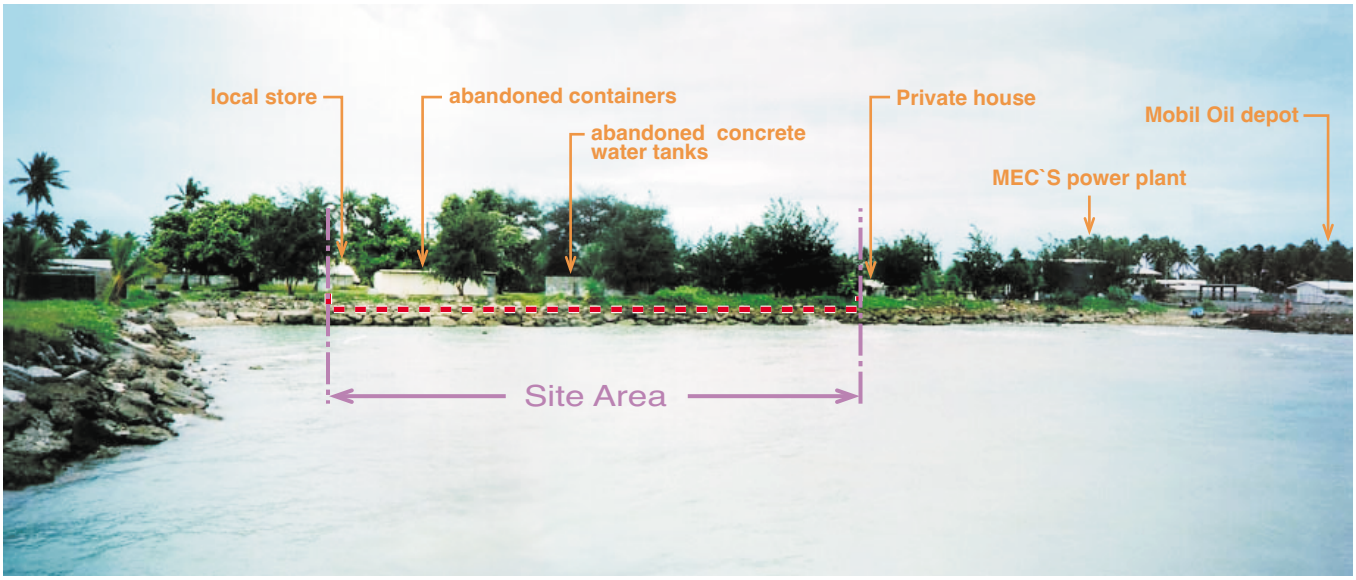
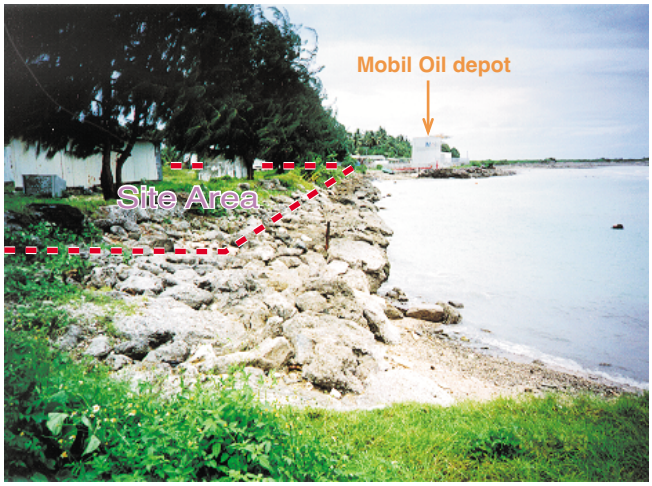
Photographs of Present Site Conditions

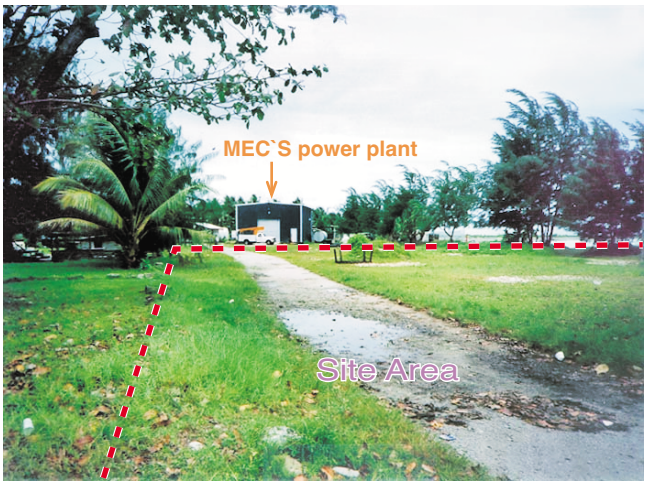


■ Site Overview from Existing Pier

■ Existing Pier : located 150m seaward from the Site



■ Stone filled seawall facing to the west side of the Site



■ Site view 1 : south end of the Site, facing to the MEC`S power plant site

■ Site view 2 : north part of the Site, showing abandoned containers and concrete water tanks

List of Abbreviations

RMI	Republic of the Marshall Islands
R&D	Ministry of Resources and Development
MIMRA	Marshall Islands Marine Resources Authority
JALG	Jaluit Atoll Local Government
JADA	Jaluit Atoll Development Association
JAFF	Jaluit Atoll Fishing Federation
ADB	Asian Development Bank
EPA	Environmental Protection Authority
HPO	Historic Preservation Office
NOAA	National Oceanic & Atmospheric Administration USA
MEC	Marshall Energy Company
RRE	Robert Reimers Enterprises
NFDP	National Fisheries Development Plan
OFCF	Overseas Fishery Cooperation Foundation
COFDAS	Coastal Fisheries Development and Assistance
NPO	Non-Profitable Organization
EEZ	Exclusive Economic Zone
GNP	Gross National Products
CDL	Chart Datum Level
FRP	Fiber Reinforced Plastics

Table of Contents

Appendix

Annex

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1.1 Background of the Project Request

The Republic of the Marshall Islands (henceforth referred to as RMI) is located 4°~14° N and 160°~173° E in the central Pacific Ocean and it is comprised of 29 coral atolls and five islands. The nation's total land area is 181km^2 ; and with the total population of about 51,000 in 1999.

The country is under the influence of the tropical/oceanic climate with year-round eastern trade wind, and with annual average temperature of about 28°C. Annual rainfall is more or less 3,000mm. However there is some tendencies of drought conditions during January to March. The wind becomes stronger during December to March, hence the sea often becomes rough difficult to navigate. Although typhoons attacked five times in the last 55years, the death case was recorded only once in 1958.

The Exclusive Economic Zone is vast at 2,430,000km^2. The fishing grounds are an abundant source of wide-ranging migratory fish such as tuna and bonito. Fishing agreement fees are collected from foreign fishing vessels, including Japanese vessels. The coastal coral areas are very important for the people's daily lives as the supply source of animal protein.

After the World War II, the Marshall Islands became under the administration of the US government as the Trust Territory of the United Nations. In 1986, it became independent under the relationships of Free Association with the US government.

The economy of the RMI is based on a dual structure with a traditional self-sufficient economy and a monetary system. There are no important industries except agriculture (copra production) and fisheries. Therefore, the country's economy is strongly depended upon the Compact Fund based on the said Free Association Agreement, and the incomes relating to the US military base in the Kwajalein Atoll. The most important target of the RMI government has been to achieve an independent economy within the period of the Agreement (15 years from the year of 1986 to 2001). However approximately 50% of the national budget (about US$90 million) is still to be funded by the US government.

The concentration of the population in the urban areas (the Majuro Atoll, the capital, and the Ebeye Island adjacent to the US military base) has reached 68% of the total

population, led to a depletion and aging of the population on the outer islands--contributing to stagnancy of the copra production of annually 6,000tons level during the last 15years. Further, the social foundations, supporting facilities, transport facilities are lagging greatly on these outer islands. This has created an economic disparity in the average annual income per household of about US$10,490 in the urban areas and about US$1,570 in the outer islands (The household income levels of the Kiri Island and the Enewetak Atoll receiving the US compensation for nuclear testing, are similar to those of. the urban areas.). As a result, stimulating the economy of these islands is a major issue of the RMI government.

As the Marshallese are primarily fish eaters, the per capita annual fish consumption in the outer islands shows high level of about 122kg. But in the urban areas, it shows only about 22kg, and the balance of protein deficiency is supplemented by imported meat, canned foods, etc. The major reason of insufficiency of fish supply in urban areas is lack of fish marketing system of fish catch by outer islanders because the frequency of transport service by transport vessels connecting among atolls is low (once in 2,3 months) and not regularly scheduled. It will be one of the effective ways for stimulating the economy of outer islands to supply their fish resources to the urban areas. But in the present time, the income level of outer islanders are too low to provide fish transport vessels, motorised fishing boats and fishing gears by themselves.

Against this background, the RMI government made a plan to stimulate small scale fisheries of the Jaluit Atoll located about 230 km southwest from Majuro, and to improve fish marketing conditions of fish consumption areas (Majuro and Kiri island), which is part of aiming at achieving independent economy and improving economic disparity between the urban areas and outer islands, and requested grant aid from Japanese government for providing necessary facilities and equipment to implement the plan.

In response to the request, Japanese government carried out a preliminary survey in March 2000 through Japan International Cooperation Agency (henceforth referred to as JICA) in order to collect basic information such as budget conditions and staff capability of the implementing agency, fish marketing conditions, etc. that are necessary for formulating a basic plan. Based on the result of this preliminary survey, Japanese government decided to carry out the Basic Design Study of this Project, and JICA dispatched a Basic Design Study team.

1.2 Summary of Facilities/Equipment Requested

1) Fishery Base

①Building：2 stories 480m^2	1 building
(office, meeting room, accommodation, storage, workshop, toilet, machine room, fish handling hall)	
・Ice making machine/storage(production 2t/day、storage 2.5-3t)	1 set
・Cold storage(about30m^3)	1 set
・Fuel drum depot	1 set
・Water reservoir(30 t)	2 sets
・Septic tank	1 set
②Landing pontoon	1 set

2) Fishing Equipment

・Small fishing boat (FRP,29 ｆｅｅｔ)	9 boats
・Outboard engine (30HP, gasoline)	18 set
・Fishing gears	1 set
・Insulated box (160liter)	60 pcs
(60liter)	20 pcs
・Radio (SSB150W)	1 set
・Radio (VHF10W)	1 set
・Transceiver (VHF10W)	20 sets
・Repair tools/spare parts for engine	1 set
・Truck with crane	1 truck
・Top pan scale (150kg)	1 set
・Push cart (250 kg)	2 sets
・Drum	10 pcs

3) Fish Marketing Equipment

・Transport vessel(length17~18m, gross tonnage 20t, speed 17knots)	1vessel

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2.1 Objectives of the Project

The problems that must be resolved to improve fishery production and marketing in the Marshall Islands have been explained in Chapter 1. The objectives of the Project is to promote fishing activities and make shipment of fresh fish to respond fish demand in the Majuro Atoll and the Kili Island through providing a production and marketing system for coastal fisheries on the Jaluit Atoll, and finally to stimulate the local economy of Jaluit, and to contribute to improving present fish marketing conditions in Majuro.

2.2 Basic Concept of the Project

2.2.1 Cooperation Policy

To promote fisheries in Jaluit by improving its fish production and marketing capabilities, a fisheries base, fishing boats, fishing equipment, transport vessel, and other facilities and equipment were requested for the Project. During the initial stage of the request, the Project's activities were limited to improving fish production and marketing. However, in view of the importance of accumulating data on maintaining the sustainable use of fishery resources, the Project has been expanded to include activities aimed at improving MIMRA's system of recording fish catch. Furthermore, MIMRA is planning to introduce a user's(fishermen's) shoulder system onto the fish production equipment such as fishing boats, outboard engines, fishing gears, etc., which are the Counterpart Fund component among the equipment provided by the Project.

.

The basic conditions that were included in the project are given below.

(a) Priority will be given on establishing a stable means of marketing, a major factor in improving fisheries in Jaluit.

(b) The low nutrient salt content of the coral reef waters has contributed to a limited production of bait organisms. As a result, replenishing fishery resources is dependent on the long-term growth of young fish. Therefore, the fishing boats that will be provided by the project must be dispersed and should not be concentrated in any specific area around the atoll in order to achieve sustainable

use of fishery resources. In addition, priority will be given to allocating the fishing boats to wards where there is a low ratio of motorized fishing boats per population.

(c) The shipment volume of fresh fish from Jaluit will not exceed the fresh fish demand on Majuro and Kili Island.

(d) The equipment which can reduce fishing operation costs as much as possible, will be selected.

(e) Fish production and marketing costs will be kept within balance of the sales revenue; and realistic targets will be set accordingly.

(f) The facilities and equipment that will be provided by the Project will be resistant to salt damage. Further, safety considerations will be given priority in deciding the specifications of the fishing boats and transport vessel, that will be used in navigating the open ocean.

2.2.2 Development Framework Plan

(1) Appropriateness of the Project site

Of the nine wards on Jaluit Atoll, Jabwor ward has been selected as the site for the fisheries base that will be provided by the Project. It is located in the southeastern area of the atoll. Of the three channels that are found on Jaluit, Jabwor is adjacent to the South-East Channel, which is the least affected by the prevailing northeastern winds. The channel is suited for accommodating large vessels and subsequently, Jabwor, has inevitably developed as the center of the atoll. As of 1999, it contained about 36.5 percent of the atoll population or 610 people on this atoll.

It is also the only site with infrastructure such as a pier and anchorage for boats, a Mobil Oil reserve base, 24-hour electricity supply, a high school, hospital, and others. As can be seen in the location map, Jabwor is centrally located within a 20km radius from the other wards, with the exception of Jitoken, the northernmost ward located about 50km distant. In addition, ice production and fish handling works of fish catch in this Project will be also carried out. Therefore, the geographical conditions of the site, the availability of electricity, a quay and anchorage facilities, make Jabwor an advantageous and appropriate location for the Project site.

(2) Appropriate number of motorized fishing boats by the Project

The Project was requested to provide a total of nine boats--one boat for each of the seven wards where the registered JAFF members reside, two boats for Jabwor ward, and one boat for MIMRA to be used in supervisory activities.

Of the 29 atolls that comprise the nation, Jaluit Atoll has the seventh largest lagoon and has the fifth largest population. However, as can be seen in the table below, the number of privately owned motorized and non-motorized fishing boats per household is lower than the national average and lower than the average for the outer islands; and there is room for improvement.

Comparison of the Ratio of Privately Owned Fishing Boats Per Household in the Urban Areas, the Outer Islands, and Jaluit

Number of Households	Type of Fishing Boat	Number of Households Owning Fishing Boats	
		Number of Households	%
5,126 households	Motorized boats	956	18.6
(total national figure)	Other fishing boats	626	12.2
3,082 (urban area)	Motorized boats	439	14.2
	Other fishing boats	231	7.5
229 (Jaluit)	Motorized boats	26	11.3
	Other fishing boats	23	10.0

Note: The figures for Jaluit Atoll are data from the 1999 Census. The other figures are based on the findings of the ADB survey.

There is no accumulated data on the coastal fisheries resources of the country. This Project targets fisheries activities throughout the entire coral reef areas and subsequently, MIMRA is planning to actively utilize the Project as a means of collecting data to enable analyses of fisheries resources of a coral atoll. It will revise the practice of recording only the fish catch volume, to include the CPUE, or fishing effort of the fishermen(net operation time period of fishing, number of persons engaged, number of fishing gears engaged, etc.). Once these data are accumulated, a trend of fish catch efficiency by type of fishing gear will be grasped, and it will enable to apply to the estimation of optimum fish catch volume out of existing resources volume. However, in order to achieve this, MIMRA must persevere in its efforts to

educate, supervise, and obtain the cooperation of fishermen. The educational and supervisory activities carried out at the fisheries base alone are inadequate and they must be conducted in each ward as well. The Project will provide one boat for the educational, guidance, and monitoring operations that will be conducted in each ward, as requested by the RMI side.

Although a specific plan on the educational and guidance activities has not been formulated yet, the activities that are planned by MIMRA are shown in the table below.

MIMRA Fishery Guidance Plan for the Jaluit Atoll

Activity	Content	Location and Term
Study to establish a fishing zone	Several fishing zones in each ward to be created based on discussions with fishermen on factors such as traditional ward boundaries, topographic characteristics of reef, etc. An overall framework to be initially created and the details will be set later.	Location: All the reefs Term: One month in each ward, total 9 months.
Seminar on recording fish catch	A seminar on maintaining fish catch records using the set MIMRA form will be held for the fishermen representatives from each ward. A MIMRA officer will accompany and assist the fishermen representative in explaining the process and answering the questions of the fishermen in their respective wards.	Location: Seminar at fishery base. Explanations to fishermen in each ward. Term: Explanations to local fishermen; once in every ward within a one month period.
Monitor on actual fishing activities	In order to begin fish shipments under the Project, the expert will accompany the fishermen on their fishing trip and provide supervision on recording the data and the record-keeping method. After the first two years of the Project, the fishing operations will be monitored regularly and an exchange of opinions about the Project will be made with the fishermen.	Location: Each ward Term: One ward, once every two weeks. Repeated 3 times for each district(48 times). Monitoring activities will be carried out twice a year in each ward(32 times).
Coordinate with JADA Biodiversity Conservation Project	Discussions will be held on the protection zone that will be set up for the giant clam and mother shell of the black lip pearl shell planned under the Project. Its exact location and on-site inspection will be carried out.	Location: Discussions to be in meeting room at fishery base. Selection of the site to be made on location. Term: Chartered boat to be used for first 2 years, followed by on-site inspection within 6 months.

This type of activity within coral reef fisheries is seldom to have been carried out formerly. Therefore, this Project will provide a fishery supervisory boat for MIMRA to assist this activity since it is an extremely significant and worthy endeavor.

As the chartered boat cost is high in Jaluit, it is more economical and enables to suppress the activity cost to 1/3 compared with the cost of chartering boats for MIMRA to possess its own boat for educational and supervisory purposes(See details in Appendix 4.). It will also provide MIMRA flexibility in conducting its supervisory activities.

(3) Potential fresh fish shipment volume of the Project fishing boats

It is estimated that the average fish catch volume per household for one week on the outer islands is about 35.6kg, that the number of persons engaged in fishing is 346, and that the fish catch volume for one week is 7,476kg. Therefore, the per capita fish catch volume per week is calculated as 7,476kg/346 people = 21.6kg (47.5 lbs.). Meanwhile, the feasibility of this value was discussed with the 15 fishermen representatives from each ward. As a result, it was estimated that dependent on weather conditions and the location of the fishing grounds, an average of 18.2kg (about 40 lbs.) can be harvested with certainty. Both estimates are around 20kg, $\pm$ 2kg. Therefore, the official estimate of the per capita fish catch volume in this Project has been set at 18.2kg (40 lbs.), the average volume obtained from the fishermen representatives, in order to realise a stable volume of the shipment.

Irrespective of the use of a fishing boat, the traditional ways of fishing in Jaluit are encircling net fishing and night time spear fishing, which are carried out in shallow waters by groups of 6 to 8 fishermen. Fishing is limited to the waters around the fishing village in case there is no fishing boat. A fishing boat will allow the fishermen to fish in distant fishing grounds, and that a fish catch volume of 100 to 150kg per fishing trip is expected using these fishing methods. Other methods include bottom line fishing, gill net fishing, cast net fishing and trolling. These methods can be employed by a smaller number of fishermen. In the case of trolling, the number is limited to three crew members, in order to prevent fishing lines from entangling, but the number of crew members can be increased according to the size of the fishing boat for other fishing methods. As described earlier, the ratio of privately owned fishing boats per household in Jaluit is lower than the national average, and the

fishermen strongly desire to possess the fish production means such as fishing boats, fishing gears etc.

Presently, the commonly used motorized fishing boat is a comparatively inexpensive 14ft (4.2m) FRP boat (flat bottom type, 30HP, 2 to 3 crew member capacity). However, encircling net fishing and night time spear fishing can not be carried out in this type of boat. This Project plans to provide fishing boats that will allow these traditional fishing methods to be employed and which will accommodate a large number fishermen for one fishing operation. Therefore, fishing boats that are 22 to 29 feet (6.6 to 8.7m) in length, that will accommodate a crew of six fishermen, a large insulated box, and fishing gear, are planned by the Project. Hence the fish catch volume per fishing trip per fishing boat has been estimated at 18.2kg/person x 6 members/boat = 109.2kg/boat (240 lbs./boat).

Based on the above, the shipment volume of eight Project boats in one fishing operation has been estimated at 109.2kg/boat x 8boats = 873.6kg or about 880kg.

(4) Potential shipment volume of existing fishing boats

As explained later, the Project transport vessel between Jaluit and Majuro will operate once a week. According to this shipment schedule, existing fishing boats other than the Project fishing boats will also have the opportunity to ship their fresh fish catch. However, the fresh fish that will be handled under the Project must be preserved in ice immediately after they are caught in order to preserve freshness. As a result, the existing fishing boats that want to ship their fresh fish catch must trip to the fishery base from their respective wards in Jaluit to purchase the ice prior to beginning their fishing operations, and return once again to Jabwor to land their fish catch at the fishery base. In such cases, the fishing boats from outside of Jabwor ward must make two round trips between their wards and Jabwor (about 64 to 98km) and pay added fuel costs (US$16 to $24 for a boat 14ft in length, 30HP) that amount to about 36 to 54 percent of their total fish sales (about US$44). The Project will accept the shipment of existing fishing boats from any wards, if the quality of fish catch is good enough. However, it is rational to anticipate that only those fishing boats currently in operation from Jabwol ward, where such added fuel costs are not accrued, will participate in the Project's activity to transport fresh fish to Majuro. The

fishermen in Jabwol have shipped their fresh fish catch to Majuro using the RRE transport vessel in the past and they are highly interested in participating in the Project's activity to ship fresh fish.

There are presently 12 motorized fishing boats from Jabwor ward in operation. These fishing boats operate with a crew of two to three members. Under this Project, it is assumed the fish catch volume of one existing boat is calculated at 36.4kg by a crew of two members (18.2kg/person x 2 people = 36.4kg) instead of three members. Therefore, the potential shipment volume of fresh fish for fishing boats currently in operation is estimated at 36.4kg/boat x 12 boats/trip = 436.8kg/trip or about 440kg.

(5) Fresh fish demand in Majuro

The population on the Majuro Atoll is 23,676 in 1999, with 3,080 households, and a population growth rate of 1.8 percent. The annual fresh fish consumption volume is about 538 tons (including the 25 tons/year of fresh fish supplied from the Arno Atoll) and the per capita consumption volume is estimated at 22.7kg. Although the population growth rate is a major factor in estimating the future demand for fresh fish, the fresh fish demand in Majuro differs markedly according to income level, as is explained later. Therefore, the estimated fresh fish demand will be calculated according to the potential demand within the different income levels, rather than on long-term demand based on population growth.

