in danger of becoming soft meat in half a day, resulting in a fall of commercial value.

B. Fillet

Fillet without skin of reef fish is vacuum wrapped and then frozen to prevent split due to thinness.

C. Round

Raw fish brought from the outer island are of various kinds. They are frozen for each kind and kept to make up a certain volume of the same kind of fish to sell to restaurants. Also products are stored in this form to supply in the poor season stably.

2) Processing volume

A. Loin

Loins are desired at hospitals and schools. All marine fish are processed to loin. About 60% of arrivals from outer islands are marine fish, and landing of local fisheries at Tarawa is all marine fish.

B. Fillet and round fish

About 40% of catch at outer islands are reef fish, of which 70% are large fish suitable

for fillet (28% of total catch at outer islands), and the remaining reef fish (12% of catch at outer islands) are sold at round form. All products are frozen so that the forwarding can be controlled.

Processing volume a day is shown in Table below

Table 2-11 Processing volume of raw fish a day (Unit: kg)

Raw fish for each processing	High season: 180 days	Poor season: 80 days	260 days total processing days	Remarks
Raw fish for loin processing①×60%＋②	456	331	418	④
Raw fish for fillet processing ①×28%	122	96	114	⑤
Round raw fish ①×12%	52	41	49	⑥
Total	630	468	581	

Another Table below shows the volume of products produced from raw fish on the Table above.

Table 2-12 Volume of products produced from raw fish (Unit：kg)

Products	High season: 180 days	Poor season: 80 days	260 days total processing days	Remarks
Loin ④×40%	182	132	167	⑦
Fillet production at the plant ⑤×30%	37	29	34	⑧
Frozen fish ⑥	52	41	49	
Total production at the plant	**271**	**202**	**250**	⑨
Fillet produced at outer islands				
Kuria	14	11	13	
Aranuka	14	11	13	
Total fillet at outer islands	**28**	**22**	**26**	⑩
Grand total	299	224	276	

Based on data above, yearly production is as follows.

Loin 43.4 ton (daily average 167 kg in 260 working days)

Fillet 15.9 ton (daily average 61 kg in 260 working days)

(Production at plant: 35 kg/day Production at islands: 26 kg/day)

Fresh fish 12.7 ton (daily average 49 kg in 260 working days)

3) Staffing

One worker can process of 240kg tuna in 6 hours.

It is desirous that the workers serve concurrently as possible for cost-saving. The Project plans 1 hour for preparation, 6 hours for processing, and 1 hour for washing and cleaning at the close of work. Since the processing volume a day during the high season is 630 kg, 630 kg/240 kg/6 hours = 3 workers shall be assigned to processing, and another worker shall be engaged in wrapping work.

Necessary staffing for processing designed volume shall be as follows.

Processing	4 persons	One for wrapping
Services in the plant	1 person	Selling ice, weighing, recording, etc.
Driver	1 person	Driving truck, handling truck crane
Forklift, odd jobs	1 person	Washing boxes, conveying, cleaning
Total	7 persons	

(4) Production and customers

Institutional consumers such as hospitals and schools want loins and fillets to save cooking hours, restaurants want loins, fillets and fresh fish, and households like fresh fish. Based on the production above, products shall be allocated as follows.

Table 2-13 Selling plan **(Unit: ton)**

Customers	Fresh fish	Loin	Fillet	Weight in raw fish equivalent
TCH	0.0	17.0	5.0	59.2
KG 5 (High school)	0.0	13.3	2.0	39.9
Moroni (High school)	0.0	0.1	0.2	0.9
KTC	0.0	3.0	1.8	13.5
FTC	0.0	0.8	1.0	5.3
MTC	0.0	3.0	2.0	14.2
Hotel & Restaurant	2.0	5.8	3.0	27.0
Other	10.7	0.4	0.9	14.2
Total	12.7	43.4	15.7	174.2

(5) Delivery plan

Delivery shall be made to the hospitals and schools for 5 days from Monday to Friday. Products for Saturday and Sunday shall be delivered in Friday.

Every second day delivery shall be made for KTC and KG5 which want to purchase thrice a week. For the establishments which want to purchase 6 times a week, a Friday delivery will be largest because of addition of the delivery for Saturday and Sunday. The delivery day for the Moroni High school which wants to buy fish once a week shall be Friday.

Products left for freezing in Friday will be kept in pans on the Monday morning and cannot delivery in such form. Products to be delivered in the Monday morning must be prepared in Friday.

The delivery plan to minimise the number of delivery is as follows.

Table 2-14 The delivery plan to minimise the number of delivery

Number of delivery	Mon	Tue	Wed	Thu	Fri	Sat	Sun
3 deliveries		■		■	■ ←	□	
6 deliveries	■	■	■	■	■■ ←	□	

■Delivery

Table 2-15 Products necessary to deliver on Friday (Weight in loin equivalent)

Customers	Purchases a year (t)	Weight in loin equivalent	Number of weeks to delivery in a year	Delivery times per week	Delivery times per year	Purchases per delivery (kg)	Ratio of delivery frequency	Necessary delivery volume (kg)
	①	②= ①×40%	③	④	⑤= ③×④	⑥= ②/⑤	⑦	⑧= ⑥×⑦
TCH	59.2	23.68	52	6	312	75.9	2	151.8
KG5	39.9	15.96	39	3	117	136.4	1	136.4
Moroni	0.9	0.36	39	1	39	9.2	1	9.2
KTC	13.5	5.4	39	3	117	46.2	1	46.2
FTC	5.3	2.12	40	6	240	8.8	2	17.6
MTC	14.2	5.68	52	6	312	18.2	2	36.4
Total	133.0	53.2		57		294.7	-	**397.6**

Three customers, KCH, FTC and MTC, requires 102 kg in total on Monday, and products of 102 kg must be stocked by Friday. Hence Friday necessitate about 500 kg including the day delivery of 397 kg.

Furthermore, processed products must be stored until the freezing work begins and the stockpile for the poor season must be stored as much as possible.

(6) Stockpile for the poor season

In the high season (30 weeks from May to November) 6 times processing a week will be done (180 processing days). Since demand is even throughout the year, as Table below, the surplus during the high season can be stocked for the poor season.

Table 2-16 Stockpile in the high season

Items	Processing raw fish a processing day ①	Processing days in high season ②	High Season Total ③
Processing raw fish in high season	630kg/day	180days	113,400kg
Average required raw fish throughout the year	580kg/day	150days	87,000kg
Differentials			26,400kg

When this raw fish of 26,400 kg are to be stocked in loin form with high demand, since the yield rate of loin is 40%, 26,400 kg x 40% = 10.56 tons shall be stocked for the poor season.

2-3-3 Determination of scale

2-3-3-1 Determination of the scale of facilities

(1) Ice making plant

1) Background of introduction

A. Utilization of ice

a. Utilization situation at the Project site

There are two sets of ice plant; a 700 kg/day capacity plant at Temaike firm and a 1,000 kg/day capacity one operated by Fishermen's Cooperative at Bairiki, totaling only 1.7 t/day. Thus ice is always in short supply for fisheries as well as public use, and almost all fishermen are never using at their fishing activities, while part of retailers selling their fish at roadsides are using ice made at domestic refrigerators but they are very few. All remainders of the day are used for feed for livestock or discarded.

b. Activity of OIFP

Three islands among main four islands covered by OIFP have a fisheries center with an ice-making facility, controlling freshness of catch throughout fishing activities. The rest one island is expected to have the same center by the end of this year. On the other hand, all the cooling system at Tarawa at which OIFP's headquarters is located is now out of order, and fish products transported from outer islands are put in charge of TML until processing, while ice are being made in TML's cold storage facility to use for processing or transportation.

B. Ice of the Project

a. Quality control by ice

OIFP rejects fish products of fishermen not using ice for keeping freshness. This decision is now applied to the above-mentioned three islands, and fishermen at Tarawa are to be regulated by this decision in the future.

b. Buying from Tarawa fishermen and ice

The Project plans to buy fish products of some one ton weekly (45 tons in a year; 25% of total target volume) from Tarawa fishermen, but it is feared that increase of rejection or short of target volume and thus serious influence unfavorable for both fishermen and processing plant due to such small quantity of ice production as 1.7 t/day. The following is the outline of the artisanal fisheries at Tarawa Atoll.

Table 2-17 Outline of artisanal fisheries at Tarawa

	South Tarawa	North Tarawa	Total
Number of households	3,415	597	4012
Full time (households)	253	95	348
Part time (households)	173	71	244
Subsistence (households)	2,100	431	2,531
Number of canoes	160	114	274
Number of FAO type canoes	10	15	25
Number of skiff	95	44	139
Others	0	1	1
Marine fish (kg/w)	20,552	822	21,374
Reef fish (kg/w)	2,353	3,095	5,448
Lagoon fish (kg/w)	29,974	14,021	43,995

C. Necessity of ice-making plant

Fish products necessitates freshness control from the catching stage to consumption due to their perishability. Since Tarawa is not only in the tropics but also has a diffusion rate of home refrigerator as low as only 10%, utilization of ice must be encouraged more.

Under these circumstances, for the Project to produce foodstuff for public it is essential to introduce an ice-making plant to prevent food poisoning as well as reduction of import of food, accounting for near half of total import of Kiribati.

2) Scale of plant

A. Outlet of ice and its volume

a. For Tarawa fishermen covered by OIFP

The Project plans to buy one ton of fish a week from Tarawa fishermen using ice. Necessary volume of ice for this purpose is as follows.

Daily buying volume of fish 1 ton/week (5 days) = 200 kg/day

Average catch per fishing boat 40～60 kg/day, then 50 kg/day is applied

200 kg/50 kg = 4 boats

To secure buying of 200 kg a day, the Project shall contract with 10 fishing boats.

The ratio of ice to fish is 1: 1 in accordance with FAO standard.

Hence, required volume 50 kg/day x 10 boats = 500 kg/day

b. For arrival from outer islands

Fresh fish will arrive 2 times a week from outer islands; 380 kg/time from Abaiang and 646 kg/time from Maiana. Since these products are carried for some 3 hours being

exposed to the direct rays of the sun, ice inside each insulated boxes are almost melted. At the processing plant ice must be added in boxes to keep freshness until processing process starats. Then, required volume of ice will be decided as follows.

Total arrivals a week (380+646) x 2 times =2050 kg/week

Assuming that ice of 25% of weight of fish should be added 2050 x 0.25=512 kg/week

When the weekly operating days of ice plant are 5 days, required volume of ice a day is

512 kg/ 5days = 102 kg/day (100 kg/day)

c. For processing

Daily processing volume (at the peak of fishing season) is 630 kg/day. When applying the ratio of fish to ice of FAO standard, required ice for preservation of raw fish before processing process starts is 630 kg/day x 1 =630 kg/day

d. For delivery

No cooling is necessary during delivery because major customers are in less than 40 minute drive by pickup truck.

e. For retail selling

For retail shop in the facility, retailers on roadsides, and domestic use, 100 bags of 1 kg bag shall be prepared.

f. Total required volume of ice

For contracted fishermen	500 kg/day
For arrivals	100 kg/day
For processing	630 kg/day
For retail selling	100 kg/day
Total	1,330 kg/day

Allowing reservation of 10% 1,330 x 1.1 = 1,463 kg/day

B. Specifications of ice-making plant

a. Number of system

The plant is most important system of the project, and its breakdown or stoppage will exert serious influence on the Project. Two sets, each 1.0 t/day capacity, shall be applied.

b. Kind of ice

Ice of the Project is mainly used for processing, and for processing plate ice or flake ice are used in general. The Project shall use plate ice slower-melting than flake ice due to shortage of absolute quantity of ice and as high air temperature as 30 ℃.

(2) Ice bin

1) Storage capacity

Ice production can be controlled by the number of systems, not the production of the system, due to its constant production capacity. Hence the storage capacity for 2 days production shall be prepared.

A. Measure to meet high demand

A measure to meet large demand in a high fishing season, good catch, or simultaneous going for fishing must be considered.

B. Measure to meet maintenance demand

Ice must be supplied during maintenance or repair of a system or generator.

Storage capacity 1 ton/day x 2 days = 2 tons/room

C. Capacity

Storage capacity (V) = Weight/weight per unit capacity

$V = 2000 \text{ kg} / 400 \text{ kg/m}^3 = 5 \text{ m}^3$

D. Preserving temperature

It is apprehended that ice becomes a dumpling by rising the inside temperature when the door is opened and shut due to rather small capacity. The inside of the ice bin shall be kept overcooling at –10 ℃ to prevent this phenomenon.

(3) Freezing system

1) Background of introduction

A. Distribution of fish products

a. Catch

Fishing season of the Gilbert Islands is divided into 2 seasons; the high fishing season (7 months from May to November) and the poor fishing season (5 months from December to April) and some 75% of total catch are landed in the high season. Comparing average monthly catch between two seasons;

a) High season 1 x 0.75 x 7/12 = 0.44
b) Poor season 1 x 0.25 x 5/12 = 0.10
c) The ratio of the catch in the high season to the one in the poor season is 4:1; that is, the catch in the poor season is only 20% of the one in the high season.

b. Distribution of fish products

a) Tarawa Area

Tarawa, the capital of the country, in which some 30% of total population are living,

must import fish and fish cans from Peru and neighbouring countries to cover the shortage in the poor season.

Table 2-18 Progress of import

Items	1987	1989	1991	1993	1995
Foodstuff	8,080.0	8,669.0	9,953.0	11,923.0	15,407.0
Luxuries (tobacco, liquor, etc.)	1,588.0	1,506.0	2,285.0	2,641.0	3,134.0
Natural raw materials	574.0	451.0	503.0	891.0	674.0
Petroleum	2,960.0	3,201.0	3,631.0	3,032.0	4,782.0
Oil and fat	44.0	126.0	83.0	119.0	170.0
Chemicals	1,371.0	2,389.0	1,838.0	2,645.0	3,475.0
Industrial goods	3,564.0	2,949.0	4,113.0	5,016.0	9,091.0
Machinery, transportation equipment	7,661.0	6,585.0	8,241.0	10,089.0	6,904.0
Others	2,346.0	2,720.0	2,579.0	4,518.0	3,910.0
Total	28,188.0	28,596.0	33,226.0	40,874.0	47,547.0

Source: Kiribati Authorities

As shown above table import of foodstuff accounted for 32.4% of total import in 1995.

b) Expectation to the Project

TCH and various schools (KG5, FTC, MTC, etc.) have a problem on the shortage of fish products. TCH is forced to serve salt-rich food such as corn beef, curry beef, or curry chicken to patients due to short supply of fish. Also rather expensive imported foodstuff becomes a budgetary problem. The expectation to the Project allowable for stable distribution of fish products throughout the year is very high.

B. Controlled supply of fish products

The population Tarawa is 28 thousand, and an annual per capita consumption of fish is 150 kg, thus annual total consumption stands 4,200 tons. Since the Gilbert Islands produces some 250 thousand tons of fish, its 20% can cover demand of Tarawa. It means that preservation of surplus of catch in the high fishing season makes it unnecessary to import fish products, resulting in improvement of balance of trade.

C. Storage of fish products

About 70% of fish products handled by the Project are tunas, remainings are reef fish. Fish products are very perishable, and failure of freshness control makes flush of tuna orange meat or soft meat, unsuitable to eat, or produce vibrio anguillarum, resulting in food poisoning. To prevent these phenomenon it is best that biological, chemical, or

physical changes should retard or propagation of bacteria should be restrained. Generally speaking, quick freezing and the low-temperature preservation are applied such perishable foodstuff as fish products. The Project will keep surplus fish caught in the high season for 7 months the longest. A quick freezing system is essential.

D. Kind of freezing system

a. Object of freezing

Objectives of freezing in the Project are as follows,

a) Processed fish (loin or filet) and round reef fish.

b) Surplus caught in the high season.

b. Selection of the system

When only (a) above is frozen a contact freezer system is useful, but if both (a) and (b) are frozen a batch freezing system (air blasting, hair-pin coils) is best from the standpoint of price of equipment, running cost, easiness of operation, etc.

Since a volume handled at one time is less than 1 ton and operation will be only one round a day in the Project, works putting products in and out shall be done manually.

2) Scale of system

A. Designed freezing volume

a. Daily designed freezing volume is as follows

Table 2-19 Average Freezing Volume

Objective	Average size (mm)	Average weight (kg)	Handling volume (kg)		
			High season	Poor season	Difference
Loin	250L/100W/70H	1.0	188.2	132.5	55.7
Filet	300L/85W/20H	0.25	65.5	51.4	14.1
Reef fish	300L/150W/35H	0.3	52.2	41.4	10.8
Round tuna	1200L/300W/200H	20.0	100.0	0	0
Total			405.9	225.3	180.6

. Note: In high season operation continues for 6 days, but in poor season 4 days operation and one day maintenance shall be applied.

As mentioned above, the prime purpose of freezing is stabilisation of distribution of fish products in the poor season. Daily freezing volume of the Project shall be 405.9 kg, average in the high fishing season, to produce long-period preservation products.

b.. Freezing method

a) One freezing is done a day.

b) Standard type freezing pan (15 kg pan) shall be used.

Size of pan 680L x 410W x 75H = 0.02 M^3= 20 liter

B. Required number of freezing pan

Storing performance in the past shall be applied.

a. Loin: 13 pieces (13 kg)

b. Filet: 52 pieces (13 kg)

c. Round fish 23 fishes (7 kg)

d.Round tuna 1 fish (20 kg)

Required number of pans are as follows

Table 2-20 Number of pans

Freezing items	High season		Poor season	
	Weight	Number	Weight	Number
Loin	188.2	15	132.5	10
Filet	65.5	5	51.4	4
Reef fish	52.2	8	41.4	6
Round tuna	100.0	5	0	0
Total	405.9	33	225.3	20

Pans shall be prepared for 2 rounds plus reservation, that is; 70 pans (33 x 2 = 66 plus reservation).

C. Determination of freezing size

Dimension of hair-pin coils 3,450L x 680W x 1,770H (5 columns)

Number of pans 6 pans x 5 columns = 30 pans

E. Freezing hour

Temperature of processed loin, +30 ℃, shall be cooled to –22 ℃ at the centre of its body for 15 hours.

3) Preparation room

A. A preparation room is necessary for the freezing system.

a. Objectives of the preparation room

The following works shall be done in the preparation room

a) Preservation of raw fish until processing.

b) Pre-cooling of processed products

c) Extraction of products from the pan, glazing, and inspection of products, and packing.

b. Necessity of the preparation room

a) Prevention of delay of working

From the standpoint of working process it is best to place the freezing room next to the processing room. But the temperature difference (about 50℃) between the freezing room (less than – 30℃) and the processing room (+25℃) produces a dense fog in the processing room when the door separated two spaces is opened for taking out/in works of products (some 2.5 hours) in the processing room, which situation makes the processing works delay due to poor visibility. Also vapor and dew give damages to various electric apparatuses. In order to prevent these phenomena a preparation room is necessary.

b) Control of quality of products

Fish products of 630 kg (12 insulated boxes) shall be preserved until the processing work starts every day.

c) Pre-cooling before freezing

Processed products are produced 48 kg per hour and they must be preserved until freezing. Also, since freezing is most power-consuming, it is necessary to reduce freezing hours as short as possible. For this purpose pre-cooling must be carried out in the preparation room. Pre-cooling demonstrates the following effects.

Table 2-21 Pre-cooling demonstrates

	Temperature	Heat value to be removed Kcal/h	Effectiveness %	Hours to be reduced Minutes	Running cost (yen)
No pre-cooling		0			2880
Target temperature for pre-cooling	20℃	2000	3.9	35	2746
	15℃	4000	7.8	72	2472
	10℃	6000	11.6	114	2123

Note: Processing products: 500 kg, Specific heat of product: 0.8 kcal/kg

Temperature of product: 25℃

When the temperature dropped to 15℃ by pre-cooling, ¥106,080 (A$ 1,326) of the yearly running cost can be saved. This amount is equal to the cost of 1,894 liter fuel oil, which makes a 65 KVA generator operable for 200 hours (7 days).

B Scale of the preparation room

b. Required space

a) Raw fish to be processed

Since 630 kg raw fish are stored in 12 insulated boxes, 1.0 L x 0.5 W x 0.5 H (m)each, the required area is (1.0 x 0.5) x 12 = 6 m^2.

b) Preservation of processed products

Products (loins) are stored in a fish box with a lot of 15 pieces, and carried to the existing 50 ton cold store.

Number of products: 252 pieces

Number of fish boxes: 252/15 = 17 boxes

Size of fish box: 0.5L x 0.4W x 0.2H

0.5 x 0.4 x 17 = 3.4 m^2

c) Glazing tank

Dimensions of tank: 1.0L x 0.6W x 0.75H= 0.45

Base area of tank: 1.0 x 0.6 = 0.6 m^2

Hence, the required area shall be a+b+c = 10.0 m^2 (not including a working space)

D Cooling system

An air blast system with a ceiling type cooling machine shall be provided to cool the inside uniformly and maximize the utilization of the space.

(4) Desalination system

1) Background of introduction

A Situation of freshwater supply in Tarawa

Tarawa's soil has little water-holding capacity due to coral reef. Fresh water for daily life relies completely on rainwater. Households are using water collected in their concrete tank, and the public water service is supplying water collected on the runway of the air port.

At the proposed site the public water service is not useful due to lower supplying pressure of 0.2 kg/cm^2, and two rainwater tanks, 50 ton and 30 ton respectively, are being used.

B Situation of rainfall

a) Rainfall for the past 3 years

Appendices 5.A-20 shows the rainfall of 8 years from 1991 to 1998, when El Nino has continued. The definition of a "drought" is relativistic. When a "drought" in a given area is discussed, the population, industries, geographical features, etc. must be considered. Tarawa has no mountains and rivers, and consists of coral reefs. Less than 100 mm rainfall per month is thought of "drought" in Tarawa in this report. The followings are found in Appendices 5.A-20

a. “Drought” years are concentrated in years after 1995, accounting for 87.2% the period between 1995 and 1998.

b. There were 31 “Drought” months (32.3%).

c. Comparison of rainfall between an average of 33 years and the past 3 years

Average of 33 years in Appendices 5.A-21 covers between 1965 and 1998. From the data, little change is found between the average of 33 years and the past 3 years. The rainfall for the past 3 years, however, is smaller than the average of 33 years. In the average of 33 years the rainfall is decreasing slowly from January toward December, while drastic fluctuation are found in the past 3 years, in particular, no rainfall month was experienced twice in 1997. Regarding abnormal phenomena the Kiribati Meteorological Office says that hydrological phenomena came to an end in 1998 October but their influence will last until about 2003. Based on the Office's forecast, the Government of Kiribati has introduced a 100 ton type desalination system to maintain welfare of the people 1999 June.

When the “drought” occurs again, the Project utilizing the 50 ton rainwater tank of TML will be forced to stop its operation for 3 days as follows.

- Area of the roof of TML building: 16 L x 23 W = 368 m^2
-Rainfall 100 mm/month
-Water consumption of the Project: 12 ton/day

Assuming that the loss by evaporation and resistance is nil

-Collectable water volume: 368 m^2 x 0.1 m/month = 36.8 m^3 (36.8 ton/month)
-Operation day 36.8 ton/12 ton = 3.06 day (only 3 days)

C. Necessity of the system

Needless to say, a stable sufficient water supply is essential for a processing plant of fish products, consuming more freshwater for ice production, washing fish and equipment, sanitation to maintain quality, etc. than other production plants. It is absolutely necessary for the Project in Tarawa being in danger of “drought” to introduce a desalination system.

2) Scale of the system

A. Required volume of fresh water

a. FAO standard

FAO decided the utilization standard of fresh water at a processing plant in 1988 as follows.

Table 2-23 Standard of fresh water at a processing plant

Utilization	Ice production	Washing fish	Washing fish boxes	Cleaning the plant	Workers	Others

Required volume	1200m²/T	1L/kg	10L/m²	10L/m²	100L/person	See Note

Note: Others are freshwater to wash stalls, vehicles, etc., 15 % of total volume from “ice production” to “workers”.

b. Required volume of the Project is decided as follows

Table 2-24 Required volume of the Project (Unit : Liter)

Item	Design	Required volume	Note
Ice production	2000kg	1200 x 2.0=2400	
Washing & processing fish	630kg	1.0 x 630 =630	
Washing fish boxes	110boxes	10 x 110=1100	
Cleaning the plant	368m²	10 x 368=3680	
Workers	14 persons	100 x 14=1400	
Subtotal		9210	
Others (Vehicle, etc.)		9210 x0.15=1382	
Total		10592	

Allowing 10% reserve, required volume is 10,592 liter x 1.1 = 11,651.2 liter/day

c. Scale of the system

The system of production capacity of 12 ton/day makes it possible for the Project to operate stably. Regarding each system of 13 ton type, 30ton type, and 50 ton type, its installation cost, operation cost, maintenance cost, etc. shall be compared.

a) Power cost

Table below shows the power cost of each system. The yearly power cost of 50 ton type is cheaper by some 23% than the one of 13 ton type. Similarly, the yearly cost of 50 ton type is cheaper by some 39% than the one of 30 ton type. The 30 ton type shall be excluded due to less cost efficiency.

Table 2-25 Comparison of power cost

Item Capacity	13 t /day	30 t/day	50 ton/day	Remarks
Production hour/day of 12 t freshwater	22.2	9.6	5.8	The running cost of 30 t type is most expensive. The yearly running cost of 50 t type is lower by some ¥100 thousand
Required power: kw/h	4.6	12.0	14.4	
Required power per day	101.9	115.2	83.17	
Running hour a year	8086.2	3504.0	2102.4	

Required power for successive running throughout the year	37196.3	42048.0	30358.7	(12%, 1,832 l in fuel oil equivalent) than the 30 t type.
Power cost at ¥15/kw	557945	330720	455380	

b) Comparison of maintenance cost

Details of maintenance cost are shown on Appendices 5.A-22. The maintenance cost of 13 ton type is rather high due to longer running hour and more spare parts. The maintenance cost of 50 t type is less than 13 ton type is rather low due to less running hour (1/4 of 13 t type).

c) Comparison of maintenance cost

Appendices 5.A-22 shows comparison of the maintenance cost of 13 t type and 50 t type. The maintenance cost of 13 t type is less than the one of 50 t type, and the cost differentials become large more and more as years go on.