The survey findings on the fish consumption volume of Majuro inhabitants (150 households or 5 percent of the total 3,058 households were interviewed), that were collected during the field study of the Basic Design Study (July:2000: the peak fishing season in Majuro continues about 9 months, excluding the months of January to March when the waters are turbulent), are shown in the table below. The consumer buying trends in fish differ according to income.

Fish Consumption Trends According to Households in Majuro

Monthly Income According to Household	Number of Households		Per Capita Fresh Fish Consumption Volume per Day	Average Purchase Price of Fish Price
($/month)	(Household)	(%)	(g/person/day)	($/kg)
Under 300	326	10.7	95.4	3.38
300 to 600	889	29.1	120.0	3.38
600 to 1000	839	27.4	130.9	3.45
1000 to 1300	235	7.7	135.4	3.45
1300 to 1600	179	5.9	190.4	3.36
1600 to 2500	301	9.8	255.4	3.63
2500 to 4200	209	6.8	235.9	4.35
4200 to 6000	62	2.0	450.4	4.29
More than 6000	18	0.6	432.7	4.29

Source: Survey on the Fish Consumption Volume in Majuro, Basic Design Study Team, July 2000

Note: The number of households is based on the 1999 Census.

The ratio of households that responded that they would like to eat more fish if it was cheaper, was 84.4 percent for households with a monthly income of under $600, 43.5 percent for households with monthly earnings of $1000 to $1300, 36.3 percent for households with a monthly income of $1300 to $1600, 17.6 percent for households earning $1600 to 2500, and 0 percent for households with monthly earnings of $2500 or higher. As can be discerned from the above, the majority of the respondents were households in the lower income bracket, which comprise more than 60 percent of all households on Majuro.

Further, the ratio of households that responded that they would like to eat more fish, regardless of the price, was 0 percent for households earning less than $600 a month, 15.6 percent for households with a monthly income of $600 to $1000, 42.3 percent for households with a monthly income of $100 to $1300, 54.5 percent for households with monthly earnings of $1300 to $1600, 62.5 percent for households with a monthly income of $1600 to $2500, 42.8 percent for households earning $2500 to $4200 a month, and 28.5 percent for households with a monthly income higher than $4200. The majority of the respondents were from the middle to upper level income brackets, which comprise 20 percent of the total number of households on Majuro.

Since the inhabitants of the Marshall Islands have traditionally consumed fish, the maximum fish consumption volume of such respondents was assumed to be the same consumption level of the inhabitants on the outer islands (22.3kg/year = 335.0g/person/day), and the estimated potential fresh fish demand is shown in the table below.

Potential Fresh Fish Demand of Households That Want to Eat Fish, Regardless of Price

Monthly Income According to Household	Households That Want to Eat Fish, Regardless of the Price		Per Capita Potential Fresh Fish Consumption Volume	Potential Volume of Fresh Fish Demand Per Week
($/month)	Number of Households	Population	(g/person/day)	(kg/week)
Under $300	0	0	--	--
$300 to $600	0	0	--	--
$600 to $1000	131	1,007	204.1	1,439
$1000 to $1300	99	761	199.6	1,063
$1300 to $1600	97	746	144.6	755
$1600 to $2500	188	1,445	79.6	805
$2500 to $4200	89	684	99.1	474
$4200 to $6000	17	130	(-115.4)	(0)
Above $6000	5	38	(-97.7)	(0)
Total	735	5,650	--	4,536

Source : Survey on the Fish Consumption Volume in Majuro, Basic Design Study Team, July 2000

Remarks: Households with a monthly income of more than $4200 consume fish more than 335.0g/person/day. Subsequently, they were not counted for the potential demand estimation.

Accordingly, MIMRA has still rooms of the potential demand for fresh fish per week at about 4.5 tons, using the current fish price for its fish marketing activities. This signifies that the total combined shipment volume of fresh fish to Majuro by fishing boats from Jaluit planned under this Project, as well as by fishing boats presently in operation (880kg+440kg = 1,320kg/week), will not exceed the demand.

The ratio of lower income households that said they would increase their purchase of fresh fish if the price was lower than the current prices, was 60 percent of all households. Unlike the outer islands, a cash economy exists on Majuro. As a result, other sources of animal protein aside from fresh fish such as imported canned fish and meat, frozen beef, pork, chicken, eggs, milk, cheese, and others are marketed. The most inexpensive and common source of animal protein, other than fresh fish, that is consumed by lower income households, is canned fish.

The followings are the explanations on estimations of the potential fresh fish demand if the switch from canned to fresh fish is made by households.

Based on the fish consumption volume shown above, canned fish is commonly consumed by all households, irrespective of income bracket, and this signifies the inhabitants' preference for the taste of canned fish. Against this consumption trend, the ratio of households, that said they purchased canned fish because it was cheaper than fresh fish (and would purchase fresh fish if the price was the same as canned fish), is shown in the table below (the ratio of households that may switch from canned to fresh fish: Rc).

Ratio of Households That May Switch from Canned to Fresh Fish

Monthly Income ($/month)	Rc (%)
Under $600	72.1
$600 to $1300	63.3
$1300 to $1600	63.6
$1600 to $2500	58.8
$2500 to $4200	61.5
Above $4200	14.3

The average purchase price of canned fish for households with a monthly income of less than $1300 was $2.49/kg. The canned fish consumption volume (Cfc) per week of households that may switch from canned fish to fresh fish is shown below.

Cfc According to Income Bracket

Monthly Income ($/month)	Cfc (kg/household/week)
Under $600	2.28
$600 to $1300	3.00
$1300 to $1600	2.09
$1600 to $2500	5.15
$2500 to $4200	1.90
Above $4200	1.63

Based on the above figures, the formula for the potential fresh fish demand (Df) per week according to income bracket is shown below for those households that may switch from canned to fresh fish if the price was lower.

Df = number of households according to income bracket x Rc x Cfc/fresh fish conversion rate of canned fish (0.54)

The Df, according to income bracket calculated using this formula, is shown in the table below.

Potential Fish Demand (Df) of the Shift from Canned to Fresh Fish in Majuro

Monthly Income ($/month)	Df (kg/week)
Under $600	3,703
$600 to $1300	3,782
$1300 to $1600	440
$1600 to $2500	1,688
$2500 to $4200	451
Above $4200	34
Total	10,098 (about 10.1 tons)

In order to stimulate this potential demand, the current fish prices at the Teron Fish Market operated by MIMRA must be lowered.

According to the sales record of this market from January to July 2000, the price of fish that were transported from the Arno Atoll to the market, was divided into the following four classes based on consumer preference and fish species.

－Fresh fish ($/kg): Class A, 4.40; Class B, 3.63; Class C, 3.08; Class D, 2.42

－Salted and Dried Fish ($/kg): 5.50

Of these classes, the Class D price is set lower than $2.49, the average retail price of canned fish that was purchased by households in the monthly income bracket of under $1300.

However, in the actual sales market, fish sales fluctuated, and when sales were down, the price was discounted. There is a characteristic pattern of how the prices are reduced. As can be seen in the following table, Class D fish tended to remain unsold and about 38 percent of the purchased volume of fish was reduced 10 to 20 percent. About 15 percent of the purchase volume of Class C fish is sold at a 10 percent discount. The higher quality Class A and B fish was usually completely sold out and they were rarely sold at discounted prices.

Volume of Fish Sold According to Species at the Teron Fish Market

Class of Fish	Fish Price ($/kg)	Volume Sold (kg)	Sales Revenue (US$)
Salted/Dried Fish	Retail price: 5.50	312.0	1,716.0
	Discount Price:		
Class A	Retail price: 4.40	1,143.3	5,030.5
	Discount Price: 4.18	24.4	102.0
Class B	Retail price: 3.63	3,305.6	11,999.0
	Discount Price: 3.30	13.4	44.2
Class C	Retail price: 3.08	1,092.4	3,364.6
	Discount Price: 2.75	201.1	553.0
Class D	Retail price: 2.42	2,691.8	6,514.1
	Discount Price1: 2.20	1,359.5	2,990.9
	Discount Price2: 1.98	319.4	632.4
Total	Regular Average Price: 3.35	8,545.1	28,624.2
	Discount Price: 2.25	1,917.8	4322.5
	Overall Average Price: 3.15	10,462.9	32,946.7

Source: Sales Records of the Teron Fish Market, January to July 2000

In order to lower the overall average price shown in the table above, to the average equivalent price of $2.49/kg of canned fish that is purchased by households in the monthly income bracket of less than $1300, the price of the each of the four classes of fish must be decreased according to the following method (it is assumed that the composition ratio of the class of fish shown in the table above will not change).

The sales volume of Class D fish comprises about 42 percent of the total sales volume, and its regular retail price ($2.42/kg) is cheaper than the average price of canned fish ($2.92/kg) that is purchased by households with a monthly income of less than $1300. However, despite this low price, Class D fish is difficult to sell and must be discounted by one-third of the total handling volume in order to sell out the fish. Therefore, the regular retail price will be adjusted to the same price given in the table above on "discount price 2" or $1.98 (a 20 percent lowered adjustment), in order to stimulate sales. (According to MIMRA, the price of fresh fish purchased from the fishermen from Arno averages $1.87/kg. If the transport fuel costs from Arno are included, the price can not be discounted further.)

The sales revenue generated from Class D fish is about 30 percent of the total fish sales revenue and the remainder is generated from the sales of high grade fish. In order to adjust the overall average price to be approximately $2.49/kg, the price of high grade fish should be lowered. The price of processed fish products, that are completely sold out without a reduction in price, will be kept. The discount ratio off the current regular price of Class A, B, and C fish will be set within the range of 20 to 25 percent since a 10 percent discount will not lower the overall average price and a 30 percent reduction is too high. Subsequently, the price of Class C fish will be decreased 20 percent—$2.46/kg that is approximately the same price of $2.49/kg. The price of Class A and B fish will be reduced by 25 percent since there is a large disparity between the retail and purchased prices.

Based on these adjustments in fresh fish price, the overall average price has been adjusted to about $2.49/kg as shown in the following table.

Retail and Overall Average Price and Sale Volume after Current Fresh Fish Price Adjustments

Class of fish	Fish Price ($/kg)	Volume Sold (kg)	Sales Revenue (US$)
Salted Fish	No Reduction: 5.50	312.0	1,716.0
Class A	Reduced: 4.40→3.30	1,167.7	3,853.4
Class B	Reduced: 3.63→2.72	3,319.0	9,027.7
Class C	Reduced: 3.08→2.46	1,293.5	3,182.0
Class D	Reduced: 2.42→1.98	4,370.7	8,654.0
Total	Overall Average Price: 2.52	10.462.9	26,433.1

Based on the analysis above, the potential demand for fresh fish is about 4.5 tons per week, if the current fresh fish prices are maintained by MIMRA. If MIMRA adjusts the current retail prices as explained above, approximately 10.1 tons per week is added and the total volume for one week becomes 14.6 tons.

(6) Fresh fish demand on Kili Island

In order to rectify the shortage in the supply of fresh fish on Kili Island, this project plans to supply fresh fish from Jaluit to the Kili Island.

According to the 1999 census, the average annual income of this island's inhabitants was $8,114 (average monthly income of $676), which approximates the annual income of $9,030 of Majuro residents (average monthly income of $752). (The annual income on the other atolls is under $3000, excluding Majuro and Ibeye.) Thus, the fresh fish demand on the Kili Island was estimated based on the fish consumption volume of the $600 to $1000 monthly income bracket on Majuro, which is comparable to the average monthly income of Kili residents.

As explained in section (5) above, the fish consumption volume per day of Majuro residents in the $600 to $1000 income bracket is 130.9g/person/day. In contrast, the current consumption volume on Kili Island is 15g/person/day. The potential fresh fish demand (Dkd) per day of Kili residents was estimated at 89.7kg/day[(130.9 ― 15.0)g/person/day x 774 people = 89,707g].

Although the shipping costs become cheaper when a large volume of fish is transported on one trip, the maximum shipment volume (Sj) from Jaluit = Dkd x 3 days volume/shipment = 89.7kg/day x 3 days volume/shipment = 269.2kg/ shipment , since three days is the maximum storage period for the insulation boxes containing the ice-packed fish.

In order to decrease the shipping cost in the Project, the maximum shipment volume has been set at about 270kg (600 pounds) per shipment to the Kili Island.

(7) Shipment volume from Jaluit under the Project

①Planned shipment volume

Based on the explanations given in sections (2) to (6), the planned shipment volume per time from Jaluit has been set at 1,320 kg/time [potential fish catch volume of the Project fishing boats (880kg/trip/week)+ potential shipment volume of existing fishing boats currently in operation(440kg/trip/week)]. Of this volume, 270kg/shipment/week will be earmarked for Kili Island and the remaining 1,050kg/shipment/week will be transported to Majuro.

② Impact to existing fish resources by the project fish catch

As explained earlier, the estimated fish catch volume per week of Jaluit fishermen is about 7.5 tons. The annual fish catch volume is about 222 tons based on 30 weeks/year of fishing trips. The annual number of shipments which will be conducted under the Project is dependent on weather conditions. The monthly average wave height of the month of December to March for these ocean waters is about 30 percent higher than those of other months, and some shipments might probably be avoided during these months. The RRE transport vessel also often avoids making trips during this period. Therefore, it is estimated that shipments will be carried out for 40 weeks out of the 52 weeks in one year(operation rate: about 77%). Hence the annual shipment volume(that is the annual fish catch by the Project) is estimated at 52.8 tons(1,320kg/shipment x 40 shipment/year = 52,800kg/year), or 23.8 percent of the current annual fish catch volume of this atoll. In case the Project is implemented, the total annual fish catch volume of the atoll will be increased to about 275 tons[current

annual fish catch volume(about 222 tons) + annual fish catch by the Project(about 52.8 tons) = about 257 tons].

Studies on the volume of coastal fishery resources of coral reefs are almost nonexistent. The U.S. Department of Energy reported an optimum annual fish catch volume of 4 tons/km^2 (excluding migratory fish) in the survey studies of the Enewetak Atoll. Based on this figure, it is calculated that the optimum annual fish catch volume of the Jaluit Atoll is about 340 tons/ year, as the area of the coastal fishing ground of this Atoll is estimated at about 85 km^2[The total coastal length of Jaluit Atoll is about 150km. Assuming that the angle of bottom slope is 45^oC and that the range or fishing ground depth is 0~200m, the bottom slope width up to 200m depth is about 283m. And this bottom slope is assumed to exist at the both sides of the coral coast. Subsequently, the area of coastal fishing ground = total coastal length (150km) x bottom slope width (0.283km) x 2 = 84.9 km2].

As mentioned earlier, the total annual fish catch volume with Project is about 275 tons/year and this figure is lower than the estimated optimum annual fish catch volume of 340 tons/ year. Accordingly, it is considered the fishing activities of the Project will not hurt sustainable use of existing resources.

This Project will play a significant role in helping MIMRA to accurately evaluate the fishery resources of the atolls and to determine the trends in coastal fisheries along the coral reefs by providing accumulated data on fish catch volume.

2.2.3 Basic Policy of Facility Plan

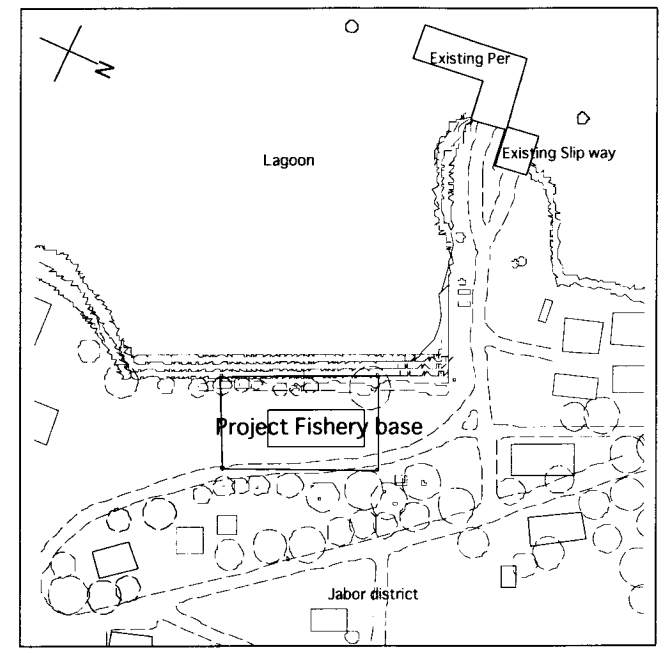
The facilities that have been requested with the aim of improving fresh fish production and marketing are landing facilities for small fishing boat and transport vessel, and building for the fishery base. The requested components were reviewed and the basic policies have been set up in the following order.

(1) Landing facilities for the small fishing boats and transport vessel

(2) Building for the fishery base

(1) Review and basic policies of the requested landing facilities for the small fishing boats and transport vessel

A pontoon for small fishing boats and transport vessel was requested to provide and install in the south side of the existing pier for large boats as shown in the drawing below. Presently, there are no landing facilities for small fishing boats and the fish transport vessel in Jaluit and these facilities are essential to the Project. However, based on the survey findings of the site, there are advantageous and restrictive factors stemming from the geographical and natural conditions of the site. The plans that have been reviewed fall largely into two groups:to focus on effective utilization and construct landing facilities at the existing pier located 150m from the fishery base site, or to build the landing facilities using the rock-filled revetment located in front of the fishery base site.



Advantageous Factors

－The existing pier blocks the prevailing northern and northeastern winds. Hence the waters on the south side of the pier is calm throughout the year, with the exception of the western and southern winds that blow rarely (two months in ten years).

－The water depth during the high tide is adequate and a boat with a 2m draft will be able to dock at all times.

－Although the water depth in front of the site is about 1-3m up to about 70m offshore, small fishing boats are able to dock at the existing rock-filled revetment. If the sea bottom is excavated, the transport boat with a 2m draft will be able to dock at this site. Due to the calm waters, the possibility that the excavated sea bottom will become covered is nil.

Restrictive Factors

－The distance between the existing pier and the site is about 150m. It is impractical to unload and transport fish catch weighing over 200kg from the fishing boats to the site on a frequent basis.

－The existing pier, built in 1987, is a cell structure made of steel sheet piles and theoretically, its durability is about 30 years. However, according to the field survey of the Basic Design Study , the corrosion of the steel sheet piles used in the foundation was only visually ascertained and a detailed study must be carried out during the Detail Design stage to ascertain the degree of the corrosion.

－In the case of a pontoon, the boats must go around the pontoon to dock on the opposite side to the pier. As a result, the cargo can not be directly loaded or unloaded, and the task becomes extremely inefficient.

－The rock used for the existing revetment is 1-2m in length and are made of a mixture of irregularly-shaped coral rock. Subsequently, it can not be utilized for loading and unloading the heavy cargo of fishing boats in its present state.

－If the landing facility for the transport vessel is not set to the existing pier but to the rock filled revetment near the site, excavation works near the site must be carried out. This will add to the project cost.

Based on the conditions explained above, the following alternate plans were reviewed.

1) Plan to construct the landing facility utilizing the existing pier

① Conditions of the existing pier

The pier has mooring facilities for large vessels, a pontoon for small and medium boats, and a slipway for landing craft. The steel frame pontoon on the calm, south side of the pier sank in 1997 due to depreciation and presently, only the lower end of the pilings remain and the facility is not in use.

The dimensions of the concrete pier deck is about 1.3m in depth, with a total length of 32.7m and a width of 10.35m (See details in Appendix 3). The foundations of the deck are sheet piles in the shape of duplicated arcs (t=12.7mm) with a diameter of about 9m. Sand and gravel was used as filling. The levee crown of the pier deck has a height of about 1.7m during the average spring high tide and about 3.2m during low tide. (According to the tide tables, the difference between the maximum high and low tide levels is about 1.8m.)

The slipway, which is connected to the north side of the pier, is about 9.5m in width, 12m in length, with an incline of about 1.8, and its upper end connects to the access road. The lower end is about 1.5m lower than the levee crown of the pier deck (the maximum high tide level) and drops off perpendicularly.

Presently, the transport vessel that operates between the outer islands utilizes the landing facility for large vessels and the large landing craft uses the slipway. After the pontoon for the small and medium boats were destroyed, the small RRE transport vessel visiting Jaluit about once a month from Majuro uses the slipway when the waters are calm. However, this transport vessel utilizes the calm, south side of the pier when the waves are rough and its cargo is unloaded manually. The task of unloading the cargo is difficult due to the long period of time when the water level is too low to reach the levee crown of the pier (60 percent in the case of the slipway, 90 percent for the pier). The small fishing boats currently in operation, utilize the rock filled revetment at the back end of the south side of the pier (in front of the Project site) for mooring and loading and unloading. However, as explained earlier, the rock-filled revetment is comprised of a mixture of irregularly-shaped coral rock which has been piled up at an incline; and moving up and down the this structure carrying heavy

loads is difficult. Therefore, it is unsuited for loading and unloading cargo in its present structural state.

② Alternate plans

As explained above, the slipway is affected by rough waves due to its location; therefore, it is unsuited for loading and unloading the cargo of the small transport vessel that will be provided by the Project. The transport vessel and the fishing boats are expected to visit the fishery base twice a week (80 times a year) and 40 times a week (1600 times a year), respectively. The following three alternate plans on the landing facility were reviewed.

Plan A: A pontoon and landing facility will be built on the calm side of the pier for the transport vessel and fishing boats. A vehicle will be used to transport the cargo from the pier to the fishery base (150m).

Plan B: The landing facility for the transport vessel will be built on the calm side of the pier and the landing facility for the fishing boats will be built at the rock filled revetment in front of the Project site. The revetment will be renovated to accommodate the landing facility. A vehicle will be used to transport the cargo between the pier and the fishery base (150m). However, a push cart will be used to transport the cargo between the fishing boat and the fishery base since the distance between the two points is about 20m only.

Plan C: A landing facility for the transport vessel and the fishing boats will be constructed near the foot point of the existing pier where there is adequate water depth and not influenced by the anxious factor of remaining life span of existing pier. A vehicle will be used to transport the cargo between the pier and the fishery base (130m).

Plan C': The landing facility for the transport vessel will be built on the calm side and near the foot point of existing pier. And the landing facility for the small fishing boats will be built utilizing the rock filled revetment in front of the project site. A vehicle will be used to transport the cargo between the pier and the fishery base (about 130m distance). However, a pushcart will be

used to transport the cargo from the fishing boat to the fishery base since the distance between the two points is only 20m.