A 50 ton type system can produce freshwater of 12 tons necessary for the daily operation of the plant of the Project with the only 6 hour running, and such short time production makes it possible for the plant to meet the peak demand of water.

Taking above factors into consideration, a 50 ton type desalination system shall be introduce.

(5) Elevated water tank

1) Background of introduction

A . Situation of water supply

Water supply at Tarawa is greatly affected by precipitation. A 50 ton freshwater tank was granted from Japan in 1982 and the Government of Kiribati constructed a 30 ton freshwater tank, sufficient now for ordinary use.

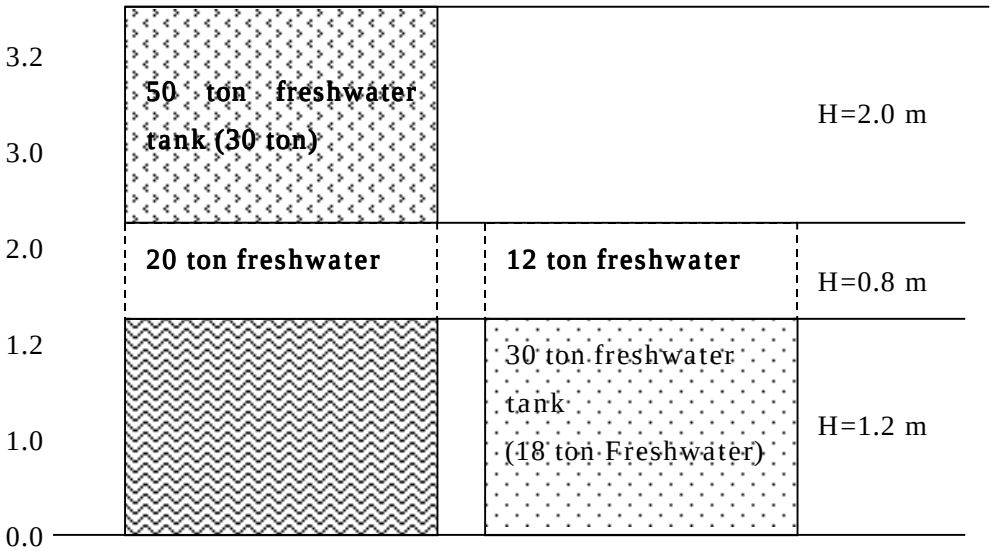
Location of freshwater tanks

Figure 2-1 Location of freshwater tanks

B. Present conditions of on freshwater tanks

a. Two tanks are not connected. The floor of the 50 ton tank is GL+1.0 m, while the one of the 30 ton tank is almost equal to GL.

b. The 50 ton tank is located near the processing plant, while the 30 ton tank is far away about 50 m ant its sending pipe and pump is broken. In order to use two tanks, a connection pipe (100 m long) and water pump shall be prepared. In this case, when 20 tons of water is accumulated in the 50 ton tank the 30 ton tank is overflowed due to the difference of elevation of two tanks. On the contrary, when the 50 ton tank is used first 18 tons of water in the 30 ton tank becomes standing water unsuitable for food processing.



Fighre 2-2 Relation between two tanks

c. The designed consumption of water is some 12 tons a day. The 50 ton tank keeps 4 days consumption. The Project will use only this tank.

C. Necessity of an elevated tank

An elevated tank is necessary to distribute required water under equal water pressure. A pressure pump is not suitable for a processing plant which requires lots of water because its capacity is generally limited, 2 kg/cm^2 x 2 liter/minute.

2) Scale of elevated tank

A. Designed consumption of water

Table 2-26 Designed consumption of water (Unit:Liter)

Items	Designed	Required volume	Note
Ice production	2000kg	1200 x 2.0 = 2400	
For washing fish, processing	630kg	1.0 x 630 = 630	
For washing fish boxes	110boxes	10 x 110 = 1100	
For washing floor	368m^2	10 x 368 = 3680	
Staff and workers	14 members	100 x 14 = 1400	
Subtotal			
Others	15% of subtotal	9210 x 0.15=1382	
Grand total		10592 L/day	

B. Required water when works are concentrated

The time zone when water is most consumed is about 1 hour before the close of work. The following works are conducted in this time zone.

Table 2-27 Water Consumption (Unit : Liter)

Works	Location	Minimum required volume
Washing fish boxes: 110 boxes	Processing plant	10 x 110 = 1100
Washing the floor: 368 m^2	Handling space	10 x 368 = 3680
Others		9210 x 0.15=1382
Total		6162L/day

C. Capacity of elevated water tank

The capacity of the elevated water tank is determined as follows

a. Least required volume is about 6200 L/h.

b. The capacity shall be always reserved in the tank to keep equal water pressure, taking piping resistance into consideration. The water demands of 1 hour is 6,162L, this means the flow of the water need 103L/min. For the Pump the capacity shall be more than 103/L. In this case more suitable pump capacity is 110L/min including work loss of the pump.

The capacity of the elevated water tank shall be full at 30min.

110L x 30min=3.330L :about 3,000L

Hence, one elevated tank, 3,000 L capacity, shall be installed.

(6) Generating system

1) Background of introduction

The site survey at Basic Design Study revealed the present situation of power at Tarawa as follows;

1. Public power supply

There is a power plant at Betio, 500 m away from the TML office building. It is 30 years old and its 2 generating sets are serviceable, while 3 sets were removed due to superannuation. The present supplying power is 1.5 – 2.3 MW against the requirements of 3 MW and the power stoppages and voltage fluctuation beyond an allowable range are frequent.

Based on this situation, taking the fact that the cost of self-generating system is cheaper than the public system into consideration, TML has been running and maintaining an independent power plant since commencing its operation in 1983.

Table 2-28 Cost comparison between public and independent systems

Item	Unit price	Monthly cost	Consuming power	Remarks
Public	A$ 0.35/kw	A$15,000	42,857kw/M	One liter of heavy oil can generate a power of 11.836 kW
Independent	A$0.50/L	A$3,650	43,200kw/M	

Note: Labor cost is not included in the cost of Independent system (hearing survey and TML materials)

2. Power system of TML

TML has 3 generator sets, 75 KVA (60 kW) each, granted by Japan in 1988. They have been used effectively for more than 10 years, and were operated under normal conditions in August 1999 when the Basic Design Study was carried out. But No.1 and No.3 generators were stopped and No.2 generator only was serviceable with difficulty through lubricating the system with 200 L oil per 3 days (normally 3 – 4 L a day) in November when the Draft Explanation was conducted.

A hearing survey was conducted and a working journal was checked to investigate causes and determine measures to be taken. The results were summarized as follows;

a. Working journal

Working journals from September 1993 to July 1999 were kept, but running hours, mechanical troubles, days of stoppage, etc. for each system were not recorded. Procurement of spare parts was not confirmed due to absence of the person in charge.

b. Hearing survey

The results of the hearing from the manager and the refrigeration engineer (responsible for the generating system) were as follows;

-Expendables such as seals, gaskets, filters, etc. were exchanged.

-Procurement or exchange of parts of the crank shaft, bearing metal, governor, oil pump, radiator, etc. are not within memory.

-All the three sets were put in order in 1996 when severely worn parts were renewed. No.1 generator was stopped due to overheating, and No.3 due to damaged supercharger. Too much consumption of lubricating oil of No.2 is caused by worn piston rings and gaskets, but no spare parts are available.

2) Analysis of the survey results

- Running hours of generator

Though exact running hours are unknown, taking the hours of stoppage due to troubles or maintenance into consideration, the running efficiency of generators is estimated at about 90% for 10 years since the provision by the grant aid. The average running ours

of each generator are then calculated as follows;

365 (days) x 10 (years) x 24 (hours) x 0.9 x 2/3 = 52,560 hours

52,560 hours = 2,190 days = 6 years

Since the depreciation period (serviceable years) is 7 years, theoretically each generator can be operated for more one year, but it may safely be said that it is deemed to be used more than 7 years because no maintenance or overhaul was given even every 3,000 or 6,000 running hours.

- Skill for maintenance

Taking the fact that TML's staffs have managed for facilities and equipment in spite of troubles into consideration, it is clear that they have skill for operation and maintenance.

- Present conditions

Parts necessary for day-to-day running or of cheaper price (useful but not pure) have been renewed as occasion demands. But any essential part has never been exchanged due to costly and burdensome overhauling work with disassembly and inspection. All the generators, including crank shafts, bearing metals, and governors, should be overhauled thoroughly due to too much wear tear.

- Necessity of the system

Taking an unstable power supply and larger voltage change resulting in burning of apparatuses or deterioration of product quality into consideration, it is absolutely necessary for the Project to introduce a new generating system.

3) Scale of the system

- Existing system

TML has a 100 ton cold store (-35℃) ranted in 1983 and a 50 ton cold store (+5℃～ -35 ℃). The existing generating system is capable to supply required power the these cold stores.

- Generating system for processing facility and equipment

The capacity of the existing power system is 225 KVA (75 KVA x 3 sets). The Project, including facilities, equipment and materials, requires a power of 171.25 KVA at total, and hence the existing system is to be capable of supplying necessary power to the Project at an economical load factor of 76%. However, if one of generators is stopped due to trouble or maintenance, the power will be insufficient, resulting in suspension of the operation. Furthermore, the Project must handle and process the foodstuffs and supply them for such public institutions as hospitals and schools. Hygiene is the most important aspect of the Project. Hygiene management and quality control require a

stable supply of ice and a stable operation of the cold storage and freezing systems. In order to meet these requirements one set of 75 KVA generator should be provided.

- Accompanied works and accessories

The overhaul work of the existing system is accompanied by some additional works; painting fuel oil tanks, arranging fuel oil transfer pumps, burying oil piping, etc. With the provision of the new generator, an incoming panel, a switchboard, a distribution panel, and wiring materials shall be provided.

(7) Air conditioning system

1) Background of introduction

A. Situation of processing of fish products

OIFP is the only public processing plant in Tarawa, while two private companies are operating, one for tuna jerky and the other for salt/dry products.

B. Products of OIFP

OIFP is producing such processing products as loin and filet for hospitals and schools. At present, OIFP deposits its raw fish with TML's cold store due to the breakdown of the cooling system, and takes them out at each processing work, limited from 6 a.m. to 9 a.m. or 6 p.m. to 8 p.m. With this poor operation, OIFP's share of fish products market is less than 1 %. The reason why OIFP is continuing bad operating that it is difficult for OIFP to control freshness of raw fish and products due to lack of suitable facility and equipment for processing.

C. Fish processing and food sanitation

The Project plans to mainly process tuna. Failure of control of freshness of tuna makes flesh of tuna orange meat or soft meat, unsuitable to eat, and also spoilage of fish products produces vibrio anguillarum, staphylococci, salmonellae, etc. resulting in food poisoning. Since fish products produced by the Project are to be consumed at such public institutions as hospitals and school, extreme care shall be used to prevent such food poisoning.

D. Necessity of air conditioning system

In order to improve above-mentioned situations, it is essential to prepare working environment suitable to processing together with the introduction of cooling/freezing system, and as one of such measures an air conditioning system shall be introduced.

2) Scale of the system

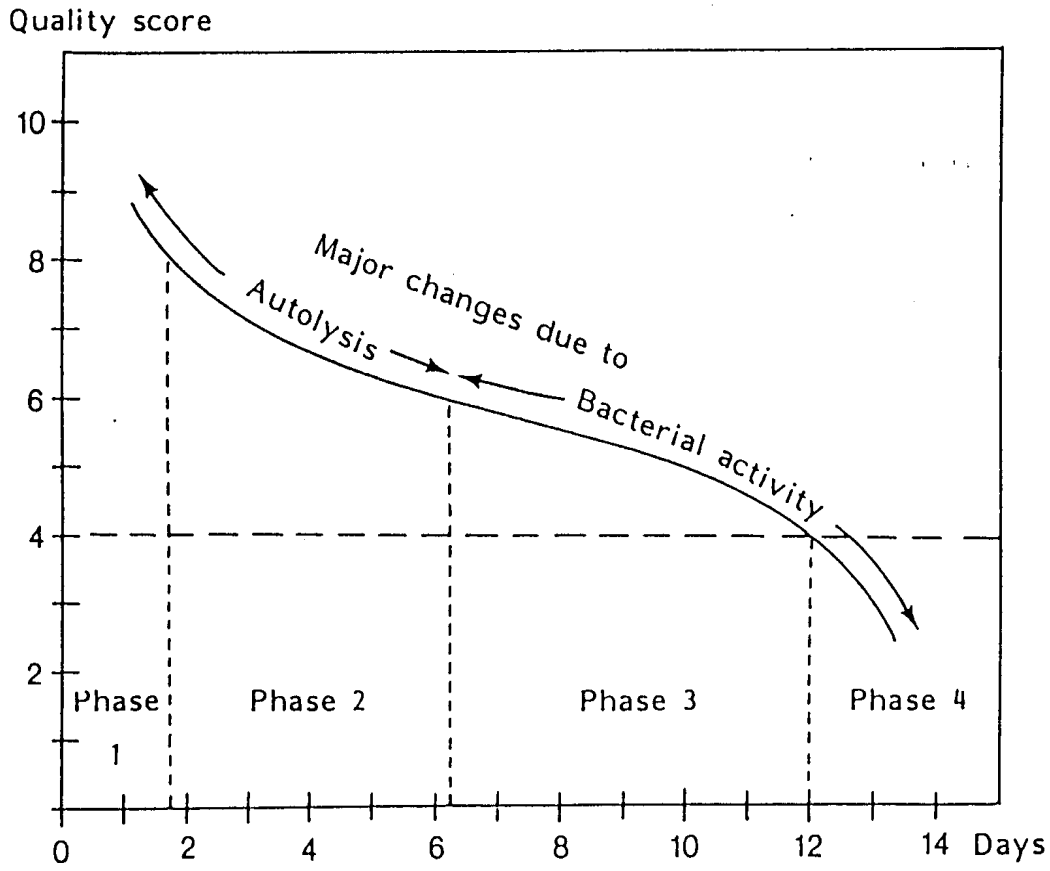
A. Related standard

Recently HACCP is applied to food processing, but it does not regulate such environmental standard as air temperature and a humidity in a processing plant. The hygiene standard of EU regulates room temperature at less than +15 ℃, but no humidity is described. There is no general standard in Japan, and 18 to 20 ℃ temperature and 60% humidity are generally applied.

B. Results of a study

According to a study in a fisheries institute in Denmark the relation between preservation temperature (X axis) and preservable days (Y axis) of fish products is shown as Figure 2-3 following page. It shows the lower preservation temperature is the longer fish products can be preserved.

Average daily temperature at Tarawa stands at 28 ℃, exceeding 30 ℃ between 11 a.m. and 2 p.m., and so fish products begin to become stale within only one day according to Figure 2-3. It is necessary for prevention of spoilage waste or food poisoning to control room temperature and humidity under a constant level to restrain propagation of bacteria.



Fighre 2-3 quality score of temperature and humidity

C. Capacity of the system

Since fish products of the Project is exclusively for domestic use and the freshness of raw fish is kept to some degree before processing, the capacity of the proposed system shall be determined based on the following conditions.

- Working efficiency shall be considered together with freshness control. The lower temperature is, the better for fish, but temperature less than 20 ℃ is really not bearable to I-Kiribati, people in the tropics. Hence, 23 ℃ shall be applied.

- Heat load

Capacity of processing room: 170 m^2 x 2.2 mH = 3,741 m^3

Table 2-29 Designed temperature and humidity

	Present	Designed	Difference
Ambient temperature (℃)	30	23	7 deg
Ambient humidity (%)	85	60	25
Absolute humidity (kg/kg)	0.023	0.905	0.882

Hence, immersion heat from the outside is calculated to be 3,548 kcal/h

Heat load by lighting, workers, machinery: 4,753 + 3100 = 7,853 kcal/h

Total heat load is 11,401 x 1.1 = 12,541 kcal/h.

D. Installation of the system

Three sets of coolers and one regulator shall be installed in the processing room. Other cooling units shall be placed in the machinery room, controlled by the engineer collectively.

2-3-3-2 Determination of the scale of equipment and materials

(1) Equipment and materials for processing

1) Processing table (5 units)

Fish boxes table of concrete made are now being used for processing instead of the locally-made so-called processing tables unsuitable to processing work due to being rickety without adjusters. It is needless to say that the processing tables are essential for processing work. The tables must be provided.

Three workers are employed in processing work as shown in 2) of 2-3-3-3(Page2-52). The layout of the processing space is shown in Figure 2-4 (in Page2-53).

The biggest fish to be processed in the Project is yellowfin tuna, average 1,200 mm long and 250-300 mm high. Three tables with sink, therefore, each about 3,000 mm long and 800 mm wide, shall be prepared. One piece of chopping board and two pieces of fish knife shall be attached to each table.

Between the processing table and a wrapping table mentioned later a table, 2,000 mm long and 800 mm wide, on which a fish box full of processed fishes is temporarily put shall be placed. Its height shall be 880 mm, possible to adjust slightly.

The existing 4 chopping boards and one fish knife will be reserved. Three kinds of whetstone, rough, medium and finish, each one, are provided for maintenance of knives.

2) Wrapping table (one unit)

Above-mentioned so-called processing table is now used for wrapping work. It is inefficient due to being rickety and no wrap-holder. A wrapping table shall be placed independently so that blood water and flesh waste cannot mix with products. Wrapped products will be placed in the freezing pans, 680 mm long and 410 mm wide, and kept in the freezing system.

Two units of wrap-holder with cutter to wrap a product with a wrapper of 350 – 400 mm wide are attached to the wrapping table. Since a vacuum wrapping machine, 900 mm x 900 mm, and a scale will be placed on the wrapping table, its size shall be 2,500 mm x 2,500 mm and has an adjustable 880 mm height.

3) Vacuum wrapping machine (one unit)

The existing vacuum wrapping machine is for tuna jerky and is unsuitable for filet. Wrapped filets presently distributed are often broken due to its thinness of 2 cm. Provision of a vacuum wrapping machine, therefore, is pressing. A table-type vacuum

machine with an effective width of 35 cm shall be provided.

4) Band saw (one unit)

It is necessary to cut frozen by-catches of tuna or marline caught by TML's offshore fishing boats. The existing band saw is completely broken and a new one must be procured. From the standpoint of safety and salt damage, a band saw with a guide device and of salt-resistant specifications shall be provided. Also part of hand saw shall be washable.

5) High pressure washing machine (one unit)

A high pressure washing machine shall be provided for washing floors, tables, boards, boxes and so on. In the Project, one worker will be assigned for washing work, and he has to wash more than 100 boxes, taking about 5.5 hours, in the high fishing season. The provision of this machine will decrease the washing hours to about 1.8 hours, resulting in reduction of labor cost.

6) Insulated box and fish box

A. Product box (60 boxes)

The product box with metal folding handles are used for storing products and delivery. Its size shall be 500 mm(L) x 400 mm(W) x 200 mm(H), storing 15 kg fish.

At the peak season, 630 kg of raw fish will be handled, producing 299 kg of product, with 20 boxes. Also 33 boxes shall be prepared for the peak delivery of 499 kg for Friday and Monday. Adding 7 boxes as reserve, 60 boxes in total shall be provided.

B. Fish pan (70 pieces)

As shown in 2-3-3-1 (Page2-30), 70 pieces of fish pan is necessary for freezing.

C. Bucket (35 pieces) and pallet (35 pieces)

The Project plans to store 10.5 ton loin in the existing 50 ton cold store for the stockpile in the poor fishing season. For stacking the stockpile, 300 kg capacity bucket, 800 mm(L) x 800 mm(W) x 800 mm(H), shall be prepared. Required number of buckets is 10,500 kg/300 kg = 35 pieces, and the same number of pallets is also necessary for stacking using forklift. Materials shall be of stainless steel instead of galvanized steel due to food sanitation. The bucket shall be of type capable of folding to store neatly after forwarding.

D. Insulated box for transportation between islands (45 boxes)

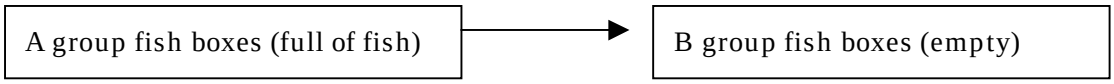
Shortage of fish boxes for transportation makes it impossible for fishermen to preserve their catch. Insulated boxes matching production ability shall be provided for each island.

Transportation from each island is as follows.

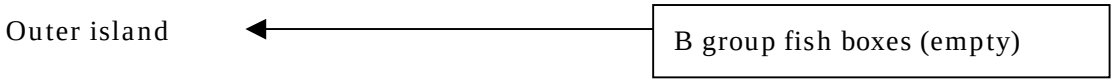
District	Weekly arrive (average)	Box capacity	No. of box	Size of box
Abaiang	746kg	50kg/box	15	1000(L)×500(W)×500mm(H)
Maiana	1292kg	50kg/box	26	1000(L)×500(W)×500mm(H)
Kuria	67kg	50kg/box	2	1000(L)×500(W)×500mm(H)
Aranuka	67kg	50kg/box	2	1000(L)×500(W)×500mm(H)
Total			45 boxes	

Boxes full of raw fish will be put in the 50 ton cold store, and the volume for one day processing work will be carried to the processing plant. Boxes for one week shall be prepared because the transportation is made twice a week.

(To the plant)



(Bring back B group fish boxes to outer island)



E. Tank for conveying and washing (2 tanks)

Raw fish in the insulated fish box will be transferred to a tank and conveyed to the processing table, and then, washed in the tank with ice water before processing. The tank must be large enough to accommodate tuna 1,200 mm long. Two tanks with caster, 1,300 mm(L) x 850 mm(W) x 750 mm (H) each, shall be provided.

(2) Conveying equipment

1) Barrow (3 unit)

Two barrows carrying fish in the insulated boxes or ice shall be provided. The size shall be allowed to carry 4 boxes (2 columns of 2 boxes), with effective space of 1,000 mm long and 800 mm wide. Besides, one wagon capable of carrying 8 fish boxes (4 columns of 2 fish boxes), shall be provided. The size of the fish box is 500 mm(L) x 400 mm(W) x 200 mm(H). All the barrows and wagon shall be of salt-resistant

specifications for food plant.

2) Forklift (one unit)

A forklift will be used for carrying cargoes between the 50 ton cold store and the processing plant or loading cargoes on trucks. The electric forklift shall be provided to avoid exhaust gas in the cold store and the processing plant. The forklift will operate fully 3 hours for a day, one hour for carrying frozen products between the plant and the 50 ton cold store and the cold preservation vehicle and transferring fish boxes with raw fish from the 50 ton cold store to the plant in the morning, one hour for preparation of forwarding in the afternoon, and another for moving and stacking fish boxes in the plant.

3) Truck crane (one unit)

A truck crane is necessary for cargo work between the wharf and transportation vessels. Since a horizontal distance between the road on the front of the plant and the berth of the wharf is 3 m, the effective length of the beam must be more than 3 m, and its lifting capacity must be more than 200 kg to lift a fuel oil drum.

Manual loading of 12 boxes, totaling 1,200 kg (600 kg fish plus 600 kg ice), needs of 18 hour/man (6 men x 3 hours), and the introduction of the truck crane can reduce the 18 hour/man to 3 hour/man.

Hence, a truck crane (2 ton type truck with one ton crane) shall be provided. The truck will be used for carrying engines for repair, spare parts, fishing gear, or pulling up 8 m type plywood fishing boats of OIFP, besides 3 to 4 hour regular loading work for a day.

4) Cold preservation vehicle

It is necessary to provide a cold preservation vehicle for delivery of frozen products to such institutional customers as hospitals, schools and restaurants.

A. Volume of delivery

Delivery will start 8 a.m. in the morning. As shown at the Table 2-30 below, the peak of volume comes Friday delivering goods for Saturday and Sunday collectively, 379 kg converting to loin.

Table 2-30 Weekly delivery volume **(Unit: kg)**

Name of customer	Number of serving fish in a week	Purchase a year (ton)	Purchasing week a year	Weight converting to loin per delivery (kg/1time)	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun
TCH	6	59.2	52	75.9	75.9	75.9	75.9	75.9	75.9	75.9	
KG5	3	39.9	39	136.4		136.4		136.4		136.4	
KTC	3	13.5	39	46.2		46.2		46.2		46.2	
FTC	6	5.3	40	8.8	8.8	8.8	8.8	8.8	8.8	8.8	
Moroni high school	1	0.9	39	9.2						9.2	
MTC	6	14.2	52	23.7	18.2	18.2	18.2	18.2	18.2	18.2	
Total					102.9	285.5	102.9	285.5	102.9	294.7	

The delivery plan will be as follows when goods for Saturday and Sunday are delivered on Friday collectively.

Table 2-31 Weekly delivery plan **(Unit: kg)**

	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.& Sun.
Delivery volume	102.9	285.5	102.9	285.5	397.6	-

102.9kg (Friday)+294.7kg (Saturday & Sunday) =397.6

B. Delivery schedule

A small pickup type refrigeration truck will be used as a cold preservation vehicle. The truck can carry 27 fish boxes (3 columns of 9 boxes) of each 15 kg capacity, totaling 405 kg fish product at a time. Based on the delivery plan above the weekly delivery will conduct as follows.