2) Plan to construct the landing facility for the transport vessel and fishing boats near the Project site

① Present conditions of the sea in front of the site

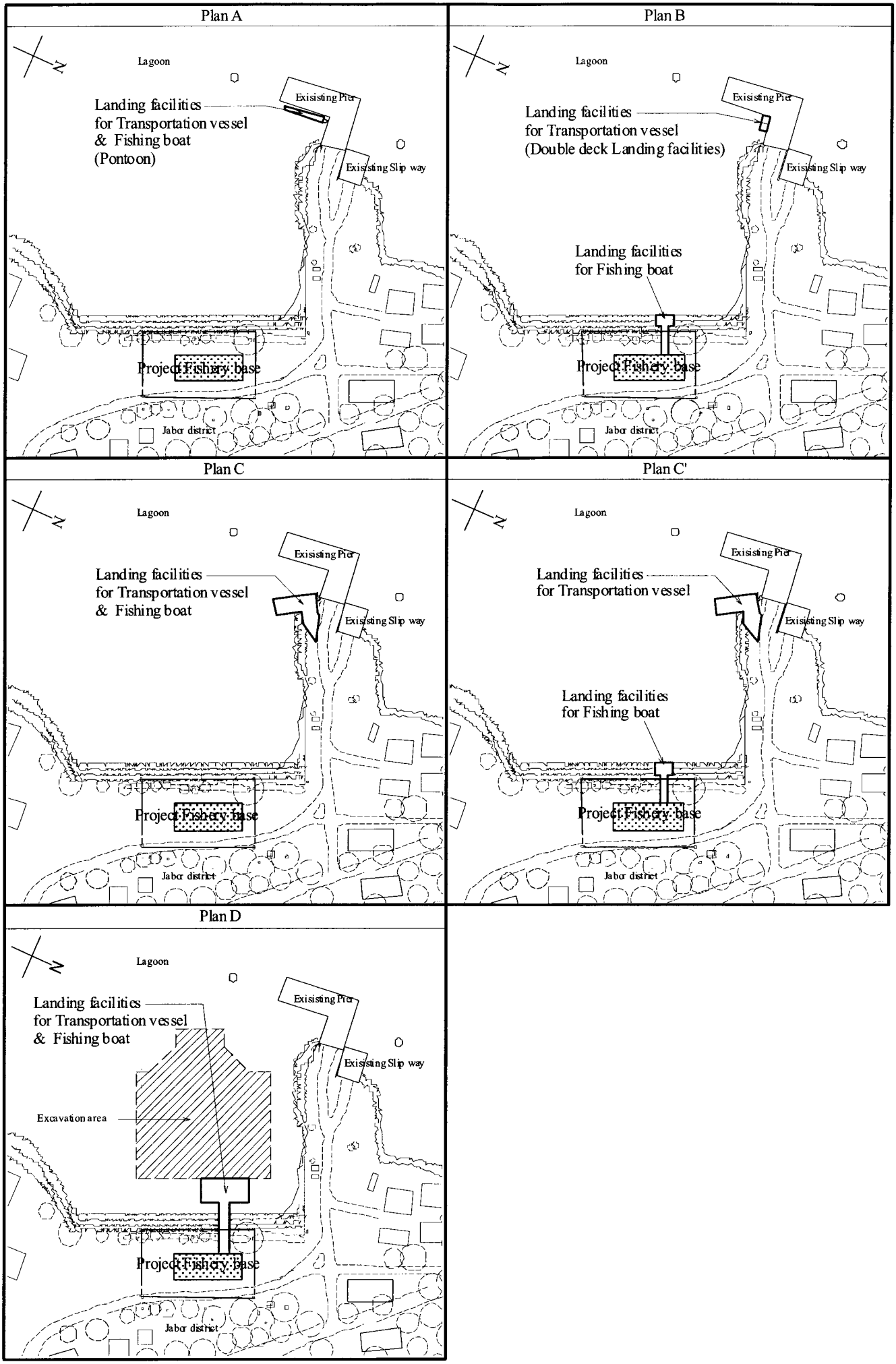
As explained earlier, the water depth in front of the project site is about 1~3m in the offshore waters 70m away and, the small fishing boats are able to approach the water front of the existing rock filled revetment. As shown in Appendix 1, the sea bottom must be partially excavated in order for the transport vessel to approach near to this revetment.

② Alternate plan

A landing facility for the transport vessel with a draft within 2m will also be constructed in front of the site. If this facility is shared with fishing boats, it will be the most rational facilities in terms of loading and unloading cargo, in comparison to plans A, B,C and C'. In order to achieve this, the following plan has been proposed.

Plan D: A jetty approximately 10m in length from the revetment will be constructed in front of the Project site. In order to enable the transport boat to turn around its direction safely, the sea bottom at the upper end of the jetty will be excavated.. The fishing boats will also land their catch at this jetty. A push cart will be used to transport the cargo from the fishing boat to the fishery base (about 30m).

Drawings of A~D alternate plans and comparative evaluation table among these plans are shown in the following 2 pages.


Plan A
Lagoon
Landing facilities
for Transportation vessel
& Fishing boat
(Pontoon)
Exisisting Pier
Exisisting Slip way
Project Fishery base
Jabor district
Plan B
Lagoon
Landing facilities
for Transportation vessel
(Double deck Landing facilities)
Exisisting Pier
Exisisting Slip way
Landing facilities
for Fishing boat
Project Fishery base
Jabor district
Plan C
Lagoon
Landing facilities
for Transportation vessel
& Fishing boat
Exisisting Pier
Exisisting Slip way
Project Fishery base
Jabor district
Plan C'
Lagoon
Landing facilities
for Transportation vessel
Exisisting Pier
Exisisting Slip way
Landing facilities
for Fishing boat
Project Fishery base
Jabor district
Plan D
Lagoon
Landing facilities
for Transportation vessel
& Fishing boat
Exisisting Pier
Exisisting Slip way
Excavation area
Project Fishery base
Jabor district

Comparative Review of the Proposed Location of the Marine Facilities

	Plan A	R	Plan B	R	Plan C	R	Plan C1	R	Plan D	R
	Improve existing pier Add a floating pontoon to existing pier for transport vessel and fishing boat		Improve existing pier + revetment in front of fishery base Add deck for transport vessel at existing pier + build landing facilities for fishing boats in front of fishery base		Improve revetment at existing pier Build landing facility for transport and fishing boats on the revetment of near the existing pier		Improve revetment at existing pier + improve revetment in front of the fishery base Build landing facility for transport and fishing boats at the revetment near existing pier		Improve existing revetment in front of the fishery base Build landing facility for transport vessel at revetment near the existing pier + landing facility for fishing boats at revetment in front of fishery base.	
Impact of weather and tide level	Unaffected by weather or tide	◎	Unaffected by weather; must change deck level according to tide level	○	Unaffected by weather; must change deck level according to tide level	○	Unaffected by weather; must change deck level according to tide level	○	Unaffected by weather; must change deck level according to tide level	○
Water depth of calm area	No problems	○	No problems	○	No problems	○	No problems	○	Water channel for transport vessel needed	×
Loading/unloading fish	(Loading heavy weight) Truck with mounted crane needed; lowered work efficiency (Handling light cargo, movement of people), utilize movable stairs, unstable moving up and down carrying cargo	△	(Handling heavy cargo) truck with mounted crane needed, work efficiency unaffected (Handling light cargo, movement of people) install stairs, stable	◎	(Handling heavy cargo) Same as Plan A (Handling light cargo, movement of people) install stairs, stable	◎	(Handling heavy cargo) Same as Plan B (Handling light cargo, movement of people) install stairs, stable	◎	(Handling heavy cargo) Same as Plan B (Handling light cargo, movement of people) install stairs, stable	◎
Line of Work Movement	150m from fishery base to pontoon; distance travelled by truck for one shipment: 14.4km; annual total distance: 576km	×	150m from fishery base to pontoon; distance travelled by truck for one shipment: 2.4km; annual total distance: 96km	○	Same as Plan A	×	Same as Plan B	×	30m from fishery base to landing facility; no usage of truck; work line distance of one person for one shipment is 420m	◎
Use of truck for one shipment (roundtrip)	15.0hr/time, week; maximum operation 6.25hr/day	×	4.5hr/time, week; maximum operation 2.5hr/day	○	4.5hr/time, week; maximum operation 6.0hr/day	×	4.5hr/time, week; maximum operation 2.5hr/day	×		
Construction cost	Slightly high in comparison to Plan B	○	The most economical of all the plans	◎	Higher cost in comparison to Plan B	△	Same cost as Plan C	△	Excessively high in comparison to the other plans (4.5 times higher than Plan B)	×
Environmental Impact	No problems	○	No problems	○	No problems	○	No problems	○	Negative impact	×
Durability	Inferior compared to the other plans	×	Superior compared to Plan A	◎	Superior compared to Plan A	◎	Superior compared to Plan A	◎	Superior compared to Plan A	◎
Maintenance	Regular maintenance essential; high maintenance costs	×	Very minimal maintenance cost	◎	Very minimal maintenance cost	◎	Very minimal maintenance cost	◎	Very minimal maintenance cost	◎
Correlation with existing pier (Note 2)	Affects the durability of the pier Construction cost reduced by using pier	△	Affects the durability of the pier	△	Does not affect the durability of the pier	○	Does not affect the durability of the pier	○	Does not affect the durability of the pier	○
Overall Rating		×		◎		△		△		×

◎: Best of the four plans
○: Good
△: Feasible
×: Unfeasible
R : Rating

(Note 1) See Appendix 4 for breakdown of truck operations
(Note 2) the durability of the existing pier was estimated using Technical Standards and Explanations on Port Facilities; minimum 25 years, maximum 30 years was estimated.

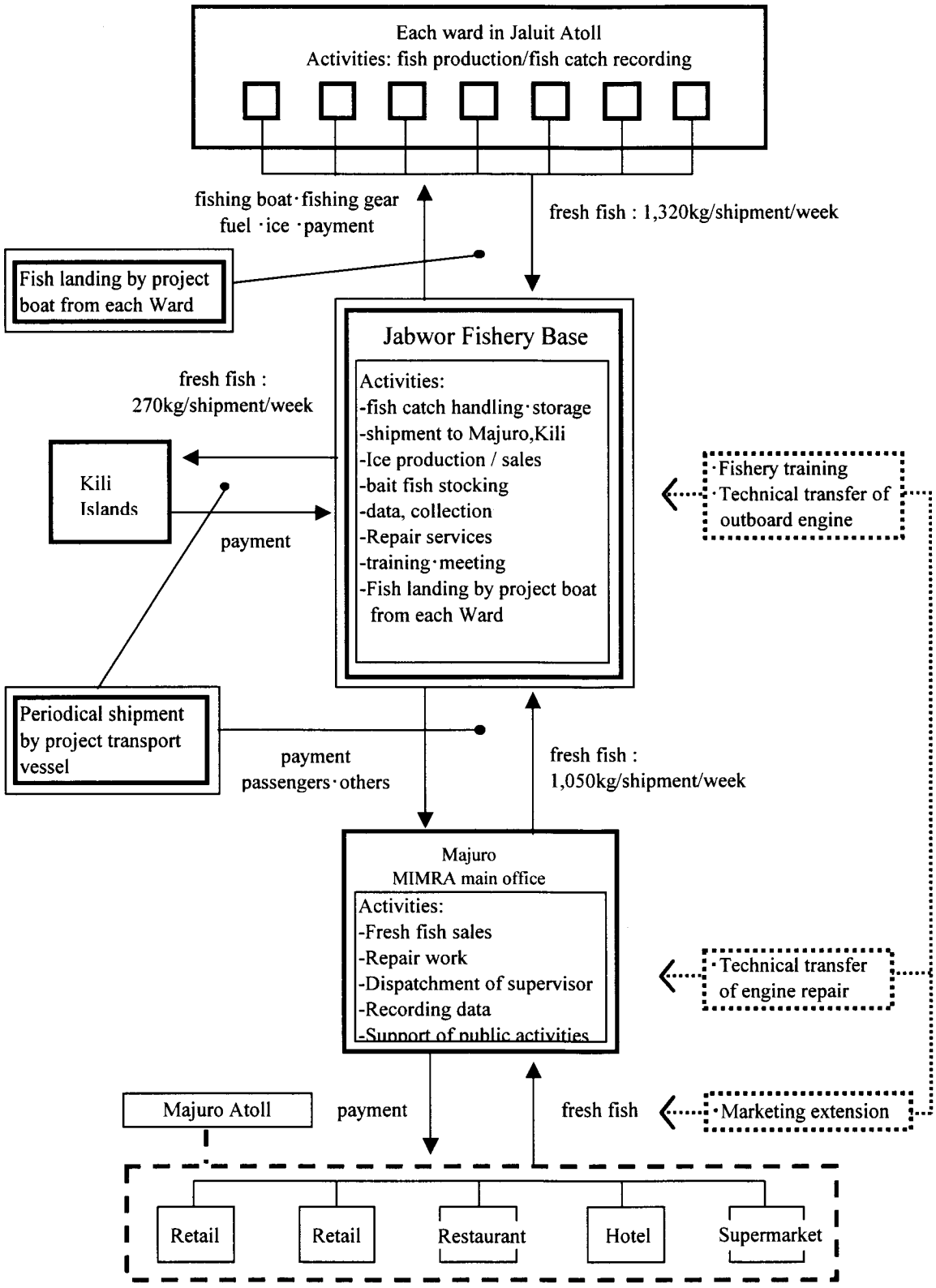
Based on the review explained above, Plan D is the most optimum in terms of cargo handling efficiency, rational line of work movement, and low maintenance costs. However, it will incur the highest construction cost and will be affected by rough waves when the southwest winds blow. In contrast, Plan B is inferior in terms of cargo handling efficiency and rational line of work movement, but its construction cost is the lowest of all the plans. Similarly to Plan D, Plan B will not generate maintenance costs. In addition, it will be unaffected by the occasional southwest winds since it will be located behind the existing pier.

In terms of the Project scope, the handling volume of fresh fish for one shipment is about 1.32 tons ($1600 sales revenue for fishermen; $64,000 annually). Hence the factors such as cargo handling efficiency and rational line of movement can not be overly emphasized, if excessive costs are generated. Therefore, Plan B will be adopted for the Project based on an overall review. However, as explained earlier, Plan B will be affected by the remaining life span of the existing pier. Therefore, in the detail design stage of the Project, the detailed survey on the rust progress of the seat pile of the pier will be carried out. If the rust progress value is found to be greatly more than the value obtained from theoretical analyses, Plan C ’will be taken as the alternative plan. Because, in terms of cargo handling efficiency, rational line of work movement and low maintenance costs, Plan C’ is almost the same level as Plan B, although its construction cost is comparatively higher.

.

(2) Review and basic policy of the building components of the requested fishery base

The relation of the project activities with requested fishery base/equipment is shown in the following figure.



Remark : ⋯⋯ Support program of fishery development by OFCF

As shown in the above figure, the fishery base is an essential facility for supporting this Project activities. Accordingly, the fishery base building is to be provided by the Project. A review of the building components of the requested fishery base is given below.

① Office

An office will be provided by the Project as one segment of the fishery base. Presently, MIMRA does not have an office or staff members in Jaluit; and it plans to employ a manager for the fishery base from among the Jaluit residents. The administrative and management tasks of the staff members of the fishery base include maintaining communications with the MIMRA headquarters, each respective ward, and the transport vessel, to record, organize, and store various types of data (fish catch records, shipment records, ice sales records, records on the use of the cold strage, equipment sales record, equipment maintenance record, accounting records, etc.). Therefore, an office that will enable these administrative tasks to be carried out will be provided by the Project.

② Meeting Room

A meeting room has been requested for the fishery base. Presently, there is no public or private meeting room facilities available in Jaluit. As a result, meetings for small groups of people are carried out in private homes, and churches are utilized for large meetings.

The following types of meetings will be held periodically at the fishery base for project activities.

◊ A Project Monitoring Committee comprised of 11 representatives from each of the wards, MIMRA, JADA, and JAFF will be created to manage and operate the project at the ward level. The committee will be responsible for discussing the management of the project in each ward.

◊ The fishermen representatives from each ward, who are responsible for transporting the fish catch to the fishery base, will exchange information on the fishing conditions with the MIMRA manager. Discussions will also be held on fish catch adjustments for the next shipment.

◊ MIMRA will be responsible for teaching the fishermen representatives new fishing methods, the proper method of recording the fish catch, the importance of conserving fishery resources, and other supervisory activities related to fishing.

◊ MIMRA will be responsible for up-to-date information about JADA and JAFF activities and for being aware of the degree of progress that has been made, in order to coordinate and adjust the project's activities through regularly held discussions.

There is a need for a meeting room to accommodate the supervisory sessions with fishermen. Utilizing private homes and churches is no longer feasible to meet the needs of the Project, therefore, the Project will provide a meeting room based on such factors as usage, the number of participants, and frequency of use as shown in the table below.

Types of Meetings, Number of Participants, Frequency of Use Anticipated

Types of Meetings [1)]	Purpose	Participants	Frequency of Use
Project Monitoring Committee	Discuss issues on project implementation in the wards.	Total of 11 members: MIMRA officers, fishery base manager, representatives of JADA, JAFF,wards	Once a month
Meeting on shipment adjustments	Adjust the weekly fishing schedule of each ward.	Total of 17 members: Fishery base manager, fishermen ward representatives	Once a month
Fishing supervision course (new fishing methods, recording method of fish catch, etc.)	Supervision and technology transfer by MIMRA officers	16 fishermen ward representatives, 16 fishermen transporting fish catch, etc.[2)]	Initially once a month for 8 months, once a month when the transport boat arrives
Discussions with JADA, JAFF	Regular exchange of opinions with JADA, JAFF representatives	MIMRA officers, fishery base manager, 8 JADA, JAFF representatives	Once every three months

Note: 1) See section 2.2.2 (2) 2) on "MIMRA Supervisory Activities in Fishing" for information on fishing supervisory activities by MIMRA officers.
2) Total number of fishermen targeted is about 350.

③ Fish Handling Hall

A fish handling hall that was requested as part of the fishery base facilities will be provided by the Project. Presently, a distribution system for fish collection, sorting and shipment activities does not exist in Jaluit. As explained earlier, fresh fish will be shipped to Majuro and Kili Island 80 times per year under this Project. This will require tasks such as weighing, sorting, recording, and repacking to be carried out. These tasks must be carried out in an environment that is removed from the hot weather to prevent the rapid deterioration in fish quality. In order to secure a suitable and hygienic environment and to ensure that good quality fish is marketed to Majuro and Kili Island, the Project will provide an enclosed, roofed fish handling hall with concrete flooring and tap water and drainage facilities.

④ Workshop

A repair workshop that was requested as part of the fishery base facilities will be provided by the Project. Presently, there is no repair workshop for boat engines on Jaluit. The fishermen maintain and repair their own boat engines. However, due to the lack of a proper workshop, overhauling tools and spare parts are unavailable and serious repair work or a change of parts can not be carried out. If the engine can not be repaired on Jaluit, the fishermen are forced to transport their boat engines to Majuro to repair or order spare parts at an exorbitant cost and loss of time.

Presently, there are 27 boat engines in Jaluit and with the start of the Project, 18 new boat engines will be provided; and the demand for a repair workshop will increase. The installation of a workshop equipped with repair tools and boat engine parts will enable general repairs and change of parts to be carried out in Jaluit. Additionally, this will contribute to the safety of the fishing boats, extend the durability of boat engines, and reduce maintenance costs. A repair workshop will also enable other equipment and facilities to be repaired and its contribution to the Project is significant.

Presently, there are two mechanics at MIMRA who have received technical training in Japan. They are currently undergoing further training with an OFCF engine expert. They have been trained to repair boat engines, freezer units, and other equipment.

MIMRA plans to recruit a Jaluit resident as a mechanic for the fishery base workshop. The recruit will undergo training in general repair work by these mechanics (one of the two mechanics is a Jaluit resident who will provide on-the-job-training for the newly hired mechanic). Therefore, there is no foreseeable problem in securing a staff member for the workshop.

⑤ Crew Accommodations

Crew accommodations that was requested as part of the fishery base facilities will be provided by the Project. Presently, there are no hotels or restaurants in Jabwor. MEC operates a 24-hour power generator in Jabwor and maintains a two-room boarding facility with kitchen amenities for its staff members. This facility is also rented to outsiders for $50/day, but the frequent use by MEC employees makes it difficult for planned use by outsiders.

With the project's implementation, weekly visits by transport vessel crew members and MIMRA officers, who will be visiting Jabwor regularly to conduct supervisory fishing sessions for fishermen, are anticipated. Three crew members of the transport vessel are expected to stay in Jabwor for three days during their visit to the fishery base and the MIMRA officers will be staying in Jabwor for three to four days due to the frequency of available flights between Majuro and Jaluit. Due to the lack of accommodations for such project-related personnel who will be visiting Jabwor regularly, the Project will provide crew accommodations.

⑥ Fuel Drum Storage

A fuel drum storage facility was requested for the fishery base to store fuel for the boats. Presently, fishermen purchase their fuel from the Mobil Oil supply stop. However, fuel can not be purchased from this supply stop during after working hours and on holidays. MIMRA plans to install a fuel drum site at the fishery base to store fuel (gasoline) to provide a 24-hour fuel supply for boats in lieu of Mobil Oil.

However, as is explained later, according to the fish shipment schedule, fish will be shipped out on Tuesdays and Thursdays. Fishermen will have to purchase their ice and refuel their boats on Monday and Tuesday when the Mobil Oil supply stop is in operation. Therefore, it is unnecessary for MIMRA to provide a constant supply of

fuel in place of Mobil Oil at the fishery base. Additionally, storing a large volume of gasoline in drum cans is dangerous and the scope of the project is not large enough to employ fire prevention personnel to carry out constant inspections of the site. Furthermore, drum cans containing gasoline weigh more than 200kg, which is much too heavy to be loaded and unloaded manually from a fishing boat, in addition to the constant danger of damaging the FRP vessel due to the weight. In contrast, plastic fuel tanks (capacity: 24liters) are lighter than drum cans and easier and safer to load and unload and they are rust-free.

According to the Project plan, fishing boats are required to purchase ice for their insulation boxes at the fishery base prior to departing on their fishing operations. The estimated volume of fuel needed for one fishing operation is 74liters (see Appendix 5), which is equivalent to four plastic fuel tanks. Therefore, drum cans will not be utilized to store surplus fuel for each ward. The Project's fishing boats will be equipped with two 24-liter fuel tanks as standard spare parts. In lieu of the drum cans, the project will provide compact, plastic fuel tanks to cover the shortage. A bicycle trailer will be provided to enable the fishermen to transport these fuel tanks for the 300m distance between the fishery base and the Mobile Oil supply stop.

⑦ Ice-making/Ice Storage Facilities

Ice-making and ice storage facilities have been requested for the fishery base. The objective of the Project is to market good quality fish to Majuro and the Kili Island from Jaluit. To achieve this objective, ice must be used during the fishing operation stage and throughout the marketing process to maintain the quality of the fresh fish product. Therefore, an adequate supply of ice is essential.

Presently, an ice-making facility with a 0.5 ton capacity per day was installed in Jaluit by JADA in 1997. In 1999, the facility was out of operation for about six months because of refrigerant leakage. It was repaired by a technician from Majuro and is currently in operation. However, this ice-making facility was built for regular commercial use and is not rust-proof. The aluminium fan of the condenser and the freezer show signs of corrosion, despite the fact that the machine was installed only three years ago. Since this JADA ice-making facility is considered not to last more than 3 years, it is essential to provide a new ice making machine with rust proof

treatment by the Project. And in the process of setting its required capacity, the alternate ice demand of JADA ice plant shall be taken into account aside from required ice demand of the Project.