3 times a week

Plant ~ 40 km KCH ~ 1 km FTC ~ 38 km ~ MTC~ 4 km Plant

Going and returning 83 km (3 times a week)

Twice a week

Plant ~ 40 km ~ 1 km KG5 ~ 1km KTC ~1 km ~ FTC 38 km MTC ~ 4 km Plant

Going returning 85 km (twice a week)

Once a week

Plant ~ 40 km KCH ~ 1 km KG5 ~ 1 km KTC 1 km ~ FTC ~ 18 km Mormon school ~ 20 km MTC 4 km ~ Plant

Going and returning 85 km (once a week)

The total distance is 83 km x 3 + 85 km x 3 + 85 km x 1 = 655 km a week.

Besides, the delivery to the restaurants will be conducted.

The daily driving hours are 3 to 4 hours, driving by the driver who is now employed by

OIFP. Maintenance and repair will be made at the workshop of TML. Spare parts are available at local dealer's shop.

(3) Equipment of the retail shop

1) Chest freezer (one unit)

A chest freezer is necessary for selling fish at the new retail shop. The 800 liter type freezer (-25 ℃), commonly used in Kiribati, is supplied.

2) Showcase (one unit)

The newly installed retail shop must become a model fish shop in sanitation. Fish products of about 20 kg a piece will be demonstrated and sold in the showcase. The size will be 2,400 mm (L) x 700 mm (W), and the demonstration shelf of 1.0 to 1.5 m^2 will be provided. Cooling temperature will be designed at 0 to –5 ℃.

(4) Scale weighing machine

All scales shall be of salt-resistant type.

A Retail shop	15 kg table type
B Processing plant	15 kg table type
C For selling ice	200 kg floor type
D For weighing fish	200 kg floor type

(5) Computer

The computer which OIFP is now using is too old, 1982 model, to use for accounting and collecting/analyzing data. A new model one must be introduced. Also a printer system is necessary for printing bills, reports, and other documents. The IBM type, the similar type which TML is now using, shall be introduced with WINDOWS as operating system in English writing and a software for calculation. A software for accounting shall be provided by TML.

(6) Live well for lobster

The existing lobster live well cannot keep lobster transferred from outer islands alive for more than 3 days due to no aeration system. Since one arrival of lobster is about 38 kg average (some 50 lobsters) and one lobster occupies an area of 0.45 m x 0.45 m, a base area of some 10 m^2 is required. The proposed well shall be fixed to the concrete floor in the facility in the same way as the one of OIFP. The followings are necessary to install the live well.

A. Aeration system

The installation of the aeration system makes it possible to keep lobster alive for longer period with increasing dissolved oxygen and agitating water.

B. Air stone

An air stone is necessary for better dissolving of air.

C. Air tube

5 m long air tube is required to connect the aeration system with the air stone.

2-3-3-3 Scale of the facilities

(1) Scale of the integration of fisheries foundation

Based on the conclusions of Paragraphs 2-3-3-1 and 2-3-3-2, the equipment and materials shall be arranged and installed functionally in one building.

From the standpoint of function and management of the integration of fisheries foundation, an ice-making/storage facility, cold storage facility, freezing store, and freezing system shall be arranged around a handling space and processing room, connecting with passages in the existing brine freezing/ice-making plant area of the existing building.

One extended building shall be attached to the existing building, in which a fish retail shop, office, toilets, and locker room shall be placed.

Finally, the integration of fisheries foundation will consist of the existing one-story building of steel frame construction with a floor area of 488 m^2 plus the added one-story building of steel frame construction with a floor area of 153 m^2, a total floor area being 641 m^2.

(2) Rooms in the building

The details of each room in the integration of fisheries foundation building are as follows.

1) Handling space and working passage

The handling space of 10 m x 4.5 m = 45 m^2 shall be placed for handling, sorting, weighing, recording, arranging, etc. The working passage, 4.0 m wide capable of operating a forklift, shall be connected to the handling space, opening on to the outdoors at the end for easy maintenance of apparatuses at the backyard. At the south end of the handling space a lobster live well, 3.0 L x 2.0 W x 0.7 D m, shall be installed.

Both the handling space and the working passage shall be of concrete hardener finish due to water splashing and wear and tire by cargoes.

2) Processing space

In the peak season 630 kg raw fish are processed to fillet or loin every day. One local worker can process raw fish of some 40 kg an hour per, 240 kg for 6 hours (one day). Hence, a working space of 3 persons, 630 kg/240 kg = 2.63, is required. When 3 sets of the processing table with a sink are placed, the processing space shall require an area

of 13 x 9 = 117 m^2, and its layout is as follows.

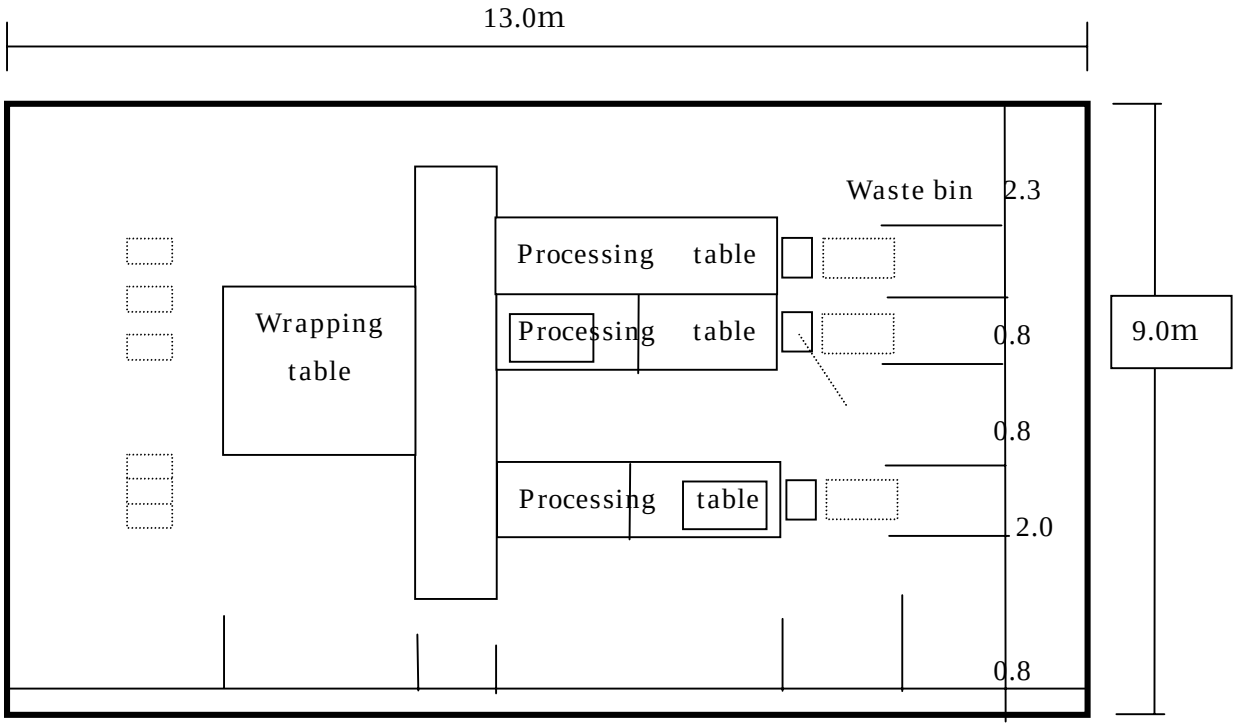


Figure 2-4 Layout of the processing space

The floor of the processing space shall be of non-slip porcelain tile to prevent falling down of workers, and the walls shall be of steel panel finish due to water splashing. Floor washing shall be conducted with a high pressure washing machine, and at the ends of gutters the waste boxes shall be installed to prevent waste from flowing into the drainpipe and the septic tank. Air-conditioning shall be made for sanitation and the ultraviolet sterilizing lamps shall be provided. All workers shall enter into the space through a tub for water to wash their feet.

3) Ice-making/storage facility

The facility shall be installed between the front road and the processing space for convenience of selling ice to fishermen and usage of ice at the processing space. The ice bin, 3.6(L) x 3.6(W) x 2.1 (H) m, shall be of prefabricated unit panel type with a higher insulation effect, for shortening the construction period. Wooden hurdles are placed on the floor.

The required space of the ice bin panel unit will be 4.5m x 5.0m = 22.5 m^2 for providing a maintenance passage at 3 sides. The ice-making plant shall be placed on the ice bin

and produced plate ice will be dropped into the ice bin automatically.

4) Preparation room and freezing system

The preparation room and the freezing system shall be placed on the left and right side on the anteroom respectively, facing the processing space. The preparation room shall keep processed semi-products until freezing or frozen products before forwarding. The freezing system shall be placed facing the preparation room. The anteroom, preparation room, and freezing system shall be made of united panel box. Considering a shorter construction period and effective insulating capacity, a prefabricated unit panel shall be applied.

Required panel area is 36.7 m^2.

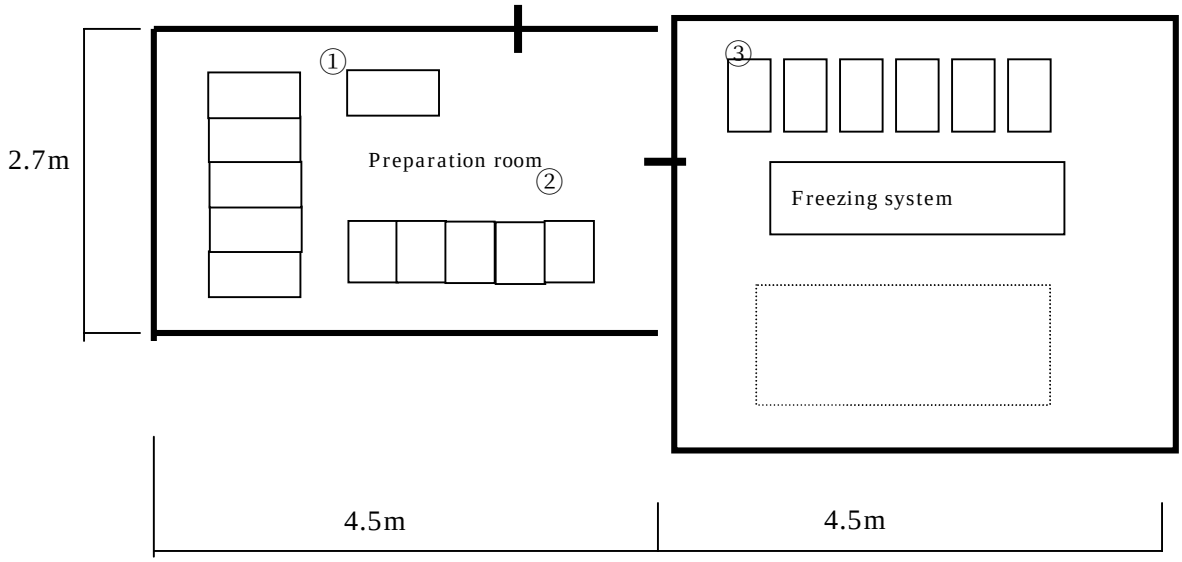


Figure 2-5 Layout of Preparation room and Freezing system

5) Machinery room and workshop

Behind the anteroom/freezing room/freezing system the machinery room shall be place. It shall house 4 cooling machines including the air-conditioner and condensers connected to each system and the electric control panel, requiring the area of 77.3 m^2. The upper part of the walls of the machinery room shall be made of perforated concrete block for ventilation requirements. Rainwater blowing into the room will be properly drained.

The workshop for maintenance of the facilities of the Project and the existing cold storage facility shall be adjacent to the machinery room. Placing a freezer-size machine or equipment to be repaired in the center and a tool shelf on the wall, the

room requires an area of 6.5 m x 4 m = 26 m^2 plus an area of 3.0 m x 4.0 m x = 12.0 m^2 for storing parts.

6) Apparatus store and forklift lot

The apparatus store, 2.5 m x 4.5 m = 11.25 m^2, shall be installed to store the conveying equipment, weighing machine, fish boxes, etc., and the forklift lot, 2.5 m x 4.5 m = 11.25 m^2, to keep a battery forklift and a battery charger.

7) Guardroom

The guardroom for the security of the whole facilities shall be placed on the center of the building, the place facing the road at the northern end of the building. It occupies an area of 4 m x 4.5 m = 18 m^2.

8) Materials room

The materials room for storing wrapping/packing materials, apparatuses, etc. shall be placed next the processing space, occupying an area of 4 m x 8 m = 32 m^2.

9) Retail shop

The fish retail shop housing a chest freezer, a show case, and a selling counter shall be installed on the road side of the building, occupying an area of 7.5 x 4.0 m = 30.0 m^2.

10) Office

The office room shall be placed at the position capable of monitoring all activities in the building, facing the passage. A partition shall be installed to separate the space for management business and the worker's station.

The staffs consist of one manager, one selling supervisor, one accountant, plus three workers, totaling up to 6 persons. The required space is as follows;

Manager room:	4 m x 4 m = 16 m^2
Space for workers:	4 m x 4 m = 16 m^2
Space for clerks:	10.25 m^2 (5.125 m^2/person x 2 persons)
Meeting corner:	3 m x 3 m = 9 m^2
Pantry:	2 m x 2.5 m = 5 m^2
Total	56.25 m^2

The office room has only one opening for the outside air, lacking a comfortable natural ventilation. Also, from the standpoint of maintenance of the computer system, air-

conditioning shall be made at the office room. The room shall be an open space without partitions, except the manager room and the pantry.