The three types of ice that are produced by ice-making machines are plate, flakes, and block. Among them, plate ice is comparatively slower to melt and effective to cool fish. Accordingly, plate ice is the most suitable ice to use in the tropical zone. The MIMRA main office has a plate ice-making machine and the ice is distributed to the outer islands of Arno, Aur, and Mili for the fish catch and marketing purposes. The MIMRA mechanics are experienced in the maintenance and repair of the plate ice-making machine. Therefore, plate ice will be used in this Project.

⑧ Cold Storage Facility

A cold storage facility for storing bait fish for bottom fishing was planned and requested for the fishery base. Presently, there is no cold storage facility in Jabwol and the RRE store has the only chest freezer on the atoll (three freezers with a storage capacity totalling 1,200 liters). However, these facilities are used to store the commodities of the RRE store and can not be used by outside parties.

The groupers and snappers that are harvested in bottom fishing are highly preferred by the local inhabitants and they are 20 percent higher in price in comparison to the parrot fishes which are caught in the shallows. As a result, the economic expectations of the fishermen engaged in bottom fishing are high. However, the big eye scads and round scads that are used as bait fish are found only seasonally in the waters of the lagoon. Presently, as there is no cold storage facility to preserve the bait fish that is harvested, the fishermen are limited to using bait fish adequate in volume for only one bottom fishing operation (two fishermen on existing fishing boats, about 4kg/trip: about 2kg/person/trip). Schools of big eye scads and round fish are found only in May and June in the waters of the lagoon and a large volume of these bait fish (about 500kg/fishing operation) can be harvested by several fishermen using an encircling net.

If the bait fish catch is frozen at $-20^{o}C$, it will allow bottom fishing to be carried out regularly. The project's fishing boat, with a capacity of six crew members, will be

able to carry out 42 fishing operations annually using 500kg of frozen bait fish [500kg/(6 people x 2kg/person/operation) = 41.7 operations 42 times]. If the transport vessel operates 40 times a year, one fishing boat out of the eight boats provided by the Project will be able to engage in bottom fishing throughout the year. Increasing the opportunities to carry out bottom fishing operations that harvest high value fish, will contribute to higher productivity by fishermen. It will also contribute to increased income and therefore, the project will Provide a small cold storage facility to store bait fish.

⑨ Machine Room

In order to protect the ice-making/ice storage facility and the cold storage facility from corrosion, a machine room will be built to house these facilities. In addition another machine room for the water pump for the water reservoir will be built.

⑩ Water Supply and Drainage Facilities

(i) Water supply facility/water reservoir

A public water supply is not available in Jabwor and the water supply is dependent on rain. Each facility and home in Jabwor have water reservoirs to trap the rain water, which is pumped out for general use. A water supply is essential to maintain sanitary conditions within the fishery base and for making ice. Therefore, the Project will provide a water reservoir and a water pump. The reservoir will be of adequate capacity to store water throughout the dry season.

(ii) Drainage Facility

Jabwor does not have a public drainage system. Hence public buildings generally have a septic tank where the polluted water is stored, decomposed and the overflow is allowed to drain into the ground through a seepage pit. Although storm drainage is not required under the Project, general waste water from the toilet facilities, the floor washings of the fish handling hall, and the washing of the insulation boxes will be generated. Waste water from the toilet facilities will run into the septic tank where it will be allowed to decompose and the overflow will be allowed to drain into the ground from the seepage pit. Other types of waste water will be released directly into the seepage pit.

⑪ Electricity

Jabwor's 24-hour supply of electricity is powered by two diesel generators that is maintained by the MEC. These power generators were newly installed in 1993 and the electricity capacity is

250KW x 2 generators = 500KW.

The average electric load is about 120KW to 140KW and normally, there are no fluctuations in power with the operation of only one generator. The required electricity load that is required by the Project is less than 55KW, which can be adequately supplied. Power failures are rare and there have been only two such failures in the past six months. The power supply is 220V, 60 Hz and the lighting is 110V, 60 Hz.

The project will provide electricity facilities for the air conditioning facilities, the ice-making / ice storage facilities, the cold storage facility, the lighting, street lights, water pump, and others.

⑫ Air Conditioning Facilities

The annual average temperature in Jaluit is about 28^{o}C and the average relative humidity is a high 80 percent. A wireless unit will be installed in the office and records on fish catch, fish shipments, ice sales, use of the cold storage facilities, equipment maintenance, bookkeeping, and other documents will be kept at the office. Air conditioning facilities are needed due to a relative indoor humidity of higher than 80 percent. In addition, the stored documents will become mouldy in such humidity and the furniture, beds, and other interior areas of the crew accommodations will be prone to fungus and the propagation of ticks and other parasites. In order to maintain a hygienic environment, air conditioning facilities with dehumidification function will be installed in the office, meeting room, and crew accommodations.

2.2.4 Baic Policy of Equipment Plan

According to the project request, it was planned to provide equipment for fish production, for fishery base and for fish transportation to consumption areas that are necessary for improving present fish production and fish marketing conditions. The requested equipment was reviewed and the basic policies have been set up in following order.

(1) Equipment for fish production
(2) Equipment for fishery base
(3) Equipment for fish transportation

(1) Equipment for fish production

① Fishing Boats

A total of 9 fishing boats (one of them was for fishery supervisory boat for MIMRA) was requested for the Project. The result of the request reviewing is explained in Section 2.2.2(2)[Appropriate number of motorized boat by the Project]. Eight small fishing boats is planned to provide.

② Outboard Engines

A total of 18 outboard engines (two of them were for fishery supervisory boat for MIMRA) were requested for the Project. The result of the request reviewing is explained in Section 2.2.2(2)[Appropriate number of motorized boat by the Project].

Local fishing boats operate not only in calm lagoon areas inside the atoll but also in surrounding area out side of the atoll for trolling and bottom fishing. In case of fishing operations outside of the atoll, fishing boats are basically under the risk of drifting caused by engine troubles ,sometimes resulting in long period of a drift accident. To avoid such accident, many local fishing boats mount two outboard engines. Although one of the engines gets a trouble, the boat still can return to the atoll by using remaining another engine. The Project fishing boats are planned to provide with two engines mounted system with an outboard engine of 50% HP out of the required HP for the boat.

③ Fuel tanks

Installation of a fuel drum storage and provision of fuel drums were requested for the Project. However this request will not be included in the Project contents because the idea is too risky to maintain the fishery base. Instead, two small spare fuel tank are planned to provide for each fishing boat[Refer to 2.2.3(2)⑥(Fuel Drum Storage)].

④ Fishing Gear

Fishing gear will be provided by the Project as part of the equipment that has been requested. The fishing gear will be utilized in the fishing boats that will be provided by the Project and they will be shared by the fishermen. According to the field survey findings, traditional fishing methods predominate. Therefore, fishing spears (including underwater goggles, lights, fins, and snorkels), gill nets, cast nets, bottom lines, and trolling will be provided. Spare of the fishing gears will not be provided since the transport vessel from Majuro will periodically deliver supplies and commodities when this Project is implemented.

(2) Equipment for fishery base

① Fishery supervisory boat

According to the request, one fishery supervisory boat was planned to provide. The result of the request reviewing is explained in Section2.2.2(2)[Appropriate number of motorized boat by the Project]. One fishery supervisory boat is planned to provide.

② Outboard engines

According to the request, two outboard engines for the fishery supervisory boat were requested to provide. The result of the request reviewing is explained in Section 2.2.2(2)[Appropriate number of motorized boat by the Project]. As in the case of the small fishing boat, the boat is planned to mount two outboard engines.

③ Fuel tanks

The fishery advisory boat will engage not only in educational advises to local fishermen on resources conservation but also in carrying out monitoring survey of fishing operations in each ward. Its fuel consumption is likely to be the same level of

those of the project fishing boat, and therefore the boat is necessary to carry the same number of spare fuel tanks. Two small spare fuel tanks are planned to provide.

④ Insulated Box

According to the request, insulated boxes were requested to provide as the equipment for fish cooling and handling. Insulated boxes have not been utilized for marketing purposes in Jaluit since fish marketing activities have been nonexistent. The review findings and basic policies on providing insulated boxes for storage and handling of fresh fish are given below.

(i) Insulated boxes for fish catch store

The insulated boxes will be used to pack and transport fresh fish as well as ice; and it is an essential item for preserving fresh fish quality. The exterior dimensions of the 160-liter boxes that have been requested are 1.1m x 0.5m x 0.5m and they can contain about 100kg of fish and ice (the bulk specific gravity is about 0.67 when the fish catch is stored in ice). The introduction of insulated boxes in other projects has been successful. The fish catch volume per fishing boat for one fishing operation has been estimated at about 109kg. It will require 326 liters of ice to pack this volume of fish in ice for transport. Hence two 160-liter insulated boxes will meet the needs of one fishing operation; therefore, the project will provide insulated boxes with a 160 liter capacity.

(ii) Insulated boxes for frozen bait fish

Insulated boxes with a capacity of 60 liters were also requested for the Project to store bait and other varieties of fish (shellfish) and fishing gear. Under this Project, frozen bait fish will be used for bottom line fishing as part of the regular fishing operations. A six-member crew will utilize 12kg of bait fish for one fishing operation and a small insulated box will be needed for storage purposes. A 25-liter box is capable of holding 12kg of bait fish, therefore, the Project will provide 25-liter insulated boxes in stead of 60-liter ones.

(iii) Fish boxes for fish handling

Although this item was not requested, it will be provided under the Project as it is needed for sorting and weighing the fish catch in the Fish Handling Hall. A 40-liter box that contains 20kg of fish is the standard size for handling by one person. Therefore, 40-liter fish boxes will be provided by the Project.

(iv) Fish boxes for cold storage

This item will be used in the cold storage facility for bait fish storage and it will be used in combination with racks. If the bait fish is directly left on the floor rather than stored on racks, a hygiene problem arises stemming from crushed fish or delayed cooling and lowered quality. Therefore, the Project will adopt the method of storing boxes on racks. An adequate weight for the boxes containing fish is estimated at 10kg. Therefore, although this item was not requested, the Project will provide 25-liter fish boxes for cold storage purposes with a capacity of 13kg.

⑤ Communication Units

Wireless communication units that will be used among the fishery base, the MIMRA headquarter, the transport vessel and each ward have been requested for the Project. A SSB (short wave) and VHF (ultra-short wave) units are presently used by the MIMRA headquarter. The SSB unit is used for communication between the MIMRA office and the outer islands (Ibeye, Ailinglaplap, Likiep). In addition, the MIMRA boat, the Lentanil, which navigates the open sea between Majuro and the outer islands (Aur, Mili) is equipped with both SSB and VHF units, in the event one unit becomes inoperable. MIMRA has installed the VHF unit as a safety measure since it utilizes the international frequency for emergencies (156MHz). The transport vessel which will be provided by the Project will be of the same class as the Lentanil; therefore, the same communication units will be installed. A review and basic policy of each unit are given below.

(i) SSB 150W

An SSB wireless unit is essential in collecting information on the navigation schedule of the transport vessel and for other administrative communications. It will be used as a means of long-distance communication between Majuro and Jaluit (130 nautical miles, 234km). In addition, it will also be used during emergencies or

disasters. Presently, MIMRA does not have an office in Jabwor and there is no wireless unit installed. Therefore, the fishery base and transport vessel will be provided with a SSB unit.

(ii) VHF 25W

The transport vessel will be equipped with a VHF unit for communications between Majuro, Jabwor when it enters the port. As mentioned above, the VHF unit utilizes the international frequency for emergencies (156MHz) to communicate with boats navigating nearby.

(iii) CB radio unit

The same type of the CB radio will be provided by the Project to enable communications between the seven fishing boat locations in the wards and the fishery base. They will be installed at the homes of project personnel designated by the local elected representative.

(iv) Wireless Antenna

Antennas are needed in each of the wards where a wireless unit will be installed. SSB, VHF, and CB wireless unit antennas will be installed at the fishery base and CB wireless unit antennas will be installed in each of the seven locations in the wards.

⑥ Repair Tools and Parts for Outboard Engine Repairs

Repair tools and spare parts for outboard engines have been requested as a part of the fishing equipment. A review of these tools and spare parts has been given in the section 2.2.3(2)④ [Workshop]. Presently, fishermen in Jaluit and Majuro are provided workshop sessions in repair technology for outboard engines as part of the technical cooperation of the COFDAS project. Therefore, the Project will provide the repair tools and spare parts because it will be possible to secure a local mechanic with the capacity of outboard engine repair as a workshop staff.

⑦ Truck with Crane

A truck with a mounted crane has been requested for the Project. The existing pier was constructed to accommodate a large transport vessel. Hence the levee crown of

the pier is high (the top level is about 2.5m higher than the mean sea level) and small and medium boats are unable to load and unload their cargo. In addition, a crane for loading and unloading purposes for small and medium boats has not been installed and a truck with a mounted crane in Jaluit is not available.

The Project will construct a landing facility for the transport vessel along the calm, south side of the existing pier. In principle, the transport boat will be empty when it arrives from Majuro, but general commodities and people will also be transported for a fee. Fresh fish will be packed in ice in five 160-liter insulated boxes and transported from Jaluit to Kili Island (the weight of one box is estimated at about 100kg) and fresh fish packed in ice in 19 insulated boxes will be transported to Majuro. If there is surplus space, general commodities and people will also be transported for a fee. The distance from the fishery base to the pier is about 150m and a truck is needed to transport the heavy cargo. In addition, a crane is needed to load the 160-liter insulated boxes on the transport vessel.

The Project transport vessel will come to Jaluit once a week. This shipment schedule will be affected by the weather conditions, and the frequency of the annual shipment is assumed to be 40 times a year by the Project. The operation frequency of the truck will be 3days a week while the transport vessel stays in the fishery base. In case the shipment is 40 times a year, the truck will be used for 120days. If the weather condition is good, it may allow up to 52 times shipment in a year and subsequently, the truck will be used for 156days. Since the crane will be used only during the three-day visit of the transport vessel, a truck with a mounted crane will be provided rather than installing a crane on the pier, that is exposed to the salt wind for all the year round. A truck with a mounted crane can be parked at the base, thereby increasing the crane's durability. Therefore, a truck with a mounted crane will be provided by the Project.

⑧ Weighing Scale

A weighing scale will be frequently used to weigh the fish catch and due to the use of the 160-liter insulated fish boxes, the scales must be able to accommodate loads of over 100kg. In addition, the fish itself will also be frequently weighed and measured as part of the data collected on fishery resources. Therefore, the project will provide a

platform scale and a fixed hanging scale for weighing fish. Generally, the locally used measuring unit is in pounds. Hence weighing scales with a measuring unit in pounds will be provided.

⑨ Pushcart

Pushcarts have been requested for the Project, which can be used in transporting and moving heavy items (insulated boxes, outboard engines, fish boxes, etc.) to the fishery base, fish landing site, Fish Handling Hall, and other areas. Therefore, the project will provide pushcarts since this item is not presently available in Jaluit.

⑩ Fuel Drums

As explained in the section 2.2.3(2)⑥ [Fuel Drum Storage], the Project will provide compact plastic fuel tanks in lieu of fuel drums.

⑪ Ice making machine / ice storage

As explained in the section 2.2.3(2)⑦[Ice-making/Ice Storage Facilities], the Project will provide the ice-making / ice storage function for the fishery base.

The three types of ice that are produced by ice-making machines are plate, flakes, and block. The MIMRA headquarter has a plate ice-making machine and the ice is distributed to the outer islands of Arno, Aur, and Mili for the fish catch and marketing purposes. The MIMRA mechanic is experienced in the maintenance and repair of the plate ice-making machine. In addition, the merit of plate ice is that it is easy to use for cooling of fish in contrast to the merits and demerits of using block or flake ice. Therefore, plate ice will be used in this Project.

Considering the planned shipment volume of fish (max. about 1ton per shipment), it is assumed required capacities of ice-making / ice storage will not be large. Therefore, the ice-making machine will be a standardized unit type, and the ice storage will be a prefabricated type for easy installation, respectively. However, both equipment will be taken to the sufficient anti-corrosion measures in order to protect the equipment from heavy deterioration by salt rust in the Marshall Islands.

⑫ Cold storage

As explained in the section 2.2.3(2)⑧[Cold Storage Facility], the Project will provide the cold storage function with –20°C. Considering the estimated catching volume of the bait fish(about 0.5tons per time), it is assumed required capacities of ice-making / ice storage will not be large. Therefore, the cold storage will be a prefabricated type for easy installation, respectively. However, equipment will be taken to the sufficient anti-corrosion measures in order to protect the equipment from heavy deterioration by salt rust as in the cases of ice-making / ice storage facilities.

⑬ General Furniture

As for general furniture, it was not requested for the Project. However, the Project will provide such furniture that is essential to carry out the daily activities in the rooms of the fishery base. Among the furniture, fixtures such as shelves, counters, etc. will be handled by the construction works, and the general furniture such as tables, chairs, etc. will be handled by the equipment procurement works.

(3) Equipment for fish transportation

① Transport Vessel

Presently, the privately-owned transport boat of the RRE operates between Majuro and Jaluit. RRE has shown the interesting in the transportation service of fish using its own transport boat, the LONA, (350Hp, 17-ton cargo capacity) for about 22 cents per kilogram of fish. However, the operations of the LONA is irregular and it arrives in Jaluit only when the RRE branch store in Jaluit is in need of supplies. These trips average about once a month or twice two to three times a year.

As can be seen from the fresh fish shipments from Jaluit that have been planned under the Project, the transport vessel is scheduled to operate four times a month. If the LONA is utilized to transport fresh fish, it must leave Majuro two to three times a month with an empty cargo hold. In addition, at a charge of 22 cents per kilogram of fish, it will cost $330 to transport 1,040kg of fresh fish (1,500kg including ice) with fuel costs totalling about $400. If the added expenditures for crew member wages, maintenance and depreciation costs, and others are included, this venture becomes economically unviable for RRE, based on the transport fees proposed by the company.

In contrast, the total cost for one trip to transport 1,320kg of fresh fish to Majuro by the transport vessel provided by the Project is $948, including the personnel cost of $425 and fuel cost of $523. If the buying price of fresh fish averages $1.21/kg (buying price of the OFCF COFDAS project) and the retail price at the destination is set at $2.52 [the similar price level of the average $2.49 retail price of canned fish: see details in Section 2.2.2(5) Fresh Fish Demand in Majuro], a surplus of $742 is still achieved. In conclusion, the provision of a transport vessel to transport fresh fish is economically viable.

Therefore, the Project will not rely on the services of the RRE transport boat, but will provide a transport vessel that will provide regular transport service.

2.3 Basic Design

2.3.1 Design Policy

(1) Applied Construction Standard

There is no basic construction law on constructing facilities in the Marshall Islands; and the Uniform Building Code of the United States is generally utilized in constructing private and public facilities. It was ascertained with the Facilities Engineering Division (FED) of the Ministry of Public Works that Japanese design standards can be also utilized. Therefore, in principle, the Japanese standards for structural and architectural design will be employed in this Project. However, the UBC design seismic velocity and design wind load will be utilized, in view of the natural conditions that prevail at the site. In addition, permits from the FED, the Environmental Protection Division (EPA), and the Historic Preservation Office (HPO) will be obtained prior to the start of the construction work.

(2) Policy on Natural Conditions

1) Ground conditions

According to the findings of the bearing test at the Project site, the soil bearing strength was found to be higher than 5t/m^2. The test pitting findings showed no underground voids created by the suction characteristic of sand foundations. The structural foundations are to be studied using the test and survey findings (see Appendix 1-2).

2) Weather (rainfall volume, wind)

The location of the building and installation site of the equipment will be based on such data as monthly rainfall volume, wind direction, and wind velocity (average monthly and maximum velocity). In addition, the frequency and the drought period are to be analysed to determine the required volume of water reservoir of rain water.

3) Sea bottom and tide levels

Based on the results of the sounding test and tide observations at the existing pier and the front of the existing revetment, the location of the landing facilities for the fishing boats and transport vessel is to be reviewed. In addition, the level of the landing facilities are also to be reviewed based on tide measurements (see Appendix 1-1, 1-2).

(3) Policy on Corrosion of Facilities and Equipment

In constructing the fishery base and the landing facilities, materials that are rust proof and a construction method that takes salt corrosion into consideration shall be employed. Countermeasures against salt damage will be sufficiently considered for the installation sites of equipment that will be directly exposed to wind and rain.

(4) Policy on Construction Conditions

The construction materials will be procured from Majuro since there are no construction related companies in the Jaluit. The technical level of construction companies are quite low and the number of construction companies that employ adequate construction methods, quality, and safety are limited. The grade of the construction materials that will be utilized must be clearly defined, in order to control construction costs.

(5) Policy on Local Building Contractors and Local Materials

The number of general building contractors possessing their own heavy equipment and having an in-house technician is limited. Many of the technicians are Filipinos and local technicians are rare. In principle, local technicians possessing their own construction machines will be employed.

The materials will be selected based on an overall review of the purpose, durability, cost, etc. and locally procured materials will be used. The inventory volume and delivery period of the materials must be confirmed prior to implementing the Project.

(6) Policy on the Operations and Maintenance Capabilities of the Implementing Agency

The scope and content of the facilities will be suited to the technical level of the staff members in charge of maintenance and operations; and the grade and specifications of the equipment that will be provided by the Project will incur minimal maintenance costs (electricity consumption volume, consumables, etc.).

(7) Policy on Construction Works

The construction works will take into account the large volume of rainfall or squall conditions that prevails, in order to minimize the impact of the rainfall on the construction works.

(8) Policy on Equipment Procurement

All construction materials will be transported from Majuro by boat; and since most of the construction materials will be imported, their procurement will have a great bearing on the construction works. Therefore, the inventory volume of the construction materials will be consistently confirmed in order to ensure that a shortage of materials does not occur.

2.3.2 Basic Plan

(1) Facility Plan

1) Marine Facility Plan

① Installation of landing facilities for the transport vessel at the existing pier

(i) Floor/section plan

Concrete, double deck landing facilities are planned to enable the transport vessel and other boats of the same class to land at the pier when the L.W.L and H.W.L. is lower than the levee crown of the pier. The width and depth of each deck will be 2.5m and 3.0m, respectively and the boat width will cover more than half the deck when it is moored.

(ii) Structure

The section of the existing pier that lies below the sea is made of steel sheet pile walls that have been filled in with sand and gravel. This section will not withstand the added weight of a new structure. In addition, the thickness of the upper concrete deck (about 1.2m) and the thickness of the slab (about 0.25m) differ. Lengthening the structure using an anchor from the deck to create a new structure will not produce a durable, stable structure. Hence, double deck landing facilities will be constructed on a shallow foundation independently of the existing pier.

② Installation of the landing facilities for fishing boats at the existing rock filled revetment

(i) Floor/section plan

A concrete landing facility about 5m in width and 6m in length will be constructed stretching from the Fish Handling Hall of the fishery base towards the lagoon. The facility will be planned to enable landing, mooring, and loading and unloading activities for fishing boats to be conducted.

(ii) Structure

The existing revetment is a one to two meter coral rock-filled structure that is supported by coral bedrock. The surface of the deck and the external wall are a concrete monolithic box-like structure that is filled with rubble.