11). Locker room

The locker room of 3 m x 4.5 m = 13.5 m^2 shall be placed for changing cloths or rest by 4 processing workers.

12) Toilet (male and female)

For the staffs of 15, one salesperson of the retail shop, one maintenance engineer, 4 processing workers, 2 purchase clerks, one guardsman, and 6 office staffs, as the ratio of man to woman is 1 to 1, two booths each for 7 persons shall be provided.

For men: 2 stands and 2 stools

For women 2 stools

A shower room, 1.2 m x 2.2 m = 2.64 m^2 shall be installed between the male and female toilets. Total space of the toilet facility shall be 5.5 m x 4.5 m = 24.75 m^2.

2-3-4 Basic Plan

2-3-4-1 Basic Plan

The results of the basic design are as follows.

(1) Integration of fisheries foundation

Table 2-30 Components of Facilities

Name of components	Specification	Quantity
1) Facility		
Ice-making facility	1 ton/day, plate ice	2 units
Ice bin	2 ton storage	1 unit
Freezing facility (pre-cooling room)	10m×3.6 m	1 unit
Generating system	75KVA (Overhauling Existing 3 units and)	1 unit
Desalinating system	50 ton/day	1 unit
Elevated water tank	4 ton	1 set
Septic tank	Simplified type	1 set
2) Building	641 m^2, one story, steel frame construction (Existing building area: 488 m^2, Extension area: 153 m^2)	1 unit

Table 2-31 Scale and Quantity of Equipment and Materials

Name	Specifications	Quantity	Purpose
1) For processing			
Processing table	3000(L) x 800(W)mm 3 units 2000(L) x 800(W)mm 2 units	5 units	Processing of fish
Wrapping table	2500(L) × 2500(W)mm	1 unit	Wrapping of processed fish
Vacuum wrapping machine	Table type, for 350 mm wide wrapper	1 unit	wrapping of fillet
Cutting machine	Band saw type	1 unit	Cutting of frozen fish
High pressure washing machine	Fixed type	1 unit	Washing of plant and boxes
Insulated box & fish box	Product box Freezing pan Preserving box Insulated box	60 boxes 70 boxes 35 boxes 45 boxes	Forwarding of products Freezing Preservation for poor season Distribution
Conveying/washing tank	Movable type, with casters 1300(L) x850(W)x750(H)mm	2 units	Conveying and washing of fish and products in the facility
2) Conveying equipment			
Fish conveying equipment	Barrow Trolley	2 units 1 unit	Moving of fish box
Forklift	One ton type, electric-powered	1 unit	Moving of fish box, etc.
Crane truck	One ton crane with 2 t type truck	1 unit	Loading, unloading
Cold preservation vehicle	36 Pick-up truck		Delivery of products
3) Equipment and materials for sales promotion			
Chest freezer		1unit	
Showcase	Demonstration shelf: 1.0-1.5 m^2	1 unit	Selling of frozen products
4)Weighing machine Table type Floor type	Processing, retail selling 2 units Ice selling Selling of fish 2 units	4 units	weighing of products

2-3-4-2 Layout Plan

Operation function of the Integration of Fisheries Foundation shall be placed on the existing area for brine-freezing/ice-making plant building. Administration function not being housed in this area shall be arranged in an extended area on the south.

(3) Facility Plan

1) Plane Plan (draft)

A processing space shall be placed in the existing brine freezing/ice-making plant area through a handling space and passage. Surrounding the processing space, an ice-making/ice storage facility, freezing store, freezing system and cold storage facility are arranged. A machinery room to backup these facilities is placed at the back of this arrangement so that machines can be directly connected with facilities. Thus the practical operation function of the Integration of Fisheries Foundation was fully confined in this area.

An administration facility including a guardroom and an office shall be arranged in an area directly extended beyond the handling space and passage in the existing area. An office shall be placed on a position to allow to monitor all movements of the facility, a retail shop on the road side and a locker and two toilet rooms on the opposite side.

Table 2-32 Size of each space

Name of space		Size	
Brine freezing/ice-making plant area	①Handling space & passage	126.0 ㎡	
	②Processing space	117.0	
	③Ice-making plant/ice bin space	22.5	
	④Cold store/freezing store /freezing system	36.7	
	⑤Machinery room & workshop	115.3	
	⑥Apparatus store & forklift lot	22.5	
	⑦Guardroom	18.0	
	⑧Materials room	30.0	488.0 ㎡
Extended	⑨Retail shop	31.5	
	⑩Live well	6.0	
	⑪office	56.25	
	⑫Passage	21.0	
	⑬Locker	13.5	
	⑭Toilet (male & female)	24.75	153.0 ㎡
Total area		641.0 ㎡	

2) Structural Plan

The existing brine-freezing/ice-making plant building is of R.C. steel structure with continuous footing, and almost all of the exterior finish members and H-type steel pillar are not useful due to corrosion. Fortunately only foundation is not distorted and concrete maintains a sufficient strength. Thus it is judged that it is best to construct a steel structure building same as the old one with reutilization of these parts and members. It is needless to say that a new section plan matching new utilization of building and a new structural calculation in designing.

Almost all parts of the new facility except the administration section are frequently exposed to water. Hence, walls and pillars shall be made of concrete or apply concrete block bed up to 1 m high from the floor. Steel pillar shall be covered with concrete.

The extended section is not exposed to water so frequently, but the steel structure

shall be applied to match the structure of the existing parts, covering by concrete up to 1 m high from the floor, and the wainscot shall be made of R.C. structure to protect the building against salt damage and shock.

A. Design standard and regulations

There is no regulations and standards regarding building in Kiribati, except durability against a wind force of 60 m/sec. Also no earthquake is recorded. In designing, 1/2 of coefficient of Japan Standard regarding the seismic force, and the durability against a 60 m/sec wind regarding the wind force shall be applied.

B. Outline of structure

Table 2-33 Outline of structure

Building	Existing brine-freezing/ice-making plant building	Extended part
Upper structure	Building: R.C. steel structure	Building: R.C. steel structure Roof: Colored steel plate with rib Wall: Colored steel plate with rib Wainscot: R.C. structure Wainscot: R.C. structure
Lower structure	R.C. structure with continuous footing (reutilization of existing part)	R.C. structure with continuous footing

C. Design load

a.Dead load

Weight of each structural member, finish member, and apparatuses shall be calculated. Unit weight of basic materials of building is as follows.

Concrete	2.3 t/m^3	
Reinforced concrete	2.4 t/m^3	
Mortar	2.0 t/m^3	
Concrete block	300 kg/m^2	Unit: kg/m^2

Live load	Slab, small beam	Pillar, beam, foundation	earthquake
Roof	30	100	0
Machinery room	500	5,000	180

-Wind load

From the standpoint of the force of typhoon at Kiribati, 225 kg/m^2 (force of a 60 m/sec wind) shall be applied.

-Earthquake load

Kiribati has no regulation regarding the resistance against earthquake because any earthquake has never been recorded. Co=0.1 (1/2 of Coeffiecence in Japan) shall be applied.

-Measures against salt damage

Careful quality control shall be done to prevent salt damage on structures due to local concrete aggregate. Its alkali-silica content shall be controlled to be below 300 g/m^3, and adequate thickness of covering shall be given to concrete members. Proper salt-resistant coating or galvanization shall be applied to steel bar subject to severe sea breeze.

3) Equipment

A. Water supply/drainage and sanitation

The existing 60 tons and 30 tons rainwater tanks will be reutilize. Water famines are sometimes reported due to no rain lasting several months. A desalinating system shall be introduced.

Drainage of waste water from the processing space and for floor washing shall be

filtered with a stainless steel dust box, and then treated in a settling tank and percolated downward through the soil through a seepage basin.

Drainage from toilet/shower rooms and others shall be led to the settling tank. Flushing toilets and wash stands shall be provided for sanitation.

B. Electrical equipment

An incoming panel in the generator room will receive electric power and then distribute to each part in the facility on required voltage. Buried lines and underground piping shall be applied between buildings in the facility, and handholes shall be provided at need. Conduit pipe racks will be installed in buildings at need. Electric lamps, receptacles and lighting apparatuses shall harmonize with natural lighting for energy-saving. Fluorescent lamps will be used inside and mercury lamps outside.

Receptacles and lighting apparatuses shall be of salt-resistant and drip-proof type.

4) Building Materials Plan

A. Building materials

Kind and volume of building materials available in Kiribati are limited.

- Exterior finish

Roof: Colored steel plate with rib

Wall: Colored steel plate with rib

Wainscot: R.C. structure

Table 2-34 Interior finish

	Floor	Wainscot	Wall	Ceiling
Handling space & Passage	Concrete trowel & hardener finish	Mortar trowel, synthetic resin emulsion paint	Flexible board, synthetic resin emulsion paint	Flexible board, synthetic resin emulsion paint
Processing space	Non-slip porcelain tile	Porcelain tile	Insulated colored steel panel, T=47	Flexible board, synthetic resin emulsion paint
Ice-making /ice bin space	Concrete trowel & hardener finish	Mortar trowel, synthetic resin emulsion paint	Flexible board, synthetic resin emulsion paint	—————
Retail shop/office/ guardroom /locker room	Concrete & plastic tile	—————	Plywood, synthetic resin emulsion paint	Plywood, synthetic resin emulsion paint
Materials store	Concrete trowel & hardener finish	Mortar trowel, synthetic resin emulsion paint	Plywood, synthetic resin emulsion paint	Plywood, synthetic resin emulsion paint
Toilet (male & female)	Concrete trowel & 50 square mosaic tile	Mortar trowel & 100 square ceramic tile	Flexible board, synthetic resin emulsion paint	Flexible board, synthetic resin emulsion paint

Plans (Plot plan, Layout plan, Section and Elevation) of the integrated fisheries facilities are shown on the following pages.

図面

図面

図面

2-4 Implementing Structure

2-4-1 Organization

The implementing authority of the Project is the Ministry of Natural Resources Development (MNRD). The implementing structure of the Kiribati side is as follows.

① Responsible authority	Ministry of Natural Resources Development
② Implementing authority	Ministry of Natural Resources Development
③ Management body	Ministry of Natural Resources Development Fisheries Corporation to be newly formed (Management of the Project, ownership of facilities and equipment/materials)

(1) Ministry of Natural Resources Development

The Ministry of Natural Resources Development consists of the Agricultural Division and the Fisheries Division, which has the responsibility of fisheries administration and employs some 60 personnel. The Fisheries Division consists of the Extension Section and Research Section, the former is in charge of extension services, aquiculture, distribution, and diffusion, while the later is in charge of admission, research, and statistics. Also 3 national corporations, TML, OIFP, and ASC, belong to the Ministry.

(2) The Fisheries Division has directly participated to the Project, sending the Acting Chief Fisheries Officer to the site survey. At present, in line of with a outer island development plan, 18 staffs of the Fisheries Division are sending to the outer islands as extension officer to direct seaweed culture, improving fishing gear, various experiments, and collecting data.

2-4-2 Budget

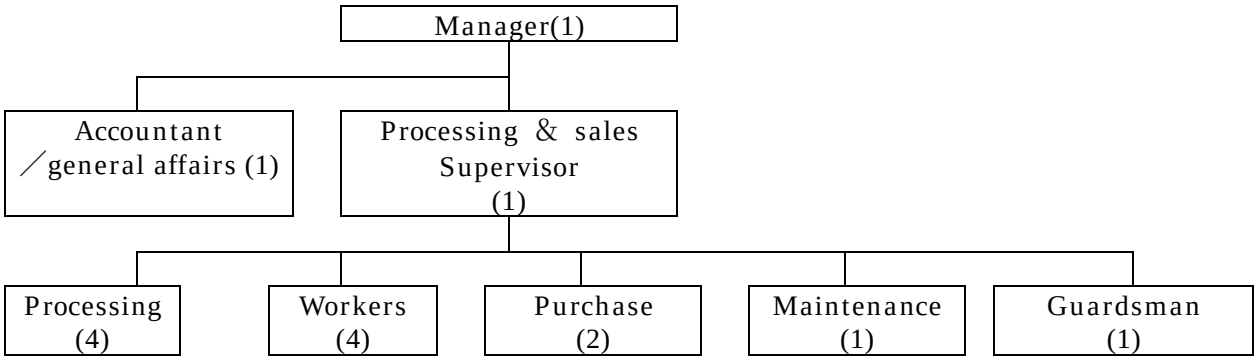
Table below shows the development of the budget of MNRD and its related authorities. A decreasing tendency of the budget of MNRD is found.

Table 2-39 Development of the budget of MNRD and related authorities

	1995	1996	1997	1998
MNRD	772	935	505	648
Fisheries Division	1,041	1,105	990	919
TML	849	662	909	777
OIFP	57	74	120	140
Total	2,719	2,776	2,524	2,484

2-4-3 Staffing

A coastal fisheries section of the new corporation which will be in charge of the Project will assign 15 personnel to the Project.