2) Building Plan

① Floor plan

The floor plan of the facilities planned under the Project is based on the line of movement from the office and administrative section to the fish landing area. In addition, the ice-making machine, the cold storage and refrigerating units will be installed in the machine room, which will be located away from the northeasternly ocean wind to protect the equipment from salt corrosion. The administrative offices will be located near the revetment on the lagoon side in order to simplify the management of loading and unloading the fish catch and other cargo. The building will be a one-storied structure for the following reasons.

- A one-storied structure will reduce the load on the building footing and lessen the differential underground settlement that is characteristic of sandy ground.
- The area of the roof can be enlarged to function as a water catchment as a countermeasure against water shortages.
- The structure is sufficiently spacious and a one-storied building is more advantageous from a construction works standpoint. In addition, there is no danger of flooding or submergence and the need for an upper floor to serve as a shelter is nonexistent.

(i) Basic room plan of the fishery base building

a. Office

The office will be staffed by one MIMRA officer (manager), a mechanic (contract employee), and one assistant staff member. The mechanic will be responsible for carrying out the tasks when the transport vessel arrives and for all repair works on outboard engines, ice-making machine and cold storage unit. And the assistant staff member will be responsible for carrying out the tasks assigned by the manager when the transport vessel arrives. (The required area will be calculated according to the "Collected Information on Architectural Design", published by the Architectural Institute of Japan.)

b. Meeting Room

The meeting room will be constructed next to the office. It will be used for the Project Monitoring Committee meetings, JADA and JAFF representative meetings,

and guidance sessions for fishermen. The room will be able to accommodate 11 desks for each of the Project Monitoring Committee members and for meetings with 15 to 16 participants, such as the guidance sessions for fishermen, the added number of people will be given chairs.

c. Crew Accommodations

Crew accommodations with a kitchen for one MIMRA officer from Majuro and three crew members of the transport vessel will be provided by the Project. The facility will contain two bunker beds, meeting space for four people, kitchen, shower, toilets (for use by fishery base personnel as well), and linen storage space.

d. Fish Handling Hall

The Fish Handling Hall will be comprised of a fish handling space, work area in front of the ice storage and cold storage facilities, and aisles. The max. volume of fresh fish per day handled at the hall is for shipment to Majuro and is estimated to be 1,050kg/day. Fish handling will include such tasks as sorting, weighing, recording, and packing the fish in ice. The fish will be transported to Jabwor from the eight wards on the atoll. The time of delivery will be either in the morning or the afternoon depending on the distance from the ward to Jabwor; and four boats in the morning and four boats in the afternoon are expected to deliver their catch. The hall will handle the catch of two boats two times in the morning and two boats two times in the afternoon (one time needs four insulation boxes, and the number of rotations per day: four rotations). The area required for the hall has been calculated to the following formula.

$S=N/(P \times R \times \alpha)=1,050/(4 \times 0.2 \times 70) = 18.75m^2 \quad 19m^2$

at this time,

S: Area of the fish handling hall (m^2)

N: Project shipment volume for one trip to Majuro (kg/day)=1,050kg

P: Project handling volume per unit area (kg/m^2)=20/ (0.65 x 0.44) =$70kg/m^2$

However,

Fish boxes (40liter, 20kg capacity): 650mm x 440mm x 200mm H will be used.

R: Number of rotations per day (rotations/day) at the hall = 4 rotations

α: occupancy ratio = 0.2

The following space will be added to this area.

- Storage area for insulation boxes waiting to be shipped: 1.1m x 0.6m x boxes stacked in 19 rows $13m^2$
- Storage area for empty insulation boxes: 1.1m x 0.6m x 21 boxes stacked in two rows $7m^2$

Therefore, the fish handling space will require a total area of $39m^2$.
In addition, the hall requires the work area of $26m^2$ in front of the ice storage and cold storage facilities, and aisles of $15m^2$.

Subsequently, the required area for the fish handling hall is $80m^2$ in all.

e. Workshop

The standard area of a workshop for repairing outboard engines is 5m x 5m with a separate storage room of about $10m^2$. The Project workshop will handle only general repairs, and equipment and repairs requiring advanced or special technical expertise will be carried out in Majuro. Therefore, bench drill, crank aligner, and other specialized equipment will not be needed and the space required for this workshop is reduced. Hence a separate storage room will not be provided and an area for spare parts will be created within the workshop. Therefore, the scope of the workshop has been set at 5m x 4.5m.

f. Machine Room

Two machine rooms will be provided as explained below.

- Machine Room 1

Three refrigerating units for ice-making machine, ice storage and cold storage, one control panel, and one rack for spare parts and maintenance equipment will be installed in the room. Space between the machines for maintenance purposes will be created.

- Machine Room 2

The rainwater supply pump (2 units), the pressure tank, and control panel will be installed in the room.

g. Ice Maker, Ice Storage Facility

The area required for the ice maker and the ice storage facility was decided based on the following process.

Required volume of ice per week

Ice usage ratio during the harvest stage is 1 fish to 1 ice and 1 fish to 0.5 ice during the marketing stage (A detailed explanation is shown in Appendix 7). Required volume of ice per week based on this ratio is as follows:

- Marketing of fish to Majuro: Fish volume 1,050kg x (1 + 0.5) = 1.58 tons/week
- Marketing of fish to Kili: Fish volume 270kg x (1 + 0.5) = 0.41 tons/week

Therefore, a total volume of 1.99 tons/week of ice is required for fresh fish storage.

- Alternate ice demand of JADA ice making machine(mainly used for cooling fish for home consumption): The sales revenue of flake ice, that is produced by JADA's ice-making machine, averages $350 per month. The retail price is $1.5/basket (18 liters). The ratio of flake ice is 0.45, and the sales volume per week is as shown below.
  (Number of baskets sold per month) x (weight of ice per basket) / (number of weeks per month) x (handling loss) =
  ($350/$1.5) x (18 liters x 0.45kg/liters) / 4 (weeks) x 1.05 = 0.50 tons/week

Therefore, a total of 2.49 tons/week of ice must be produced in order to meet the demand for fresh fish storage (1.99 tons) and general consumption (0.50 tons).

The fishery base operates five days a week. Therefore, the minimum required daily production capacity of an ice maker is 2.49 (tons/week) / 0.5 tons/day 0.5 tons/day. However, plate ice will be used in this Project, and commercial plate ice makers with a production capacity of less than 1 ton/day are not manufactured.

Only flake ice makers with a production capacity of under 1 ton/day are manufactured by mass production for commercial purposes (hotels, supermarkets, restaurants, hospitals). Such ice makers are manufactured for domestic use and are not rust-proof.

In case of a plate ice maker, it is not mass produced and is applicable to design with rust proof specification.

In Japan, nominal daily production capacity of an ice maker is calculated based on the standard conditions to withstand an outdoor temperature of 32°C and utilize a water temperature of 20°C. An ice maker with production capacity of 1ton/day that will operate in tropical temperatures of 32°C to 35°C and utilize a water temperature of 28°C to 30°C, will reduce its capacity to approx.0.7 tons/day. Therefore, a rust-proof plate ice-maker with a production capacity of 1 ton/day will be provided by the Project, which will be operated five days per week.

Based on this, required capacity and area of the ice storage are set by assessing ice consumption patterns on a weekly basis and maximum daily ice requirement as shown in tables below.

Ice consumption patterns on a weekly basis

Transport Boat and Fishing Operation Schedules

	SUN	MON	TUE	WED	THU	FRI	SUT
Transport vessel							
Majuro → Jaluit		6 18					
Jaluit ⇔ Kili			10 16				
Jaluit → Majuro					6 18		
Fishermen							
Ice purchase for Kili		12 18					
for Majuro			6 18				
Fish catch for Kili		20	6				
for Majuro			20	12			
Loading fish catch to Kili			6 10				
to Majuro				6 18			

Note: The figures in the table indicate the time (indicated by 24 hour basis).

Based on these criteria, the correlation between the ice consumption pattern for basic one week and the ice production/storage volume is shown in the table below

Correlation Between Ice Consumption Patterns

and Ice Production/Ice Storage Vol. Unit: ton

	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
Ice Requirement								
Fishing / shipment:for Kili	—	0.27	0.14	—	—	—	—	0.41
for Majuro	—	—	1.05	0.53	—	—	—	1.58
Alternate demand (JADA)	—	0.01	0.10	0.10	0.10	0.10	—	0.50
Total	—	0.37	1.29	0.63	0.10	0.10	—	2.49
Ice production	—	0.40	0.60	0.50	0.50	0.49	—	2.49
Ice storage	1.50	1.53	0.84	0.71	1.11	1.50	1.50	—

As can be seen from this table, required maximum ice storage volume is 1.53 tons on Monday. Therefore the ice storage facility will have a daily capacity of 1.5tons. The ice maker will be installed on top of this ice storage.

Dimensions of ice maker (nominal 1ton/day) : 2.25mL x 1.2mW x 2.1mH

Dimensions of ice storage (max.1.5tons) : 2.25mL x 2.7mW x 2.5mH

Accordingly, the net space for the ice storage is 2.25mL x 2.7mW = 6.0m^2. Considering inspection space surrounding the ice storage and work space in front of it, total required space for the ice storage will be 3.2m x 4.75 = 15.2m^2.

h. Cold Storage Facility

The volume of fresh fish that will be stored in the cold storage facility at –20^oC is shown below.

□ Given Condition: The one time storage volume of bait fish is 500kg (1000 pounds).

Fish boxes will be stored on racks in the cold storage and 25 liter (590 x 370 x 130mm) fish boxes with a 13kg capacity will be used. The racks will be placed near the entrance on the right and left sides in four rows and each row will contain five boxes for a total of 40 boxes or 520kg of fish.

The measurements of the cold storage facility include the thickness of the insulation panel, the thickness of protector, aisles, and the size of the racks. The results are given below.

- Width (exterior measurement): [thickness of the insulation panel 0.1m + thickness of protector 0.1m + width of rack 0.7m (length of fish box 0.59m)] x 2 (both sides) + aisle width 1.2m=3.0m

- Depth (exterior measurement): [thickness of the insulation panel 0.1m + thickness of protector 0.1m] x 2 (both sides) + length of rack 2.7m (5 fish boxes x pitch 0.45m + others) = 3.0m
- Height: Worker height 1.8m + head space 0.2m + rack height 0.7m = 2.7m

Accordingly, the net space for the cold storage is 3mL x 3mW = $9m^2$. Considering inspection space surrounding the ice storage and work space in front of it, total required space for the cold storage will be 4.0m x 4.75 = $19.0m^2$.

(ii) Planned room areas

The floor plan of the rooms is based on the "Collected Information on Architectural Design", published by the Architectural Institute of Japan as well as local case examples. The area of the rooms planned by the Project is shown in the table below.

Calculation Standard and Planned Value of Floor Aear

Room	Calculation Standard	Fixed Value by the Project
Fish Handling Hall	Number of fish boxes, work space on both sides of the aisles, layout of the parking space	80m^2 -Fish handling space:39m^2 -Others:41m^2(Work space in front of ice storage, cold storage, aisles, etc.)
Ice maker, ice storage, cold storage	Layout of ice maker, ice storage, cold storage	34m^2
Office	Unit Scope of architectural design materials General workers: 6.5 to 8.5m^2 Area for desks, chairs, wireless unit used by 3 people, layout of counter	21m^2 3 people x 7.2m^2
Meeting Room	Unit Scope of architectural design materials General workers: 1.2 to 5.0m^2	24m^2 11 people x 2.2m^2
Crew Accommodations	2 bunk beds for 4 people, layout of dining area	21m^2 4 people x 2.85m^2 Dining area including 10m^2 meeting area, kitchen, toilet, showers, etc.
Workshop	Repair space for 1 outboard engine and layout of work tools	20m^2
Storage Room	Storage layout of fishing gear, push cart, repair materials, grass cutter, cleaning equipment, and others	12m^2
Machine Room 1	3 cold storage units, control panel	14m^2
Machine Room 2	2 pumps, pressure pump, control panel	8m^2

(iii) Fixture Plan

Minimum required fixtures will be installed by the construction works, in each room of the building in accordance with the room's function. Other minimum required furniture will be provided by the Project. A summary of the fixtures and general furniture that will be installed is given in the table below.

Summary of the Fixtures to Be Installed

Room	Installed fixtures	General furniture
Office	Counter:4.0x0.6, 2.0x0.6	3 desks, 3 chairs
Meeting Room	Counter: 4.0x0.6	4 foldable desks, 1 whiteboard, 16 chairs
Crew Accommodations	Bunk beds x 2; 2.1x1.1	1 table, 4 chairs
Workshop	Shelf: 3.7x0.45, work table: 4.2x0.5	
Storage Room	Shelf:7.8x0.6	

② Section Plan

The level of the first floor will be fixed based on the results of the bearing test and such factors as the present ground level and the floor level of the existing building. The ground will ocassionally become submerged due to strong squalls in the Marshall Islands.

There are no high and low ground level disparities at the Project site. The north side of site where the existing pier is located is 20cm lower than the road. The ground on the west side, which borders the lagoon, contains a banking 50cm in height, that cuts off rainwater drainage to the sea. As a result, the project site may become occasionally flooded during heavy rains. Therefore, the first floor level of the planned building will be set at about 10cm higher than the front road.

The roof will be a highly durable, leak-proof gable roof and eaves will be installed for shade. The openings of the windows that face the direction of the squalls will be made smaller and water proof fittings will be used. The required ceiling height for each room will be secured and such factors as thermal insulation capacity and garret ventilation will also be considered.

③ Structural Plan

(i) Earthquakes, wind

The design seismic velocity has been fixed at zero since there are no earthquakes in the Marshall Islands; and the wind load in the UBC has been adopted for the Project. The standard wind force in the Marshall Islands is 44.7m/sec and the wind pressure was calculated using this figure as shown below.

P (wind pressure) = Ce x Cq x Qs x 1

However,

Ce: Planned building height and coefficient (1.3) for degree of soil coarseness and fineness

Cq: Wind force coefficient (depending on the section of the building)

I : Importance factor (1.15)

The wind pressure value obtained using this calculation is nearly equivalent to the value obtained using the calculation in the Japanese building code.

(ii) Foundation structure

Based on the findings obtained from the bearing test of the Project site, the soil bearing strength has been estimated at 5 tons/m^2. In addition, based on the test pitting findings, it has been ascertained that the ground of the site is stable. The foundation structure of the building will be wall footing, in order to raise the rigidity of the foundation and as a countermeasure against potential subsidence.

(iii) Superstructure

The local construction method will be used in constructing the superstructure of the planned building. The pillars and beams will be a rigid PC frame structure and a wooden truss will be used to lighten the frame. Structural design factors such as stress and sectional framework will be reviewed in accordance with JIA standards.

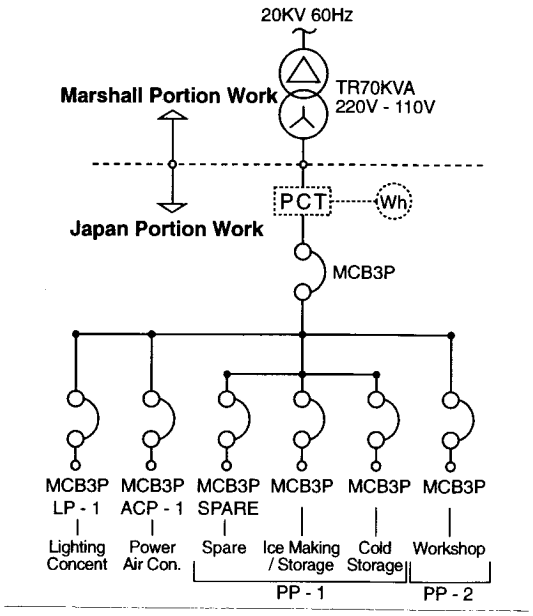
④ Facilities Plan

The facilities plan will be based on factors such as easy operations and maintenance, anticorrosion against external conditions, and minimal maintenance costs.

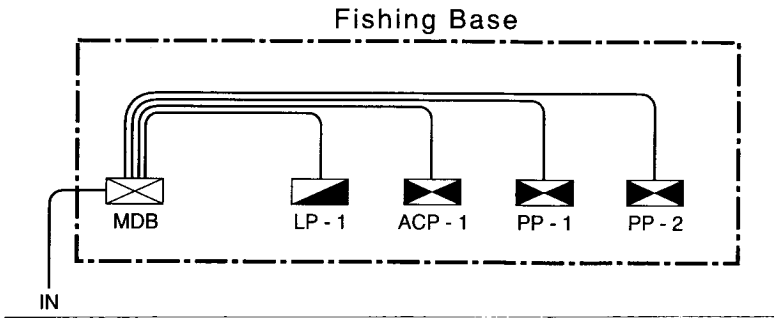
(i) Electricity facilities

a. Incoming and main lines

Low pressure electricity will be supplied to the Project site from a pole mounted transformer to an underground cable. It will be distributed to the building from a main distribution panel to the outlets, power facilities, lights, etc. The electricity specifications in the Marshall Islands are 110V, 220V, and 60Hz cycle. The main outdoor electricity line will be installed underground against salt corrosion. The incoming volume is 75KVA, 72KVA for the power facilities, and 3KVA for the lighting facilities.



Electric Single Line Diagram



Main Line Diagram

b. Power facilities

Electrilicity will be supplied to the pumps, air conditioning and refrigerating equipment via the power distribution panel. The power facilities and equipment will be anticorrosive and water proof.

c. Lighting and outlet facilities

Fluorescent lighting facilities will be installed. Outdoor lighting will be anticorrosive and water proof. In addition, street lights will also be installed. An exclusive circuit will be provided for the air conditioning and refrigerating equipment. The outdoor outlets will be water proof with earth terminals against water leakage and electrocution and a circuit breaker. The wiring for the lighting and outlets will be concealed underground wiring.

d. Communications facilities

A wireless unit will be installed in the office to communicate with the transport vessel which will be equipped with SSB and VHF wireless units. Communications between the fishery base and MIMRA in Majuro will utilize a SSB wireless unit. Anticorrosion antennas for these units will also be installed.

(ii) Air conditioning facilities plan

As a countermeasure against salt corrosion, the air conditioning facilities will be a separate air cooling type. The main unit will be installed outdoors and a wall mounted cooler will be installed indoors. Each unit will have its own controller that will enable it to be operated independently of the units in the other rooms. In principle, natural ventilation will be used in the rooms, but ventilation fans will be installed in the kitchen, toilet, and other areas where forced ventilation is required.

(iii) Drainage and water supply facilities

a. Water supply facility

Rainwater is the water supply source in Jabwor. The volume of rainwater needed for each day of the week for a one-week period is shown in the table below.

Water volume Required for a One-week Period

Type of Water	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Drinking	–	274	366	366	32	16	–	1,032
Ice	–	370	1,290	630	100	100	–	2,490
Toilet	–	158	202	208	40	20	–	628
Floor Washing	–	–	600	600	–	–	–	1,200
Total	–	802	2,436	1,804	172	136	–	5,350

Rainwater supply

Based on the table above, the required volume of tap water is 5,350L/week.

Therefore, the monthly required volume is

5,350L/week x 4 weeks/month = 21,400L/month.

Rainwater reservoir

Data on the rainfall volume for the past 30 years in the Marshall Islands, shows that the lowest recorded rainfall volume was during the drought years of 1983 at 2,192mm (86.31 inches) and 1992 at 2,221mm (87.08 inches). There was minimal rainfall of only 8mm (0.71 inches) for the three-month period of February to April during these years. In addition, the period from January to April is rough weather season and the transport vessel is expected to reduce its operations from four to three times a month during this period. Subsequently, the required volume of water per month is anticipated to drop to

5,350L/week x 3 weeks/month = 16,050L/month 16.1 tons/month.

The required volume of the reservoir during a drought year is calculated to be

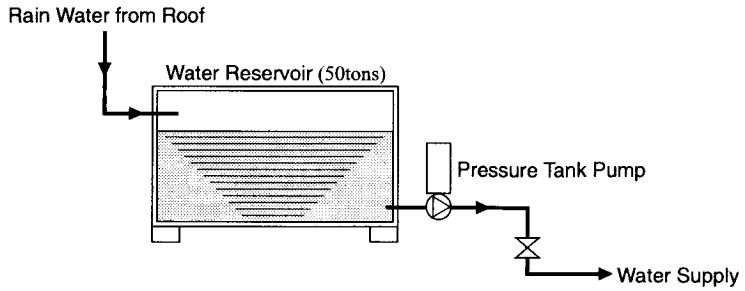
16.1 tons/month x 3 months = 48.3 tons.

Approximately 400m^2 of water catch is estimated. Therefore, in order to maintain the 48.3 tons of water for the reservoir, 121mm (4.8 inches) of rainfall per month is needed. According to statistics from the past 30-year period, the average monthly rainfall volume four months prior to the drought season was 284.5mm (11.2 inches) to 359.2mm (14.1 inches); and it was concluded that there was sufficient rainfall to supply the water reservoir.

Therefore, the net capacity of the water reservoir has been fixed at 48.3 tons 50 tons.

□ Water Supply System

Two units of pressure supply pumps operating on an automatic alternating system will supply the water. The water supply diagram by rain water reservoir is shown below.



Water Supply Diagram by Rain Water Reservoir

b. Drainage facility

Due to the lack of a public drainage system, waste water, including toilet waste water, will drain into a seepage pit from the septic tank. Household waste water and waste water from floor washings will be discharged into the ground.

□Required drainage volume

The drainage volume by type of waist water for a one week period is shown in the following table.

Drainage Volume For a One-week Period Unit: liter

Type	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
General	–	274	344	366	32	16	–	1,032
Floor Washing	–	–	600	600	–	–	–	1,200
Subtotal	–	274	944	966	32	16	–	2,232
Toilet	–	158	202	208	40	20	–	628
Total	–	432	1,146	1,174	72	36	–	2,860

□ Drainage system

Septic tanks and seepage pits that are used for local public facilities will be used for the Project.

⑤ Procurement Plan for Construction Materials

Construction materials that will be procured locally are the concrete aggregate and concrete blocks. All other materials will be imported. Locally sold materials will be given priority, but materials with limited local inventory, special materials, or quality materials will be purchased in Japan or a third country. Selection will be based on criteria such as durability and anticorrosion properties. The finished exterior of the building is shown in the table below.

Building Finish (Exterior)

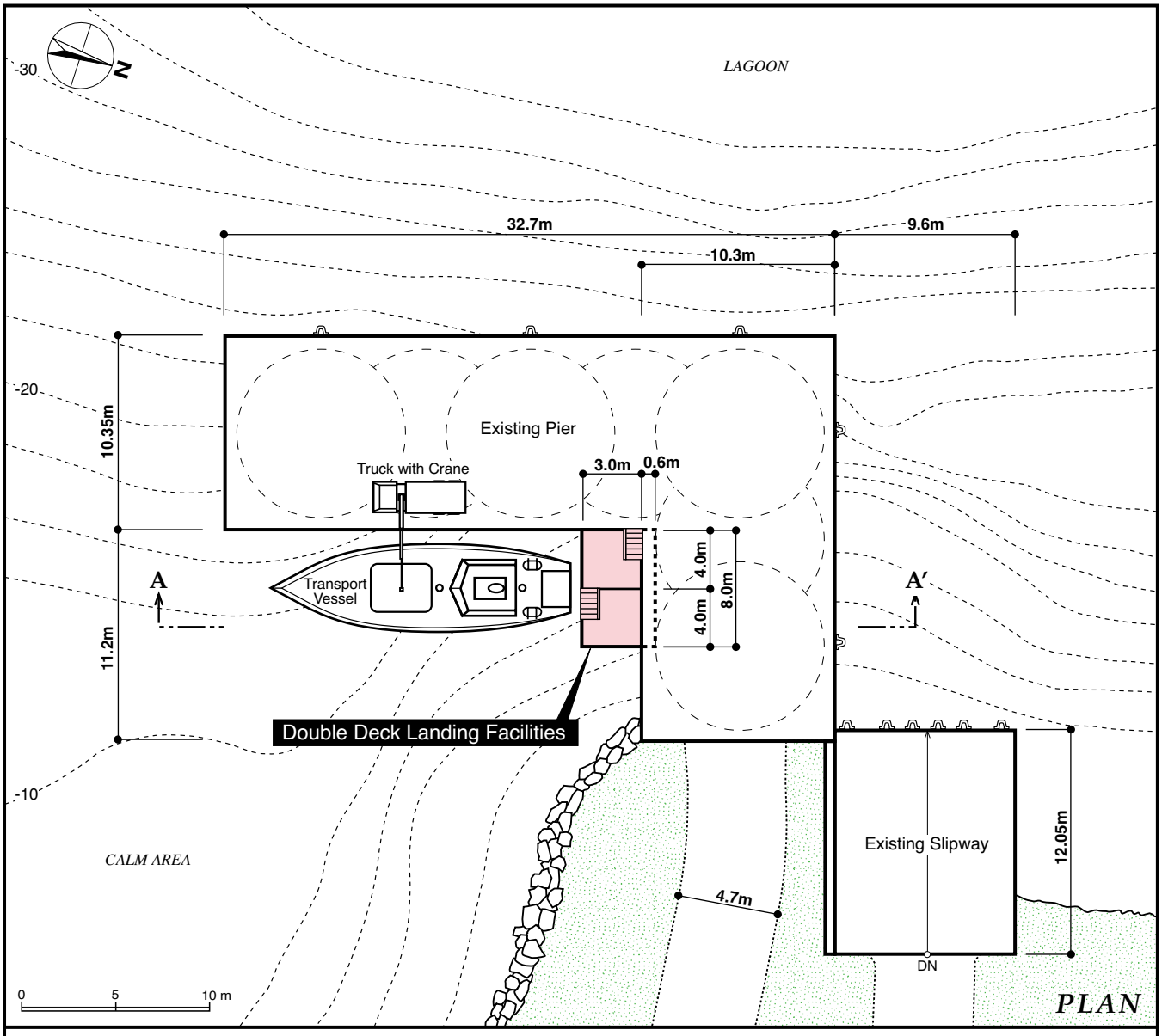
Roof	Aluminum folded plate
Exterior wall	Fair faced concrete block
Ceiling	Exposed wood frame
Frontage	Window; aluminum window, aluminum door

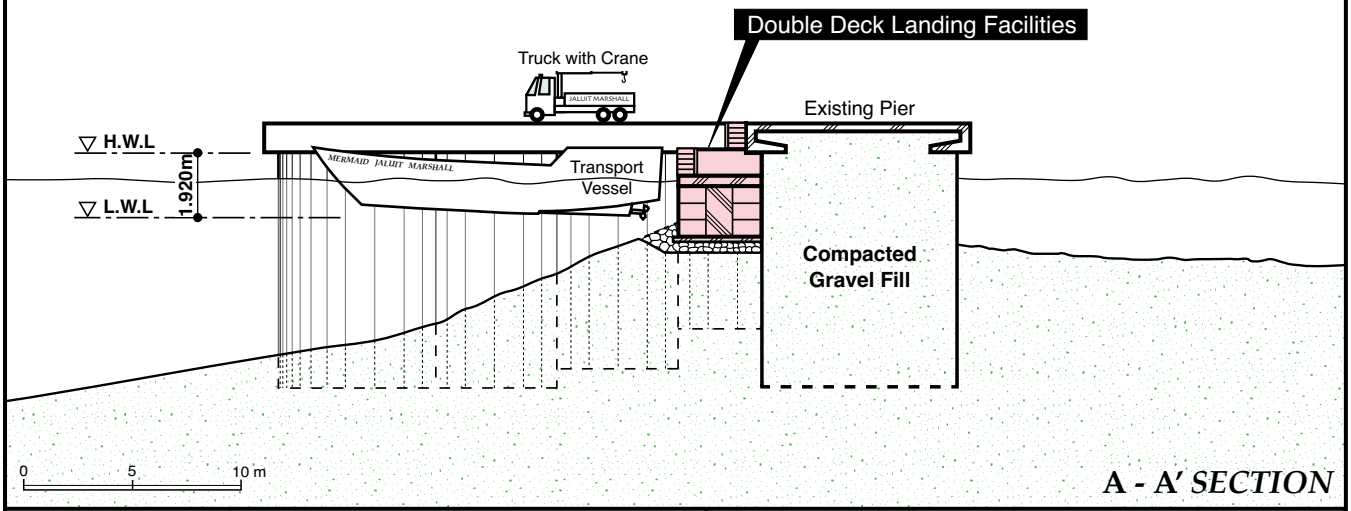
Building Finish (Interior)

Room	Floor	Wall	Ceiling	Fittings
Office, meeting room, crew accommodations	Concrete surface	Painted concrete block	Painted water-proof Plywood	Wood door
Workshop, storage	Concrete surface	Painted concrete block	Water-proof Plywood	Painted wood door
Machine room	Concrete surface	Concrete block	Water-proof Plywood	Aluminum door
Toilet	Mortar finish	Mortar finish	Painted water-proof Plywood	Painted wood door

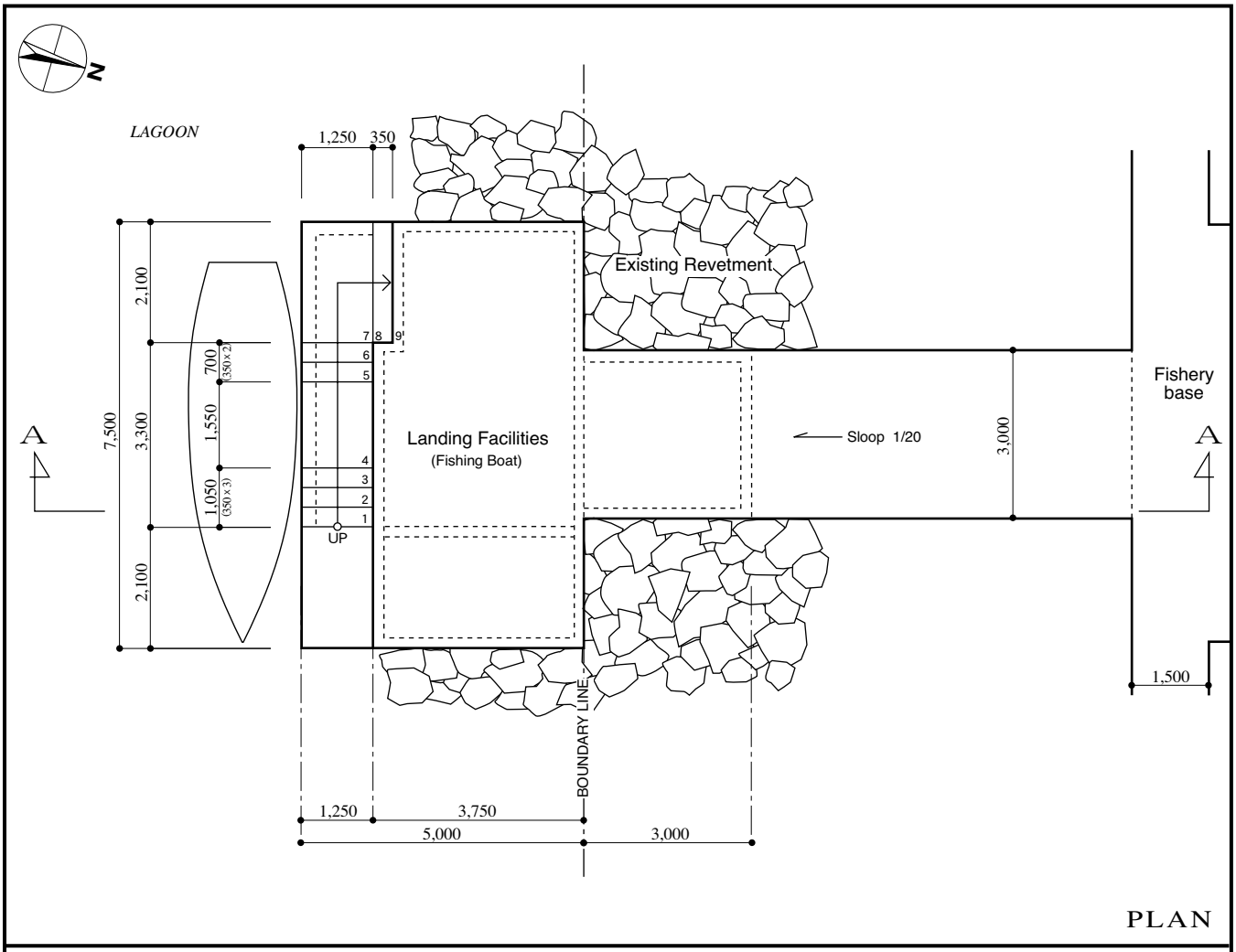
3) Basic Design Drawings

Basic design drawings are shown in the following 4pages.

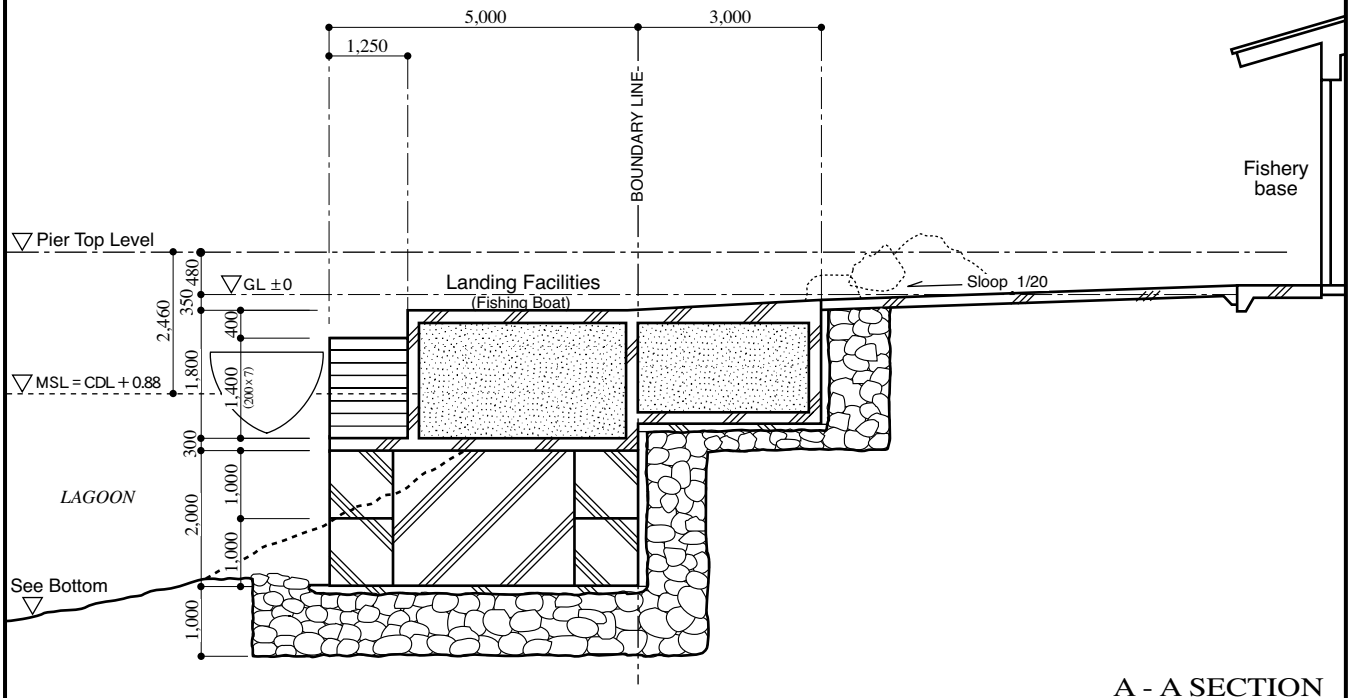




Double Deck Landing Facilities Plan • Section	THE PROJECT FOR DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL IN THE REPUBLIC OF THE MARSHALL ISLANDS JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)



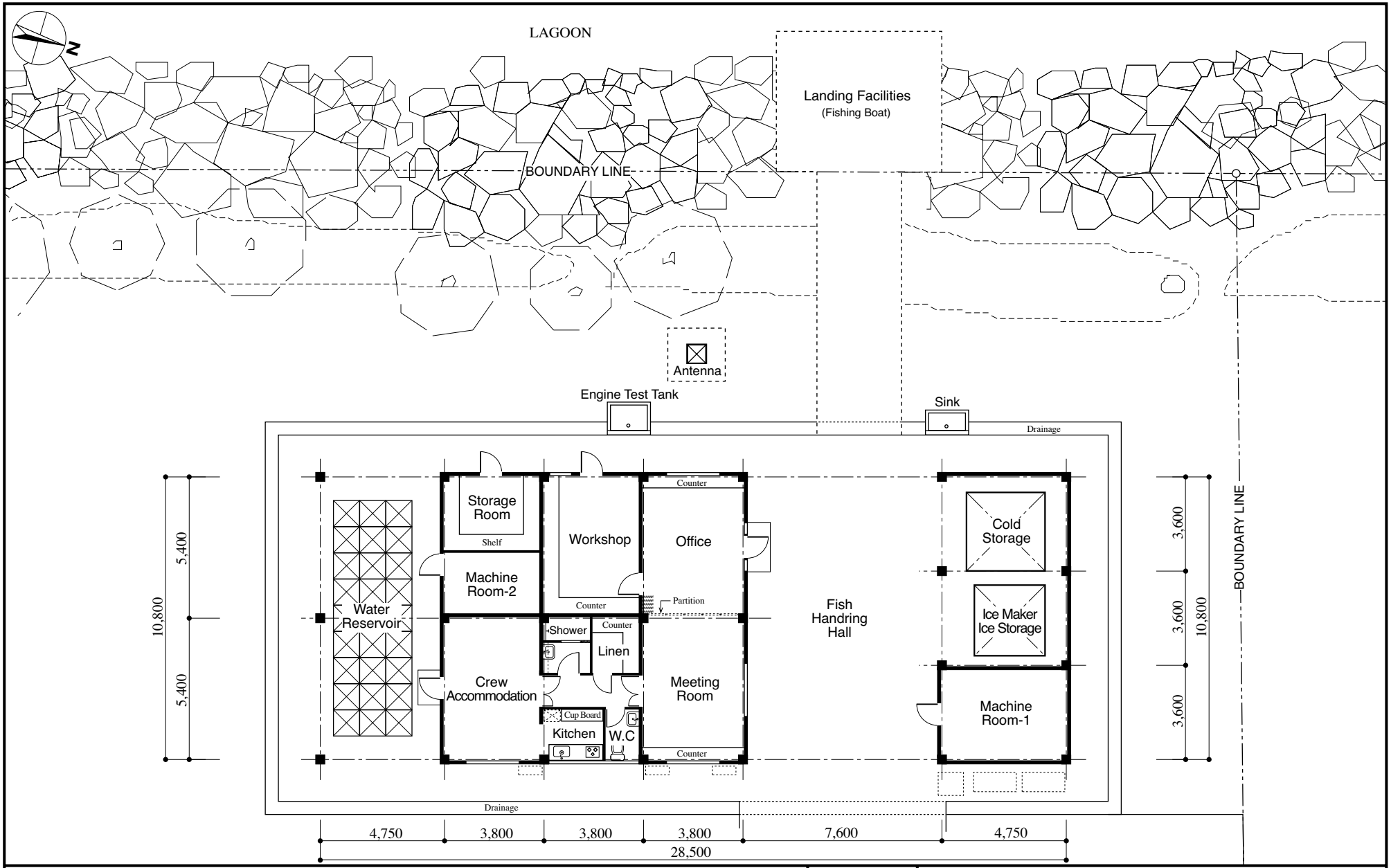
PLAN



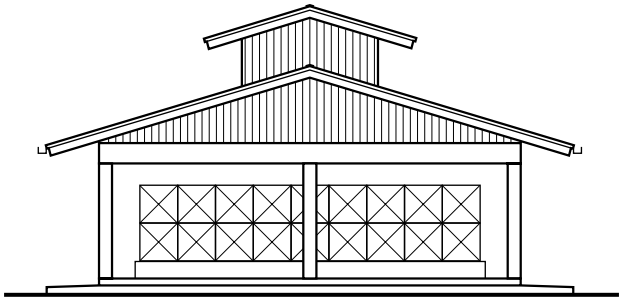
A - A SECTION

Fishery Base Plan • Section

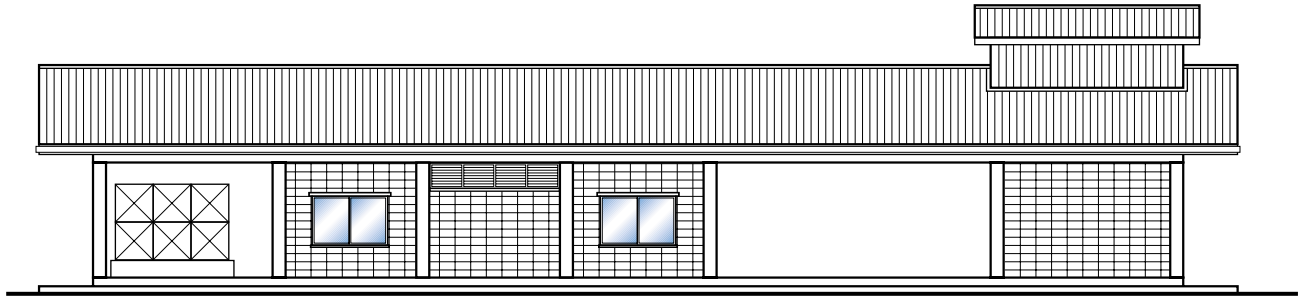
THE PROJECT FOR DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL IN THE REPUBLIC OF THE MARSHALL ISLANDS
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)



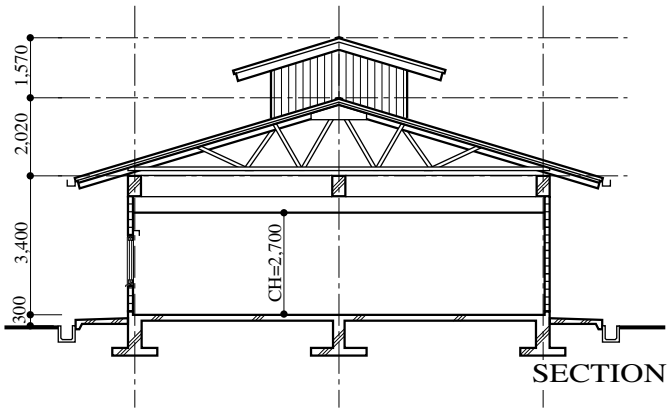
Fishery Base Layout Plan • Plan	S = 1 : 200	THE PROJECT FOR DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL IN THE REPUBLIC OF THE MARSHALL ISLANDS JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)



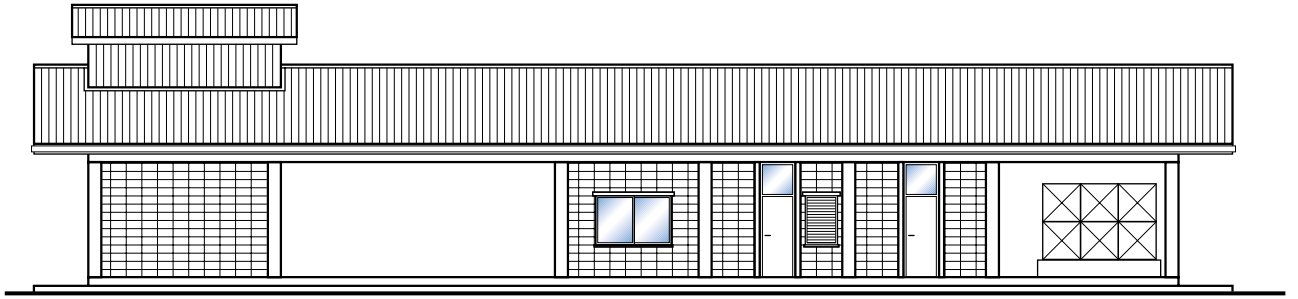
SOUTH ELEVATION



EAST ELEVATION



SECTION



WEST ELEVATION

Fishery Base Elevation Section	S = 1 : 200	THE PROJECT FOR DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL IN THE REPUBLIC OF THE MARSHALL ISLANDS JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

(2) Equipment Plan

In accordance with section 2.2.4[Basic Policy of Equipment Plan], the minimum amount of equipment needed to implement the Project will be provided. The installation site of each equipment, its purpose, and objective equipment of the Counterpart Fund that is explained later, has been shown in the equipment list. In addition, the equipment list has been divided according to the equipment that will be provided by the Japanese and Marshall sides.

1) Equipment to be provided by the Japanese side

The following equipment will be provided by the Japanese side in accordance with the Project's activities.

① Equipment for fish production: equipment used in fishing operations by fishermen (including objective items of the Counterpart Fund)

② Equipment for the fishery base: equipment that will be used at the fishery base to support activities of fish production, fishery supervision, and fish marketing

③ Equipment for fish transportation: equipment needed to transport fresh fish from the fishery base to the consumption areas

The equipment for above will be provided according to the following plan.

① Equipment for Fish Production

Fishermen from each ward will be required to purchase ice from the fishery base to pack their fish catch prior to departing on their fishing operations. At the end of their fishing operations, they will return to the base to land their fish catch. The equipment that is used during this process will be provided by the Project (includes objective items of the Counterpart Fund).

(i) Small fishing boats

Based on the basic policy in section, 2.2.4 (1), a total of 8 fishing boats will be provided by the Project. The basic design conditions of the fishing boats are given below.

-Boat type: Japanese FRP boats with 2 outboard engines and console

-Boat size: Minimum length of 22-23 feet (about 6.6m to 7.0m) with a space capacity for 6 crew members, two 160-liter insulated boxes, one 25-liter insulated boxes, and spear fishing gears for 6 people. The L, B, D ratio for Japanese

FRP boats is L/B <3.5, L/D <10.0, B/D >2.3, in accordance with the officially recognized values.

-Maximum loading capacity: One fishing boat with a six member crew 420kg, 6 sets of spear fishing gear 18kg, two 160-liter insulated boxes 30kg, one 25-liter fish box 3kg, ice-packed fish 219kg, two 30Hp outboard engines 114kg, 48 litters of fuel 48kg, and others (anchor, rope, repair tools, etc.) about 20kg for a total of 872kg plus a 10 percent safety ratio or 959kg. Therefore, the maximum loading capacity has been fixed at 1,000kg.