Note： （ ） Number of personnel

Chapter 3

Implementation Plan

Chapter 3. Implementation Plan

3-1 Implementation Plan

3-1-1 Implementation Concept

In the implementation of the Project, the following concept is to be applied in accordance with the intention of Japan's Grant Aid Program.

(1) To promote smooth execution of the Project, further efforts shall be made to achieve mutual understanding through full exchange of opinions between all the parties concerned; the Ministry of Natural Resources Development, Fisheries Division, the Consultant, the Contractor and so on.

(2) The proposed construction site are on the northern end of the wharf leading to the existing jetty at Betio, the eastern end of South Tarawa on which the capital of Kiribati, Tarawa, is situated. Procurement of equipment/materials and labor is limited due to rather small stockpile and population, about 81 thousand in the whole country. Though almost all of items are listed on catalogs, the schedule-matched procurement of every construction materials needed is difficult because you have to ordered these from Australia, Fiji, or New Zealand.
In the Project, being necessitated special facilities, major equipment and materials shall be obtained at and transported from Japan, and core staff of the construction work shall be also send from Japan to give local labor guidance in construction. In procurement, equipment and materials of good quality shall be secured under an effective operation plan of construction machinery and skilled labor.

(3) The proposed Project site, existing brine-freezing/ice-making plant, cold store and TML office building are owned by the Government, managed by TML until the proposed new corporation makes a start.
Prior to commencement of work, taking the influence on surroundings during the construction work and possible problems caused by a proper space to which the

existing facilities in service are to be relocated and removal of the existing buildings into consideration, a working method with the least volume on the site shall be decided. A full explanation shall be given to the Government on a re-location space so that the Government can have enough to arrange.

(4) Noise control

It is expected to be produced noise by various works during the construction work. Though there will be little influence on surroundings due to no intrusive noise-source, anti-noise measures shall be taken if necessary to use it.

(5) Quality control measures shall be taken in due consideration of the followings.

1) Measures against salt damage

Since the construction site is subject to salt damage due to its proximity to the sea, salt-resistant materials shall be selected and procured. Galvanizing process shall conducted with a careful inspection by Consultant. Proper measures against salt damage shall be taken to protect apparatuses during the construction work.

2) Control of concrete quality

Special quality control shall be done for concrete to be used for foundation and building works. Alkali-silica content of aggregate shall be controlled carefully below $300g/m^3$. Also a mixing plan to use Portland fly-ash cement instead of normal Portland cement shall be examined. Placing concrete shall be done carefully with washing aggregate. Workability shall be periodically checked during the construction work.

3) Quality control and performance test of equipment

Apparatuses specially ordered such as ice-making plants, cooling equipment and generating equipment shall be inspected by Consultant during manufacturing and their performance test shall be executed on completion. Installation work and

performance test after installation shall be done by Supervisor, who will instruct necessary precautions on operation to local operators.

4) Procurement of construction materials and major equipment and materials

Major construction materials for foundation and building shall be locally procured as possible. Also successfully-proved local construction methods shall be applied to get the best results.

Insulated vans, fish boxes and processing equipment shall be procured in Japan and the third countries, considering aftercare services as well as easy availability of parts.

(6) Course of Implementation Plan

Construction works of the Project are divided broadly into two parts; (a)construction of a processing facility at the existing fisheries facility site and (b) installation of such special equipment as ice-making plant, generators and so on. Since there is no public utility (both water and electricity), water-supply and power-supply shall be secured prior to preparation of Project schedule.

3-1-2 Implementation Conditions

The large-scale construction works in Kiribati were mainly conducted, and now being conducted, under Japan's Grant Aid Program. At present a project for harbor construction at Betio is under way, aiming at completion in 2000. At all construction projects in the past, major equipment and materials have been transported from Japan, and works have been conducted by Japanese specialists with cooperation of local subcontractors.

Generally speaking, training and education of experts and skilled personnel are not adequate, and the number of them is small in absolute quantity. Thus the Project will be forced to follow the above-mentioned method in works and procurement. In addition, the following points shall be kept in mind.

- It is a rainy season, strong winds attack occasionally, from November to February.
- Construction materials available locally are almost imported from Fiji, produced in

Australia and New Zealand. Cement and reinforced rods are imported directry from Australia.

3-1-3 Scope of Works

Table 3-1-1 below shows the scope of works borne by Japan and Kiribati respectively. Removal of the existing buildings and leveling site ground shall be finished prior to the commencement of construction works.

Table 3-1-1 Scope of Works

Contents of works	Japan	Kiribati
1. Securing land, removal of existing some equipment, leveling site ground, securing relocation space, and measures to continue fishing activities during construction works.		○
2. Construction work	○	
3. Import procedures and customs clearance		○
(1) Transport to Kiribati and inland transport.	○	
(2) Tax exemption and customs clearance.		○
4. Payment of commissions to Japanese foreign exchange bank regarding Banking Arrangement.		○
5. Convenience for Japanese staff engaging in the Project to enter into and departure from and stay in Kiribati.		○
6. Appropriate and effective management and maintenance of facilities granted by Japan's Grant Aid Program.		○
7. Bearing all the expenses, other than those to be borne by the Grant, necessary for construction of facilities as well as for transport and installation of furniture and equipment.		○
8. All the procedure of application for approval or permit concerning construction works.		○
9. Exemption of all the taxes including internal taxes and other fiscal levies which may be imposed in Kiribati with respect to equipment and materials and services procured by the Contractor of the Project.		○

3-1-4 Supervision Plan

Consultant supervision shall be conducted with attention paid to the following points.

(1) With the progress of the Project, the Consultant shall enhance contact with the

executing agency, the Ministry of Natural Resources and Development, and Fisheries Division, so that smooth construction works can be carried out. The schedule and specifications on securing the site, removal of existing buildings, and leveling site ground, in particular, should be fully discussed in advance from the standpoint of works to be executed by Japan side.

(2) Prior to commencement of the work the Consultant shall examine the construction plannings and working diagrams submitted by the Contractor carefully, to judge the appropriateness of the temporary work plan, executing schedule, quality plan, construction method and so on.

(3) On the completion of the Project the Consultant shall examine the final contents of works in conformity with the designed specifications, and give proper instructions to the Contractor when modifications are required.

(4) The Project Manager who stays at Kiribati is responsible for comprehensive execution management of the Project.

3-1-5 Procurement Plan

Construction materials available locally are confined to such basic materials and sand/cement for concrete. Reinforced rod, steel bar, plywood panel and electric/piping materials for general use depend simply on import from Australia and New Zealand.

It must be kept in mind that it will require time to finish local procurement because the stockpile of local agents is limited in item and quantity. Construction materials (cement, reinforcing bar, wooden form, metal form, etc.) are in principle to be procured locally. Materials unavailable locally for un-suitable for the Project due to inferior quality or poor stock shall be procured in Japan or the third countries and transported to Kiribati by sea.

Construction machinery is generally available in Kiribati apart from special ones.

Table 3-1-2 Procurement list

Items	Procurement method
1. Construction machinery	
General construction machinery	Kiribati
2. General construction materials	Kiribati, 3rd countries, Japan
3. Equipment	
Ice-making/storage facility	Japan
Quick freezing system	Japan
Generator	Japan
Cold preservation vehicle	Japan
4. Materials	Japan
Insulated box	Japan
Truck crane	Japan
Equipment and materials for processing	Japan, Kiribati

3-1-6 Implementation Schedule

After the Exchange of Notes, the Project will be implemented, taking the following process.

(1) Basic design

Based on this Basic Design Study Report, the Consultant will conduct the basic design and prepare tender documents for tendering. It will take 2 to 2.5 months to finish the task.

(2) Tendering

After the completion of basic design, tenderers will be invited by a public

announcement of the Project in Japan and selected for the tendering through qualification investigation. The implementing agency (MNRD) then holds the tendering to determine a contractor in the presence of the parties concerned. From the announcement to conclusion of a construction contract, about two months will elapse.

(3) Construction work

After verification of construction contract by the Government of Japan, construction work will begin. It will take about 11 months to finish the construction work subject to smooth execution of undertakings to be taken by the Kiribati side.

Table 3-1-3 Implementation Schedule (draft)

Months	1	2	3	4	5	6	7	8	9	10	11
(Detail Design)	(Site survey)			(Works in Japan)							
				(Site survey)							
(Construction)	(Preparation)										
		(Foundation)									
			(Building construction)								
	(Installation interior/exterior finish work)										
						(Exterior work)					
										(Delivery, training)	
(Equipment and materials)			(Manufacturing, procurement)					(Transportation)			
		(Preparation, approval)									
								(Installation, training)			

3-1-7 Undertakings to be taken by the Kiribati side

Table 3-1-4 below shows major undertakings to be taken by the Kiribati side. Among them removal of existing buildings and other obstacles and clearing and

leveling ground shall be finished by the construction work starts.

Table 3-1-4 Undertakings to be taken by Kiribati

1) Securing the proposed Project site.
2) Removal of existing equipment (block ice-making/storing, brine freezing).
3) Leveling the site.
4) Removal of goods in the existing store and maintenance shop

3-2 Cost Estimation

3-2-1 Estimated cost to be borne by the Kiribati side

Table 3-2-1 Estimated cost to be borne by the Kiribati side

Items	Amount
Removal of the existing equipment and leveling ground	A$26,000
Securing relocation place and removal of the existing maintenance shop.	A$4,000
Others(bank commissions, etc.)	A$9,000
Total	A$39,000

Chapter 4

Project Evaluation and Recommendations

Chapter 4 Project Evaluation and Recommendations

4-1 Appropriateness and benefits

The fishery, along with copra, is the mainstay of the economy of Kiribati, and its development is emphasized particularly in the 8th National Development Plan so that the basis of the economic growth can be strengthened. The implementation of the Project is expected to contribute heavily to the development of the coastal fishery that is one of important objectives of the National development Plan as follows;

1) Direct benefits

- The preservation of frozen fish products will make it possible to supply them throughout the year irrespective of fishing seasons. The introduction of a processing plant will widen the limited distribution of processed fish for hospitals and schools to the general public. Discarding raw fish left unsold at the fish market will be abolished, resulting in improved distribution of fish products and fully utilization of fish resources. (reduction of post-harvest loss).

-Improvement in fish handling technique

The Project will establish the hardware of fish handling as well as diffuse the technique regarding quality control and hygiene management as a result of multiplier effect of the Project and COFDAS project.

- Rational management of the newly-established corporation

Transferring the base of the coastal fishery to the TML premise will make it possible to reduce the cost by convergence of facilities and equipment of TML and OIFP. Also the fish processing plant will it possible to achieve a stable operation of the coastal fishery.

2) Indirect benefits

- Improvement of living conditions of fishermen

The Project will buy fish from some 1,300 fishermen of 4 remote islands. Their cash incomes will be increased, their living conditions will be improved, and the economy of remote islands will be activated. At the same time, employment opportunities will be increased in processing, distribution, and marketing fields at South Tarawa, and also nutrition of the people.

- Improvement of trade balance

One third of national import are foodstuff. The people have a strong preference for fish eating as more than 65% of animal protein being token from fish products. A

stable supply of fish products will meet the demand of the people as well as stabilize the price of fish, and thus decrease the import and improve the trade balance.

Based on the expected benefits above, it is judged that the Project is appropriate and significant as a grant aid program.

4-2 Recommendations

The Kiribati Government should take the following steps to realize the development of the coastal fishery in the 8th National Development Plan.

(1) Establishment of management system to the new corporation

It is recommended that the Government should establish a system capabling of sustainable management of the Project through effective and efficient operation of its facilities and equipment. It is also recommended that the Government should provide qualified staffs to operate and maintain effectively such facilities as the ice-making plant and freezing system.

(2) Budgetary measures

The Project requires operation funds for two months to buy and transport raw fish when starting the operation. It is recommended that the Government should allocate the funds in the budget.

(3) Fostering manpower

It is recommended that the Government should foster staffs necessary for day-to-day operation and maintenance of machinery and devices.

(4) Quality control

It is recommended that the Government should take measures to bring quality control home to staff's mind to secure a sustainable distribution of quality products.

Appendices

1. Member List of the Study Team

1-1 Preliminary Study

Mr.H.WATANABE	Leader	Deputy Director Office of Overseas Fisheries Cooperation,Fisheries Agency
Mr.T.MORITA	Project Coordinator	Fourth Project Division Grant Aid Management Dept. JICA
Mr.W.FUJISAWA	Fisheries Market Planner	Japan International Coorperation System
Mr.M.YOSHIOKA	Facility & Equipment Planner	Japan International Coorperation System

1-2 Basic Design Study

Mr.H.WATANABE	Leader	Deputy Director Office of Overseas Fisheries Cooperation,Fisheries Agency
Mr.M.IMAMURA	Project Coordinator	Fourth Project Division Grant Aid Management Dept. JICA
Mr.O.HIRAOKA	Chief Consultant Fisheries Development Planning	CRC Overseas Cooperation Inc.
Mr.M.MOTOKI	Fisheries Facility Planning	CRC Overseas Cooperation Inc.
Mr.K.YAHATA	Fisheries Equipment Planning	CRC Overseas Cooperation Inc.
Mr.M.ISHII	Construction Planning/ Cost Estimation	CRC Overseas Cooperation Inc.