-Deck**:** Completely extended one layer deck

(ii) Outboard engine

The horsepower required for the Japanese FRP fishing boat to meet the maximum loading capacity, based on the boat size given above, is 60Hp (see Appendix 8). Therefore, the project will provide two 30Hp outboard engines to ensure safe fishing operations. Additionally, the engines will be equipped with a power tilt to enable the engines to be lifted and lowered during spear fishing operations in the coral reef areas. The popularly utilized 2-cycle gasoline engines will be provided. And further a manual starter will be provided for emergencies.

(iii) Plastic fuel tanks

The project fishing boat contains the specification for two 30Hp outboard engines with two 24-liter fuel tanks. The fishing boat is estimated to require 74 liters of fuel for one fishing operation, and therefore spare fuel tanks are needed. Considering fire prevention, the tank should have a one touch joint cap for connecting with a fuel pipe. A polyethylene tank will be provided for anti- corrosion measures.

Since the tank's minimum capacity is 24liters, two spare tanks will be provided to secure necessary volume of fuel. Total 16 spare tanks will be provided for 8 project fishing boats.

(iv) Fishing gear

The following traditionally utilized fishing gear on the outer islands will be provided.

a. Three-pronged spear set

The commonly utilized three-pronged spear set that includes, underwater mask, light, fins, and snorkel, will be provided for the fishing boats. A total of 48 sets will be provided (8 boats x 6 fishermen x 1 set = 48 sets).

b. Gill nets

The commonly used gill nets are monofilament trammel nets with its dimension of 46m(150ft)L x 1.5mD and with the smallest mesh size of 2 inches. This type of net can catch smaller fishes than the plate size fish. Presently, MIMRA is making a review to formulate an fishing guideline of the minimum gillnet mesh of about 3 inches by which only more than the plate size fish could be caught. Considering such government movement for resources conservation, minimum mesh size of 3 inches will be provided by the Project. One set of gill net will be used by two fishermen. Therefore, the Project will provide three sets per fishing boat. The total number of gill nets that will be provided is 24 sets (8 boats x 3 sets/boat = 24 sets).

c. Cast nets

The commonly used cast nets on the islands are 4.3m (14ft)x 1.5m monofilament net with a 2-inch mesh size. Two sets will be used by one boat. Therefore, the number of cast nets that will be provided is 16 sets (8 boats x 2 set = 16sets).

d. Trolling line

The trolling line that are commonly used locally and comprised of a pole, float, trunk line (100m), and lure will be provided. In order to prevent the trunk line from entangling, three sets will be provided at both sides and a stern of one boat. Therefore, the Project will provide 24 sets (8 boats x 3 sets/boat = 24 sets).

e. Bottom line fishing

Bottom line fishing. which is carried out in the shallows, is comprised of a fishing pole with reel (2.5m long), fishing line (100m), a sink, and hook. One set per fisherman will be provided by the Project for a total of 48 sets (8 boats x 6 fishermen x 1 set = 48 sets).

In addition, one set of deep sea bottom fishing line for each fishing boat will be provided since the COFDAS project by the OFCF is conducting training activities in deep sea bottom fishing.

② Equipment for the Fishery Base

The following equipment for the fishery base will be provided with the aim of supporting fishing operations and to help maintain fish freshness for the fish marketing activities of the fishery base.

(i) Fishery supervisory boat

Based on the review and basic policy described in 2.2.4(2)①, one fishery supervisory boat is planned to provide. As its activity will be the same as the project fishing boats, the basic design condition of its hull is set the same as that of the project fishing boat.

(ii) Outboard engine

Based on the review and basic policy described in 2.2.4(2)②, two outboard engines are planned to provide for the fishery supervisory boat. The basic design condition of the engine is set the same as that of the outboard engines for the project fishing boat.

(iii) Plastic fuel tank

Based on the review and basic policy described in 2.2.4(2)③, two plastic fuel tanks are planned to provide for the fishery supervisory boat. , The basic design condition of the fuel tank is set the same as that of the plastic fuel tank for the project fishing boat.

(iv) Insulated boxes and Fish boxes

a. Insulated boxes (160liters)

The Project will provide insulated boxes of the same specifications as the boxes used in similar projects. Insulated boxes made of PE, with a 160-liter capacity, a heat transmission coefficient of within 0.8Kcal/m^2, and handles will be attachted. The 160-liter insulated box will contain 55kg of fish + 28kg of ice=83kg. In addition, as explained in section 2.2.2(7)1), the volume of fresh fish that will be shipped to

Majuro and Kili Island is 1050kg and 270kg, respectively. Therefore, a total of 45 boxes will be provided based on the calculation shown below.

- For the project fishing boats: 2 boxes/boat x 8 boats = 16 boxes
- Number of boxes for loading to the transport vessel to Majuro:
  - 16 boxes for fish catch by project fishing boats;

    fish catch volume 880kg÷55kg of fish/box=16 boxes
  - 3 boxes for fish catch by existing fishing boats;

    fish catch volume 170kg÷55kg of fish/box=3 boxes
- Number of boxes for transporting fish to Kili Island;
  - 5 boxes for fish catch by existing fishing boats

    fish catch volume 270kg÷55kg of fish/box=5 boxes
- Number of boxes for storage of fresh fish in Kili Island;
  - 5 boxes for fish volume of 5 boxes shipped by the transport vessel

  Subsequently, total required number = 16+16+3+5+5 = 45 boxes

b. Insulated boxes (25liters)

Insulated boxes with a 25liter capacity and a heat transmission coefficient of within 0.8Kcal/m^2 will be provided by the Project. One unit per project fishing boat to store bait fish or a total of 8 units will be provided (1 unit/boat x 8 boats = 8 units).

c. Fish boxes (40liters)

40-liter fish box (fish weight for 20kg), a mesh type for water drainage and made of synthetic resin will be provided by the Project. The maximum volume of fish that will be handled per day is 1,050kg for the shipment to Majuro. The handling work at the fish handling hall will be carried out on four rotations per day and the volume of fish handled on one rotation is 263kg. Therefore, 13 fish boxes will be provided by the Project.

d. Fish boxes (25liters)

The 25-liter fish boxes will be used to store frozen bait fish. In order to improve the heat exchange rate of the cold storage, boxes made of synthetic resin can not be used. Therefore, SUS304 pan type fish boxes with a 25liter capacity (13kg) will be

provided. The storage capacity of the cold storage is 500kg and 40boxes will be provided by theProject.

(v) Communications Equipment

a. SSB wireless unit (150W)

The same type of SSB wireless unit with a 150W output that is presently used in the outer islands will be provided (one unit).

b. VHF wireless unit (25W)

The marine type of VHF wireless unit with an output of 25W that is commonly used among the boats currently in operation will be provided for the fishery base (one unit).

c. CB wireless unit

The Project will provide the similar type of the Citizen Band radio which is presently used as a private communication means among 6 wards on the Jaluit Atoll. The fishery base will be provided with one unit, and one unit will be installed in each of the seven places where a project fishing boat will be stationed.

d. SSB wireless antenna

The same type of antenna that is installed at the MIMRA headquarter will be provided for the fishery base. It will be a panzer mast type whip antenna 6 meters long and an inclined antenna feeder will be installed. The antenna pole will be a flexible tower (with manual winch) rather than a panzer mast type of antenna for easier maintenance. The height of the tower will be more than 12m and it will be made of hot dipped galvanized steel.

e. VHF wireless antenna

The antenna will be a marine type fiberglass whip antenna and it will be installed on the flexible SSB tower.

f. CB wireless antenna

A standardized marine type 1.5m length fiberglass whip antenna will be installed in 8 places including the fishery base. CB wireless antenna for the fishery base will be

installed on the SSB antenna tower and the antennas in other seven places where the project boats are distributed will be installed on the designated buildings.

(vi) Tools and spare parts for outboard engine repair

General tools and special overhauling tools for general repair work on the outboard engines (changing the plug, coil, CDI, propeller, carburetor, water pump, lower casing gear, etc.) will be provided.

Repair work requiring special technical skills such as dismantling and reassembling the crankshaft or repairing the cylinder of a seized engine will be carried out at the MIMRA workshop in Majuro. Based on the amount and type of spare parts that are provided by the outboard engine manufacturer within two years of purchase by overseas customers, one year's supply of parts will be provided (excluding the spare parts that are provided at the time of deliver).

(vii) Truck with Crane

A truck with a mounted crane will be provided by this Project to load and unload the 160-liter insulated boxes from the existing pier to the transport vessel and to transport between the pier and the fishery base. One box containing iced fish is estimated to exceed 100kg. The required working radius needed to operate the crane has been estimated at 5.5m(loading capacity at this radius: 0.2 tons), based on factors such as the width of the transport boat, the fender of the existing pier, the width of the truck, operating space of the crane, etc. To secure the radius of 5.5m, a 2 ton crane with boom length of 6.4m is required (max. lifting cap. of 500kg at the radius of 5.5m). Therefore, an anticorrosive, two-ton truck with a 2 tone crane and with a loading platform of more than 3.4m, will be provided.

(viii) Weighing scales

a. Platform scale

The 160liter insulated box containing fish and ice is estimated to weigh 100kg and the Fish Handling Hall is expected to handle such heavy items frequently. Dimension of the insulated box is 1.1mL x 0.5mW, and the box is weighed by putting its length side onto the width side of the platform of the scale. Accordingly, the width of the platform is planned to be more than the half of the length of the box in order to secure good balance when the box is put on the platform. Only the 500kg scale has the width

of more than 0.55m. Therefore, a 500kg scale will be provided. The measuring unit of the scale will be in pounds. It will be rust proof and the scale will have casters so that it can be moved and stored indoors after its use.

b. Hanging scales

The fishing grounds of Jaluit atoll remain largely unexploited. Therefore, large fish is anticipated to be harvested and scales with a maximum capacity of 50kg was requested in order to weigh the individual fish body. However the capacity of the hanging scale with the measuring unit in pound is up to10kg (20lbs) applicable tothis purpose. The weighing range of the larger scale(120g-75kg) is not suitable to use for weighing the individual fish body. Therefore, this 10kg hanging scale will be provided by the Project. It will have a rust proof fiberglass scoop. Two units will be provided, one unit for use at the Fish Handling Hall and one unit for use at the landing facility.

(ix) Pushcart

As in the case of the platform scale, the platform width of the pushcart requires more than 0.55m to load a large insulated box safely. Only the width of the 300kg pushcart has the width of more than 0.55m. Therefore, two stainless steel pushcarts with a 300kg capacity will be provided for use in the Fish Handling Hall and the landing facility for the fishing boats.

(x) Bicycle Trailer

The fishing boats will utilize a minimum of four plastic fuel tanks (24liter capacity) or a total of 96liters of gasoline for one fishing operation. Therefore, the bicycle trailer will be required to transport approx.100kg of fuel. Therefore, one bicycle trailer with a standard capacity of 350kg will be provided. A steel bicycle trailer will be provided since an aluminum trailer can not be welded when repairs are needed.

(xi) Ice maker/ice storage

In accordance with the design policy explained in section 2.3.1(3), the specifications of the ice-maker and ice storage facilities, that are anti-corrosive and

meet the ice production conditions explained in 2.3.2(1)2)①(i)[Basic room plan : Ice maker and ice storage facility] are listed below.

Scope and specifications of the ice-making unit and ice storage facility

- Ice-making unit

・Type : Automatic ice maker for plate ice

・Capacity : Nominal capacity; 1 ton/day (net production capacity: daily 0.5 tons or more, outdoor temp. 32°C, water temp. 30°C)

・Cooling equipment : Anti-corrosive, separate air cooling type

・Main frame of ice maker : Hot dipped galvanized finish

・Exterior panel of ice maker: SUS 304 + painting

・Water reservoir : Hot dipped galvanized steel finish

・Refrigerating machine : 5.5kw, semi-hermetic type

・Condenser : Anti-corrosive, air cooling and outdoor installation type

・Heat exchanger : Copper duct and fan

Casing: Steel plate with electrically galvanized finish + baked acrylic finish

Fan : Synthetic resin

Motor: Totally enclosed outdoor type with exterior fan

Specification of Ice storage facility

・Measurements : 2.25m width x 2.7m depth x 2.5m height

・Storage volume : 1.5 tons

・Room temperature: –5°C to –10°C

・Panel : Urethane sandwich panel, surface finish is SUS304+paint, door is 0.9mW x 1.8mH

・Cooling equipment: 1.5kw separate air cooling type, anticorrosive condenser (same specifications as the ice maker condenser)

(xii) Cold storage

The cold storage facility will be a prefabricated structure with anti-corrosive measures and the scope and specifications are given below.

- Measurements : Width 3.0m x depth 3.0m x height 2.7m
- Capacity : Racks 0.52 tons
- Room temperature : –20^{o}C
- Cooling equipment: 5.5kw separate air cooling type, anticorrosive condenser ((same specifications as the ice maker condenser)
- Panel : Urethane sandwich panel, surface finish is SUS304+paint, door is 0.9mW x 1.8mH

③ Equipment for fresh fish transport

The specifications of the transport vessel that will transport fresh fish landed in Jaluit to Majuro (distance 130 nautical miles) and Kili Island (distance 40 nautical miles) is given below.

(i) Transport vessel

a. Type of boat

Boat speed

There are no islands between Jaluit and Majuro that will serve as shelter for the transport vessel. In addition, the sides of the entrance channels to both atolls are surrounded by coral reefs and there is the danger of the boat running aground. Hence, the transport vessel should navigate these channels during the daylight hours. The navigational speed of the transport boat has been set at 13 knots to cover 130 nautical miles in 10 hours within a 12-hour day.

Scope of the boat length

The transport boat will be used to transport fresh fish from Jaluit to Majuro and Kili Island using the MIMRA headquarter in Majuro as a base. In order to ensure safe operations, the vessel will be equipped with navigational and wireless communication equipment, a wheelhouse, crew's quarters, toilets, galley, engine room, storage, and a large fish hold with a capacity to store 1.6 tons of iced fish (3.15m^3, see Appendix 9). It will have a minimum length of about 16.0m (water-line length of about 13.0m, see Appendix 9).

Due to safety considerations, it is better to secure an adequate boat length, since the ocean conditions between Majuro and Jaluit are subject to an average wind velocity of more than 6m/sec for about six months. The transport vessel will be moored at the double deck landing facilityes that will be constructed on the calm, south side of the existing pier [see Basic Design Drawing: Double Deck Landing Facilities]. The distance from the end point of this landing facilityies to the end point of the existing pier is about 18m. Therefore, in order to avoid the impact of the wind and waves at the end point of the pier, the transport vessel must be shorter than 18m in length or about 17m (water line length is about 14m).

Scope of the boat shape

Under these conditions of the boat length, the correlation between the water line length (L), width (B), and depth (D) of the transport vessel is explained below.

L/B<4/60, L/D<22.00, B/D>2.05

Therefore, the basic scope of the transport vessel will be:

14.0m>L>13.0m, B>2.82m, D>0.59m, B/D>2.05

The maximum displacement volume will be 11.3 to 14.1 tons (see Appendix 11).

b. Other conditions

- To control the rolling angle during steep waves, the water line of the ship form will have a standard keel. In addition, it will be a semi-planing type that will provide a stable bow and enable the boat to maintain its speed. To ensure boat speed and stability, the boat will be a FRP semi-planing type.
- It will have a sunken forecastle and the bow will be given a flare to ensure excellent seaworthiness.
- To prevent the steep waves from entering the boat, the boat will have a complete deck.

c Engine Hp

The engine horsepower is determined according to the standard curve that was produced based on many speed tests, which is the correlation between the HP ratio (B.HP) with the displacement (W) and the V/L value (see Appendix 10). This standard curve indicates an evaluation of the ship form in terms of boat speed

according to three grades--fair, good, and fine; and the HP value for each of these grades is determined.

The grade of the HP value of the transport vessel will be good. In this case, the HP value is

L=13m to 14m and 227HP to 26HP.

According to the fishing boat inspection regulations, the transport boat will pass the inspection, if its HP value of less than the water line length (L') of 15m meets the following formula.

$V/L<(1.55 + 0.004L) \times (B.HP/5L)^{1/3}$

If L=13m, V/L'1/8= 4.2, $B.HP/5L)^{1/3}=13.4$

If L=14m, V/L'1/8= 4.0, $B.HP/5L)^{1/3}=14.5$

In either case, the transport vessel meets the standards of the inspection regulations. Therefore, the HP value of the transport vessel will be 227 to 262HP.

The list of equipment based on the conditions explained above is shown in the following table.

Equipment List (1/3)

No. Item	Vol.	Specifications	Installation Site	Purpose
I. Fishery Production Equipment				
1) Small Fishing Boat★	8 boats	FRP, 22-23ft total length, maximum loading capacity more than 1 ton, applicable to2 mounted outboard engines, with console, completely extended one layer deck	Each fishery site	Fishing operations
2) Outboard engine★	16 units	30HP, 2-cycle gasoline, with power tilt	Same as above	Engine for boat
3) Fuel tank★	16 units	More than 24-liter capacity, made of PE	Same as above	Store extra fuel
4) Fishing gear★				
① Spear fishing set	48 sets	1 set: three-pronged spear, underwater mask, underwater flashlight, fins, snorkel	Same as above	Fishing
② Gill net	24 sets	1 set: nylon monofilament trammel net, about 46m(150ft) x 1.5m, minimum mesh size 3 inches	Same as above	Fishing
③ Cast net	16 sets	1 set: nylon monofilament net, about 4.3m(14ft) x 1.5m, mesh size 2 inches	Same as above	Fishing
④ Trolling	24 sets	1 set: pole, float, 100m trunk line, lure	Same as above	Fishing
⑤ Bottom line				
a. Bottom line in the shallows	48 sets	1 set: 2.5m fishing rod with reel, 100m fishing line for the shallows, sink, hook	Same as above	Fishing
b. Bottom line in the deeps	8 units	1 set: hand reel, 300m fishing line for the deeps, sink, hook	Same as above	Fishing
II. Fishery Base Equipment				
1) Fishery supervisory boat	1 boat	FRP, 22-23ft total length, maximum loading capacity more than 1 ton, applicable to 2 mounted outboard engines, with console, completely extended one layer deck	Fishery base	Supervisory activities carried out in each fishery site
2) Outboard engine	2 units	30HP, 2-cycle gasoline, with power tilt	Same as above	Engine for boat
3) Fuel tank	2 units	PE made, more than 24-liter capacity	Same as above	Store extra fuel

Note: ★ Counterpart Fund component

Equipment List(2/3)

No. Item	Vol.	Specifications	Installation Site	Purpose
4) Insulated boxes, fish boxes				
① Large insulated box	45 units	PE made, more than 160 liter capacity, heat transmission coefficient less than 0.8Kcal/m^2, with handles	Fish Handling Hall	Storing fish with ice
② Small insulated box	8 units	PE made, more than 25 liter capacity, heat transmission coefficient less than 0.8Kcal/m^2, with handles	Same as above	Storing fish bait with ice
③ Fish box for handling	13 units	PE made, 40 liter capacity, (20kg capacity, with mesh)	Same as above	For fish handling
④ Fish box for storage	40 units	Stainless steel, 25L capacity (about 13kg)	Cold storage	Storing bait fish
5) Wireless Unit				
①SSB wireless Unit	1 unit	Marine type, output more than 150W	Office	Communication between MIMRA office and transport vessel
② VHF wireless unit	1 unit	Marine type, output more than 25W	Same as above	Communication with transport vessel
③ CB wireless unit	8 units	Output more than 4W, with 12V battery	Office / each ward	Communication with each ward
④ SSB antenna	1 set	Marine type, glass fiber whip antenna 6m long, inclined antenna feeder, hot dipped galvanized steel	Office	Communication
⑤ VHF antenna	1 set	Marine type, glass fiber whip antenna, shared use of the SSB antenna tower	Same as above	Communication
⑥ CB antenna	8 sets	Glass fiber whip antenna 1.2m long	Office / each ward	Communication
6) Boat repair tools/parts	1 set			
① Repair tools	1 set	Fishery base: tool cabinet, grinder, winch , electric drill, electric welder, gas welder, compressor, etc. 30HP outboard engine overhaul tools MIMRA main office: Special 30HP outboard engine overhaul tools (dismantling crankshaft, seized engine repair, etc.)	Workshop	Boat engine repair
② Engine parts	1 set	49 parts for outboard engine (1 year's supply), about 250 items	Same as above	Boat engine repair

Equipment List(3/3)

No. Item	Vol.	Specifications	Installation Site	Purpose
7) Crane mounted truck	1 truck	Crane capacity: With working radius of 1.7m-5.5m, lifting load of 0.5t – 2.3t, boom: 3 stage extension 6.4m long, truck; loading capacity more than 2t, loading platform 3.4m long, loading platform rust proof chassis	Fishery base	Transport heavy cargo between the pier and the fishery base
8) Scales				
① Scales	1 unit	Weighing capacity 0.25kg-500kg (8ox-1200lbs), enamel finish, with casters	Fish Handling Hall	Weigh fish
② Hanging scale	2 units	Dial type, weighing capacity 30g-10kg (1ox-20lbs), with unit measurement pound, with glass fiber scoop	Same as above	Weigh fish and small fish catch
9) Pushcart	2 units	Stainless steel, maximum load capacity 300kg, loading platform 0.9m x 0.6m	Same as above	Transport heavy cargo within base
10) Bicycle trailer	1 unit	Steel, maximum loading capacity 350kg	Storage	Transport fuel tanks
III. Transport Equipment for Fresh Fish				
1) Transport vessel	1 boat	FRP, open-going boat, service speed 13 knots, water line length 13m-14m, capacity for 6 fish holds more than 3.2m^3, engine output: about 260HP, loading mast	Pier at MMRA main office	Transport fresh fish from Jaluit to consumption areas
IV. General Equipment				
1) Office desk	3 units	Steel, 1.0mL x 0.7mW x 0.7mH	Office	Office work
2) Chair	3 units	Steel, 0.46m x 0.41m	Office	Office work
3) Table	4 units	Stainless,1.8mL x 0.6mW foldable	Meeting room	Meetings
4) Chair	16 units	Stainless, 0.44m x 0.42	Same as above	Meetings
5) White board	1 unit	Stainless,1.2mL x 1.0mH with casters	Same as above	Meetings
6) Table	1 unit	Wood, 0.9mL x 0.9mW x 0.7mH	Crew Accommodations	Meetings
7) Chair	4 units	Stainless, 0.44m x 0.42m	Same as above	Meetings

2) Equipment to be prepared by the Marshall side

The list of equipment shown in the table below is expected to be provided by the Marshall side. They have been classified from (a) to (d) according to the following definition.