1-3 Draft Basic Design Study

Mr.H.WATANABE	Leader	Deputy Director Office of Overseas Fisheries Cooperation,Fisheries Agency
Mr.M.IMAMURA	Project Coordinator	Fourth Project Division Grant Aid Management Dept. JICA
Mr.O.HIRAOKA	Chief Consultant Fisheries Development Planning	CRC Overseas Cooperation Inc.
Mr.M.MOTOKI	Fisheries Facility Planning	CRC Overseas Cooperation Inc.

2. Study itinerary

2-1 Preliminary Study

No.	Date in 1999		Itinerary		Staying
			Officials Mr.Watanabe/Mr.Morita	Consultant Mr.Fujisawa／ Mr.Yoshioka	
1	3/7	Sun	20:55 NZ032 Kansai Air Port		on board
2	3/8	Mon	09:30 Nadi, 11:30-12:05 Nadi – Suva 14:00 Courtesy call to JICA and Embassy, 18:15-18:45 Suva – Nadi		Nadi
3	3/9	Tue	07:35-10:40 Nadi- Tarawa 16:00 Courtesy call to MNRD, 17:00 Visit to TML		Tarawa
4	3/10	Wed	09:45 Discussions with Fisheries Dept.		Tarawa
5	3/11	Thu	09:00 OIFP		Tarawa
6	3/12	Fri	09:00 Visit to milkfish culture 14:00 Team discussion		Tarawa
7	3/13	Sat	09:00 Team discussion 15:00 Visit reef of South Tarawa		Tarawa
8	3/14	Sun	14:00 Discussion with MRND		Tarawa
9	3/15	Mon	09:00 Visit to beche-de-mer culture, 14:00 Discussion with MRND		Tarawa
10	3/16	Tue	09:00 OIFP, TML, 14:00 Discussion with MNRD		Tarawa
11	3/17	Wed	09:00 Visit to ASC,10:00 Visit to KGV, 11:00 Visit to Central Hospital, 16:00 Signing of minutes		Tarawa
12	3/18	Thu	09:20 - 12:25 Tarawa-Nadi 14:00 - 14:25 Nadi-Suva 15:30 JICA・Embassy	10:00 Survey at Maiana Island	Suva/ Tarawa
13	3/19	Fri		09:00 Survey at OIFP 11:00 Survey at KTC 14:00	Tarawa
14	3/20	Sat		09:00 Survey at OIFP 11:00 Survey at KTC	Tarawa
15	3/21	Sun	09:00 Survey at TML, 14:00 Team discussion		Tarawa
16	3/22	Mon	09:00 Survey at OIFP, 11:00 Survey at KGV,KTC		Tarawa
17	3/23	Tue	09:00 Survey at ASC, 11:00 Survey at Central Hospital		Tarawa
18	3/24	Wed	09:00 Team discussion, 18:00 Visit to KGV		Tarawa
19	3/25	Thu	09:20 – 12:25 Tarawa-Nadi, 14:00 – 14:25 Nadi-Suva 15:30 JICA・Reporting at Embassy		Suva
20	3/26	Fri	11:05 – 15:10 Suva-Auckland		Auckland
21	3/27	Sat	12:30 – 19:25 Auckland- Narita		

2—2 Basic Design Study

No	Date in 1999		Itinerary	Staying
1	8/1	Sun	Leaving Tokyo	on board
2	8/2	Mon	Arrive at Suva, courtesy call at Embassy, arrive at Nadi	Nadi
3	8/3	Tue	Nadi – Tarawa	Tarawa
4	8/4	Wed	Courtesy call at Foreign Office & MNRD. Discussion with TML Survey at TML & OIFP, Visit to training school, Fisheries Dept., Culture pond	Trawa
5	8/5	Thu	Discussion with TML, Survey at OIFP and Betio harbor, Survey of fish demand	Tarawa
6	8/6	Fri	Discussion with TML, Visit to Betio harbor, Survey at TML & OIFP, Survey of fish demand	Tarawa
7	8/7	Sat	Survey of fish demand, collecting materials	Tarawa
8	8/8	Sun	Survey of fish demand, collecting materials	Tarawa
9	8/9	Mon	Discussion with TML	Tarawa
10	8/10	Tue	Discussion with TML	Tarawa
11	8/11	Wed	Discussion about draft minutes, signing of minutes	Tarawa
12	8/12	Thu	Officials: Leaving Tarawa for Suva Consultants: Continue B/D study	Tarawa
13	8/13	Fri	Officials: Reporting at Embassy & JICA office Consultants: Survey at TML, Survey of demand	Suva/Tarawa
14	8/14	Sat	Officials: Leaving Nadi for Tokyo Consultants: Survey at TML & Maiana Island	Tarawa
15	8/15	Sun	Consultants: Hearing survey of demand, collecting materials	Tarawa
16	8/16	Mon	Consultants: Collecting materials(MFEP, MRND, Fisheries Div, TML, etc.), hearing survey (Hospitals, schools, restaurants, etc.)	Tarawa
17	8/17	Tue	Consultants: Discussion with TML, collecting materials(Finance, MRND, Fisheries Div. Land Office, etc.), hearing survey (Hospitals, schools, restaurants, etc.).	Tarawa
18	8/18	Wed	Consultants: Discussion with TML, collecting materials(Fisheries Div., MNRD, MFEP, Land Office, Labor Office, etc.), Survey at OIFP/TML	Tarawa
19	8/19	Thu	Consultants: Leaving Tarawa for Nadi	Nadi
20	8/20	Fri	Consultants: Nadi-Suva-Nadi, Reporting at Embassy & JICA office	Nadi
21	8/21	Sat	Consultants: Survey of data concerning cost estimation in Nadi	Nadi
22	8/22	Sun	Consultants: Leaving Nadi, arrive at Tokyo	

2—3 Draft Basic Design Study

No.	Date in 1999		Itinerary	Staying
1	10/23	Sat	Officer (Coordinator): Tokyo→Nagoya（Train） 1900 Leaving Nagoya NZ036	on board
2	10/24	Sun	Officer (Coordinator）: Arriving at Nadi Officer (Team Leader) & 2 Consultants : Haneda – Kansai Air Port (NH145) 2015: Leaving Kansai for Nadi (NZ032)	Nadi
3	10/25	Mon	o830: Arriving at Nadi, 1145: Leaving Nadi for Suva (PC152), 1210: Arriving at Suva. Courtesy call to JICA & Embassy 1815-1845: Suva → Nadi (PC177)	Tarawa
4	10/26	Tue	0540 – 0845: Nadi →Tarawa (ON222) Discussion with MNRD and OFCF	Tarawa
5	10/27	Wed	Courtesy call to MOF, MFEP and MNRD Explanation of Draft Basic Design Site survey	Tarawa
6	10/28	Thu	Explanation of Draft Basic Design Site survey	Tarawa
7	10/29	Fri	Explanation of Draft Basic Design Site survey	Tarawa
8	10/30	Sat	Survey at North Tarawa, Fish demand research	Tarawa
9	10/31	Sun	Team discussion, Fish demand research	Tarawa
10	11/1	Mon	Discussion about Minutes, financial analysis of new organization. Site survey	Tarawa
11	11/2	Tue	Discussion about minutes and management system of new organization. Site survey	Tarawa
12	11/3	Wed	Discussion about draft Minutes, signing of Minutes	Tarawa
13	11/4	Thu	1120 – 1425: Tarawa →Nadi (ON141) Nadi→Suva（by car）	Suva
14	11/5	Fri	Reporting at Embassy and JICA office Suva→ Nadi（by car）	Nadi
15	11/6	Sat	1140: Leaving Nadi for Nagoya (NZ035) 1810: Arriving at Nagoya Nagoya→Tokyo（Train）	

3. List of Party Concerned in the Recipient Country

Ministry of Foreign Affairs	
Permanent secretary	Mr. David Yeeting
Ministry of Finance	
Chief economist	Mr. Atanteora Beiatau
Acting senior economist	Ms. Norma Yeeting
Economist	Ms. Ngaina Roniiti
Senior economist	Mr. Tata Teitiaua
Ministry of Natural Resources Development	
Minister	Hon. Emile Schutz
Permanent secretary	Mr. Kaburoro Ruaia
Deputy secretary	Mr. Tukabu Teroroko
Senior Resouce Economist	Mr. Tetoaiti Tabokai
Project Manager	Mr. Betarim Rimon
Fisheries division	
Acting Chief Fisheries Officer	Mr. Johnny Kirata
Senior Fisheries Officer	Ms. Tooti Tekinaiti
TML & OIFP	
Acting General Manager	Mr. Baie Teanako
Ministry of Works and Energy	
Acting Permanent secretary	Mr. Francis Ngalu
OFCF	
Expert (Fisheries division)	Mr.T.Yamazaki
Expert (COFDAS project)	Mr.K.Fujita
Expert (COFDAS project)	Mr.M.Hatano

5. Other Relevant Data

A-18 Tarawa OIFP Fish purchases by each islands
A-19 THC Fish purchases record(1998)
A-20 Rain fall in Tarawa
A-21 Weather condition in Tarawa
A-22 Maintenance cost of Desalination system

Tarawa OIFP Fish purchases by each islands　　Unit：kg

Year	Mon	Abiang	Times	Miana	times	Kuria	times	Alanuka	Times
1996	1	164	1						
	2	621	4						
	3	756	2	2,645	4				
	4	1,326	4	1,258	4				
	5	1,550	3	643	4				
	6	1,405	5	678	2				
	7	1,672	4	1,913	4				
	8	948	2	1,299	4				
	9	889	2						
	10	485	1	1,044	3				
	11	581	1	2,601	6				
	12			276	1				
Tatal		10,397		12,357					
1997	1			1058	5	610	1	624	1
	2	1,863	5	1,439	4			524	2
	3	1,990	4	1,307	3			330	2
	4	2,166	3	125	1	298	1	200	1
	5	1,200	2	1,057	3	1,228	2	560	1
	6	2,580	4	1,956	5				
	7	836	2	1,112	4				
	8	664	2	611	2	305	1		
	9	257	1	900	2				
	10					488	1	168	1
	11			1,518	3	229	1	1,558	3
	12			1,648	3	1,159	2	23	1
Total		11,556		10,234		4,317		3987	
1998	1			1,477	4	2,388	4	585	3
	2			788	4	1,935	2	615	3
	3			699	4	1,699	2	648	3
	4			1,574	3	594	2	314	2
	5			982	3			230	1
	6			3,555	9	1,440	3	1,348	3
	7			883	3	1,107	1	662	2
	8			1,237	3	1,730	2		
	9	261	1	806	3			843	1
	10	10	1	2,121	3	535	4	9	1
	11	670	3	2,809	6	3,278	4	5	1
	12	869	2	3,285	6			543	3
Total		1,810		17,951		14,706		5802	
1999	1			692	1	655	1	15	1
	2			453	1	130	2	75	1
	3			602	2			41	1
	4			1,370	4	395	2	35	1
	5			752	4				
	6			2,160	5	213	1	74	1
	7			2,121	4			36	1

Source：OIFP Tarawa　(1996-1999)

6. References

	Name of References	Issued	Month Year
1	Annual Review and Update of the Medium Term Strategy 1998	National Economic Planning Office Ministry of Finance and Economic Planning, Government of Kiribati	February 1999
2	Economic Statement 1998	National Economic Planning Office	March 1999
3	Report of the Twelfth Meeting of the Standing Committee on Tuna and Billfish 16-23 June 1999	Secretariat of the Pacific Community, Noumea, New Cakedinia	July 1999
4	Kiribati Statistical Year Book 1988 10th Anniversary of KIRIBATI INDEPENDENCE 12th July 1989	Statistic Office, Ministry of Finance, Bairiki. Tarawa Republic of Kiribati	July 1989
5	Summary Results of the Artisanal Surveys Conducted in the Outer Islands	Fisheries Division	August 1999
6	Production by Islands, 1985-1997	Atoll Seaweed Company Limited	August 1999
7	Price Ordinance(CAP.75)	Ministry of Commerce, Industry and Tourism	11th Mar. 1999
8	Freight Rates (per cubic metre) General Cargo (Domestic)	Kiribati Shipping Services Limited	August 1999
9	MV Tebenebene Voyage Report (Photo copy of Part of above report)	Fisheries Division, Ministry of Natural Resources Development	1997 - 1999
10	1998 BUDGET	Government of Kiribati	Nov. '97
11	1999 BUDGET	Ministry of Finance	Mar.'99
12	INTERNATIONAL TRADE 1997	Ministry of Finance	Mar.'99
13	Report on the '95 Census of Population	Statistic Office, MOF.	Nov.'97
14	KIRIBATI TELEPHONE DIRECTORY 1999	TSKL Connecting Kiribati	1999