(a) General furniture, gardening equipment

(b) Equipment not necessarily needed for the project

(c) Equipment and consumables that can be purchased locally, at low cost

(d) Leased equipment

Optional Equipment To Be Provided By the Marshall Side

	Amount	Installation Site/Purpose
(a) Closet	1	Crew Accommodations
(a) Refrigerator	1	Crew Accommodations
(a) Sofa	1	Crew Accommodations
(a) Washing machine	1	Crew Accommodations
(a) Lawn mower	1	Storage
(b) Typewriter	1	Office
(b) Computer	1	Office
(c) Safe	1	Office
(c) Calculator	1	Office
Office supplies	1	Office
(c) Cleaning equipment	1	Storage
(c) Painting equipment	1	Storage
(d) Propane gas cylinder	1	Crew Accommodations

Chapter 3 Implementation Plan

Chapter 3 Project Plan

3.1 Implementation Plan

3.1.1 Implementation Policies

(1) Implementation System

The Project implementing body on the Marshall side is MIMRA. Following the signing of the Exchange of Notes between the governments of the RMI and Japan, the RMI government will sign a contract with a Japanese consultant company, that will be responsible for preparing the detail design and supervising the implementation of the Project. The RMI government will also sign a contract with a Japanese construction company that will be responsible for the construction works undertaken by the Japanese side and for the procurement and installation of the equipment provided by the Project. The construction company will be placed under the supervision of the Japanese consultant company. Following the completion of the construction and installation works, MIMRA will take over the management and operations of the Project as the responsible body.

(2) Execution Policy on Construction Works

Based on the premise that the Project will be implemented as a Japanese government grant aid project, the following policy will be applied pertaining to the implementation of the Project.

1) The Project implementing body on the Marshall side, the Japanese consultant company, and the Japanese construction company will be responsible for maintaining close communication, an adequate exchange of views, and for the efficient implementation of the Project.

2) Since all of the construction materials will be procured and shipped from Majuro, the relevant parties will be responsible for preparing a schedule of the construction works based on an adequate assessment of hiring construction workers and the procurement activities for construction materials. Based on the local conditions that prevail, the construction works will be managed flexibly and efficiently.

3) A rational and efficient temporary construction works plan that adequately reflects the living environment of the workers in Jaluit will be prepared.

4) As the Project site borders the sea, countermeasures will be taken to store and protect construction materials from the negative effect of the sea winds during the construction stage.

5) All parties will endeavour to ensure that temporary storage of construction materials and the transport and installation work will be carried out safely and that proper accident prevention measures will be taken.

3.1.2 Factors to be Taken Notes

The following factors will be considered in execution of the Project.

1) The procurement and transport of construction workers, materials, and equipment will be carried out safely and the construction period will be adhered to.

2) The Project site is narrow and it is difficult to secure added land area for a temporary work yard. Therefore, a temporary construction plan will be carefully prepared not to bring inefficiency on the construction works.

3) Construction methods with minimum vibration, noise, and negative impact on the surrounding environment will be adopted since the Project site is surrounded by homes and an elementary school.

4) The construction works pertaining to Japanese grant aid projects are tax exempted. Tax exemptions for equipment and materials imported for the Project must be adequately discussed with the relevant ministry. The Japanese construction company will sufficiently coordinate its activities with the Project implementing body and procedures will be pursued in accordance with the laws of the country.

3.1.3 Scope of Works

The Work pertaining to the Project will be apportioned between the Japanese and RMI sides as shown in the table below.

Scope of Works

Scope of Work	Japan	Marshall
1. Securing of land for building construction and temporary facilities		O
2. Installation of public utilities at the site		
- Replacement and permit to replace the pole mounted transformer to be installed onto the pole.		O
3. Gardening works inside the site		O
4. Construction work		O
- Buildings in the compound		
- Roads in the compound	O	
- Landing facilities of transport vessel	O	
- Landing facilities of fishing boat	O	
- Street lights	O	
5. Equipment	O	
- Equipment/material procurement		
- Installation work	O	
- Test operation of equipment	O	
- Instruction on equipment use	O	
6. Import /Custom procedures	O	
- Transport to RMI & domestic transport	O	
- Tax exemptions & custom clearance	O	
7. To bear commissions to the Japanese foreign exchange bank for banking services based upon the B/A		O
8. Provide arrangement for the stay, immigration procedures of Japanese nationals going in/out of Palau in conjunction with project related work		O
9. Adequate maintenance & operation of the facilities constructed & equipment provided under the grant aid.		O
10. Responsible for all the expenses, other than those borne by the grant, necessary for construction of the facilities as well as the transportation and installation of the equipment.		O
11 Responsible for all permits/applications required for execution of construction work.		O

3.1.4 Consultant Supervision Plan

(1) Construction of the Facility

The basic policy and factors pertaining to the supervision of the Project are explained below.

① The consultant company will coordinate closely with MIMRA in order to ensure that the construction work and the transport and installation of the equipment is carried out efficiently. In particular, the timing of the electricity installation work is important since it is closely related to the construction work that will be carried out by the Japanese side; therefore, adequate discussions on the specifications and

work schedule between the two parties will be carried out before the installation work is implemented.

② Prior to the start of the construction work, the construction plan and shop drawings submitted by the Japanese construction company will be adequately studied and the appropriateness of the temporary plan, work schedule, quality of the materials that will be used, and construction method will be reviewed.

③ The ice maker/ice storage and cold storage facilities require special installation work. Therefore, it will be closely coordinated with the construction work and the installation work for electricity, water supply and drainage.

④ The construction work and the specifications of the equipment that has been installed will be inspected after the work has been completed and prior to turning the project over to the RMI side. Appropriate measures will be taken if repairs are required.

⑤ A construction engineer will be sent to the project site to supervise the work. Civil engineering, structure , and equipment technicians will be sent as needed to oversee the construction work at the Project site.

(2) Equipment Installation

The installation period of the equipment is related to the finishing works of the building construction. Hence close prior communications between the relevant parties regarding transport, installation methods, and other tasks will be carried out.

3.1.5 Equipment Procurement Plan

All of the construction materials in the Marshall Islands, excluding the sand and gravel made of coral rock, are imported. Based on the content and specifications of the materials that will be used in the Project, there is the issue of quality. In view of the circumstances, the construction materials used in the Project will be procured from the following countries.

Procurement Origin of Construction Material/Equipment

Materials/Equipment	RMI	Japan	Transportation Method
1.Construction materials			
-Concrete block, sand/gravels, etc.	◯		
-Others		◯	marine transport
2.Facilities materials			
-Fluorescent lamp	◯		
-Other		◯	marine transport
3.Civil works materials		◯	marine transport
4.Equipment		◯	marine transport

3.1.6 Implementation Schedule

If the Project is implemented as a Japanese government grant aid project, the tasks of preparing the tender documents, construction works, procurement and installation of the equipment, and the signing of the contracts for these tasks with the relevant parties will be carried out following the signing of the E/N by the RMI and Japanese governments. The implementation schedule of the construction works, equipment procurement, and installation is shown in the tables below.

(1) Detail Design

A detail design of the Project based on the Basic Design Study Report will be prepared, and then tender documents will be prepared. This process will take about 2.5 months.

(2) Tendering

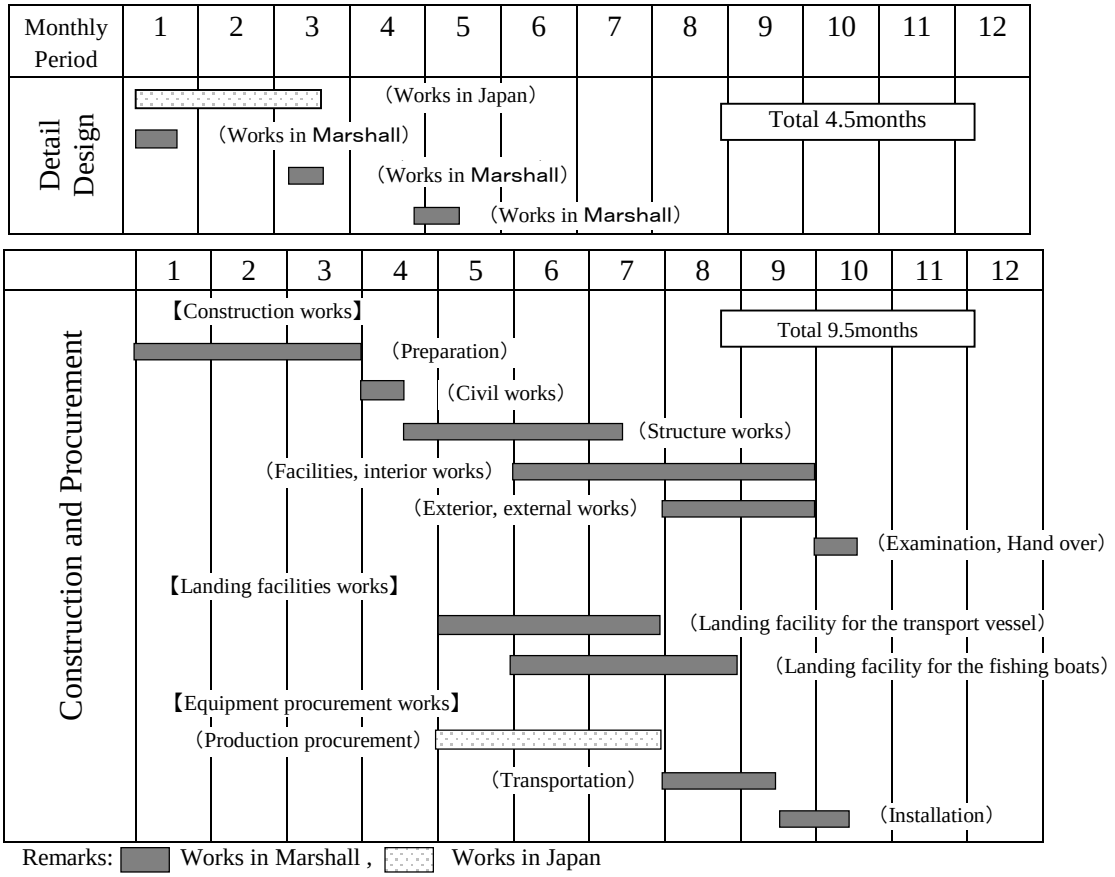
Following the completion of the detail design, a review will be carried out at the Project site. The construction schedule, recruiting participants for the tender on the construction works and procurement / installation of the equipment by public announcement, a review of the participants' qualifications, selection of the tender participants will be carried out. Based on the review findings, a general competitive tender will be conducted in the presence of relevant parties. This entire process will take about 2.0 months.

(3) Construction Works and Equipment Procurement and Installation

Following the signing of the contract between the Marshall government and the Japanese construction company and its verification by the Japanese government, the construction work and the task of procuring and manufacturing the equipment will begin. This entire process will take about 9.5 months.

The Project implementation schedule is shown below.

Project Implementation Schedule



3.1.7 Obligation of Recipient Country

MIMRA, which is the Project implementation agency, and other relevant agencies are responsible for completing the following works within the designated time frame for Project implementation.

(1) Removal of existing facilities and obstructions

All removal works of the existing facilities and obstructions and land grading activities in the Project site must be completed prior to the start of the construction work.

(2) Intake works of public facilities into the Project site

Application for and work of replacement of the capacity of the existing pole-mounted transformer adjacent to the Project site including appurtenant works are to be done. The replacement works must be completed during the construction period.

(3) Planting work

The planting work in the site will be prepared during the construction period, and be commenced at the place where it is possible.

(4) Procurement of equipment to be provided by the RMI side

Equipment that will be procured by the RMI side will be completed by the completion of the construction work.

(5) Granting and application for construction permits

Applications for permits of all works related to construction and their approval must be completed prior to the start of the construction work.

(6) Tax exemptions and customs clearance

The RMI side will be responsible for procuring exemptions on domestic tax, etc. on materials, equipment and services purchased by the construction company in the RMI during the Project implementation period.

(7) Banking Arrangement (B/A) and Authorization to Pay (A/P)

In order to facilitate the Project implementation, Banking Arrangement to a foreign exchange bank in Japan and the issuance of Authorization to Pay are to be undertaken smoothly during the Project implementation phase.

(8) Arrangement for stay and immigration procedures of Japanese nationals engaged in the Project.

3.2 Operation and Maintenance Plan

3.2.1 Estimated Project Costs of the RMI side

The estimated project costs of the RMI side for this Japanese government grant aid project is about US$75,300. A breakdown of the costs is shown as follows.

Cost Items	Estimated Costs (US$)
1) Removal of facilities and obstructions	45,700
2) Access road construction	2,000
3) Electricity installation	20,000
4)Equipment procurement<1	3,300
5)Banking Arrangement	4,300
Total	75,300

Remarks<1:Equipment to be provided by the RMI side, if necessary.

3.2.2 Operation and Maintenance Costs

The responsible agency and the implementing agency of this Project is the Ministry of Resources and Development and MIMRA, respectively. When this Project is decided to implement, its operation budget will be consulted to the MIMRA Board and then necessary costs will be arranged. Further, MIMRA has an obligation to deposit the amount equivalent to the total FOB price of the equipment for fish production such as fishing boats, fishing gears, etc., to a bank under the name of the Counterpart Fund within 4years from the date of signature of the Exchange of Note. In case the repayment for the said equipment by local fishermen is delayed, MIMRA should reimburse for this amount. However, the expenditure of such necessary cost would be approved by the MIMRA Board since the financial conditions of MIMRA is very healthy in the present time.

The balance of revenue and expenditure of the Project is shown in the table below. The details of the figures in this table are explained in Appendix 12.

Income Statement of the Project Unit: US$1000

Year	1	2	3	4	5	6	7	8	9	10
Revenue										
Sales of Fish	169.2	169.2	169.2	169.2	169.2	169.2	169.2	169.2	169.2	169.2
Sales of Ice	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Sub-total	174.6	174.6	174.6	174.6	174.6	174.6	174.6	174.6	174.6	174.6
Expenditure										
Purchase of Fish	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9
Electricity	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
Fuel	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Maintenance cost	2.1	2.1	3.2	3.2	23.2	3.2	32.2	6.2	3.2	21.2
Renewal cost	-	-	-	-	2.8	-	9.9	-	-	55.5
Sub-total	96.3	96.3	97.4	97.4	120.2	97.4	136.3	100.4	97.4	170.9
Balance	78.3	78.3	77.2	77.2	54.4	77.2	38.3	74.2	77.2	3.7
Balance carried forward	78.3	156.6	233.8	311.0	365.4	442.6	480.9	555.1	632.3	636.0

Remark : The personal cost of US$36,600 for newly recruited staff for this Project was not included in this table. This cost will be budgeted by MIMRA.

The operation and maintenance cost of the Project will be basically managed by its operation income. But as for about US$ 8,000 equivalent to the cost of one month operation out of the first year annual operation cost of US$ 96,300, the amount is necessary to be arranged by the MIMRA budget as a start-up operation capital. The budget arrangement of this cost would be possible by MIMRA, because this amount occupies only 3.0% of its total project operation /maintenance cost of US$ 26,400 in 1999, and 0.17% of its operation income of US$ 4.83 million, respectively.

Above described financial balance of the Project looks very healthy at first. Because the balance was calculated based on following assumptions:

-Current sales price of fish in Majuro would be maintained.

-Personal cost of US$ 36,600 for newly recruited staff of this Project will be arranged by MIMRA budget.

In case MIMRA will not arrange the budget of this personal cost, the amount of the annual surplus will be reduced to US$ 41,700. In addition, if MIMRA will reduce the current average fish price level to the average price of fish cans (US$ 2.49/kg), US$ 38,100 of sales income of fish will be reduced annually, and only US$ 3,600 will remain as the annual surplus. In this case, it will be difficult to manage the maintenance and replacement costs of facilities and equipment by the Project operation. Consequently, as for the policies of dealing with the said personal cost and

fish sales price, it is necessary for MIMRA to take measure based on careful assessment in order not to hurt the sustainable operation of the Project.

Chapter 4 Project Evaluation and Recommendation

Chapter 4 Project Evaluation and Recommendations

4.1 Project Effects

The following effects are anticipated if the Project is implemented.

(1) Direct effects

--Increased fishing opportunities

The fishing equipment that will be provided by the Project will allow eight fishing boats and a crew of six fishermen to operate 40 fishing trips annually, thereby enabling new fishing opportunities equivalent to 1,920 fishing trips by individual fishermen per year.

--Creation of fisheries income

The annual fish production volume in Jaluit is about 222 tons, but most of this volume is consumed locally. With the implementation of the Project, the fish production volume is estimated to increase by about 53 tons and this surplus volume will be shipped to the consumption areas by the transport vessel provided by the Project, which is anticipated to generate income increase for the fishermen.

--Increased annual per capita fresh fish consumption volume

Supplying fresh fish to Majuro (population 23,514) and Kili island (population 723) from the Jaluit atoll, will increase the annual per capita fresh fish consumption volume.

--Improved safety and fishing efficiency of motorized fishing boats

The safety and fishing efficiency of motorized fishing boats in Jaluit (34 boats) will improve due to the installation of a repair and maintenance workshop for outboard engines at the new fishery base.

--Improved awareness of fishermen and accumulated data based on properly kept fish landing records

MIMRA will be able to educate and supervise the fishermen of Jaluit on the sustained use of fishery resources and thereby, raise their awareness about the

importance of achieving sustainable resources and maintaining adequate fish landing records.

(2) Indirect effects

--Improved distribution of goods

In principle, the transport vessel that will be provided by the Project will be used to transport fresh fish, but surplus cargo space can be used to transport goods and commodities between Jaluit and Majuro. The transport vessel will operate once a week between the capital, Majuro, and Jaluit. Presently, goods and commodities are transported once every one to three months between these two areas and the flow of goods is anticipated to improve greatly.

--Use of accumulated data to develop fisheries

The fish landing data that will be collected under this Project will reflect the fishing endeavor of the entire atoll. As a result, this data can be utilized by MIMRA in future fishery development projects on the other atolls.

--Economic development by the Counterpart Fund

The Project enables the Counterpart Fund to be utilized for fisheries and social development activities.

4.2 Recommendations

To ensure that the facilities and equipment provided by the Project are effectively utilized after its implementation, the RMI government must carry out the following countermeasures.

--Procure the required budget

MIMRA must procure the start-up maintenance capital needed for the Project.

--Specific countermeasures aimed at establishing the Counterpart Fund

If the project is implemented, MIMRA will be selling fish production equipment to the fishermen in Jaluit, and therefore, it must quickly arrive at an agreement with the fishermen about the selling price, repayment method, and other details pertaining to the establishment of the Counterpart Fund.

--Strengthening the selection and capabilities of the manager of the fishery base in Jaluit

MIMRA must select the adequate personnel as the manager of the new fisheries base and take measures to strengthen the capabilities of the manager, who will be responsible for the shipment of fresh fish to the consumption areas, for coordinating the production of fishermen in each district of Jaluit, and for overseeing adequate fish landing records by fishermen.

--Reinforce awareness of the importance of maintaining proper fish landing records

Therefore, this Project will introduce measures that will teach fishermen on Jaluit to keep records of their fish landing and CPUE volume for collection and analysis by MIMRA, in order to obtain the index needed to establish adequate fish landing volume. The importance of accumulating such data should be emphasized within MIMRA, and measures for responding to this matter should be discussed and implemented.

--Establish a fresh fish sales system on Majuro Atoll and Kili Island

MIMRA must establish a fresh fish sales system based on the following factors.

Majuro Atoll : Review the existing pricing system for fish based on class. Lower the price of fish that is generally leftover (the class of fish that has a very low preference among the inhabitants)

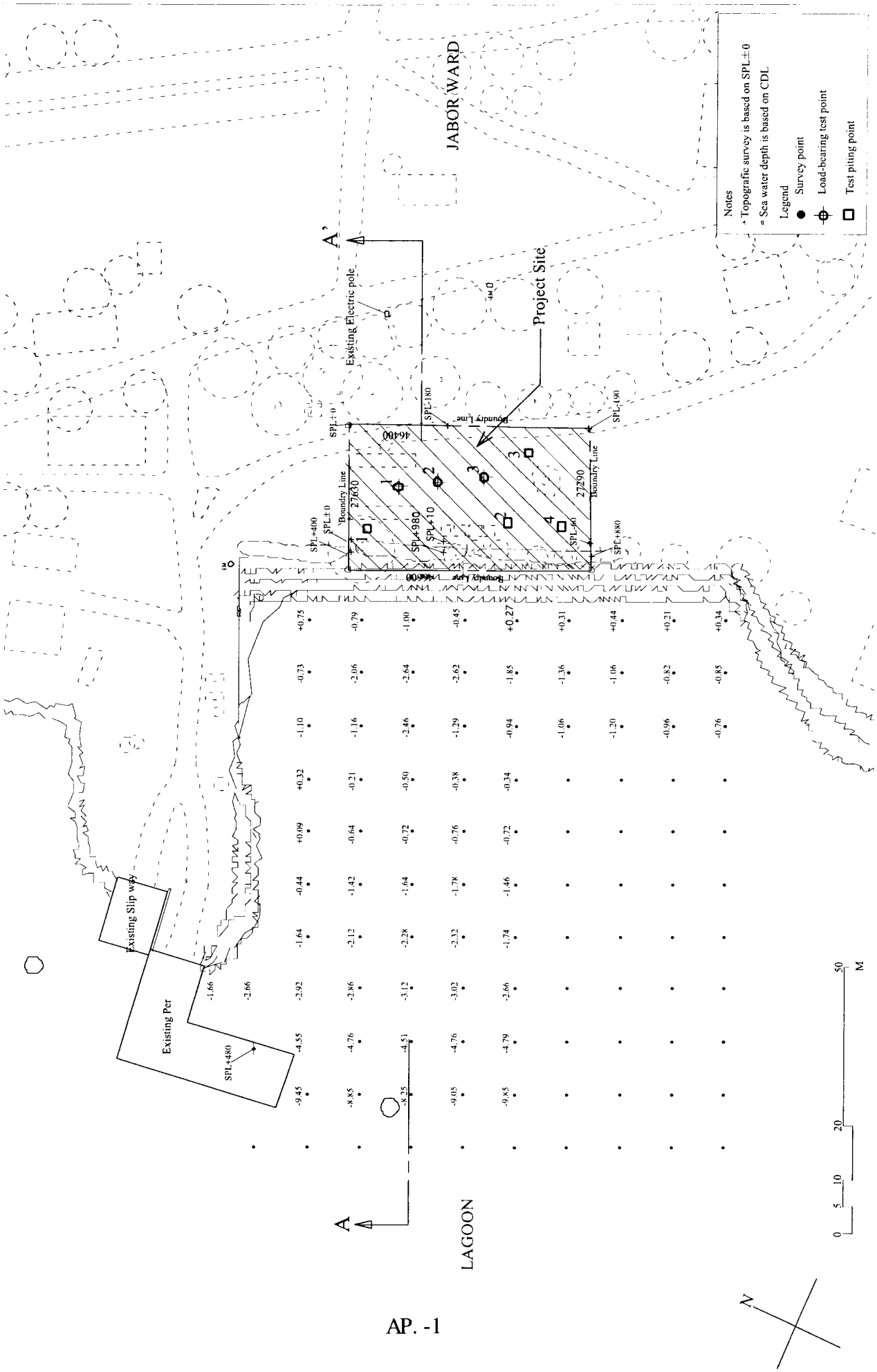
Kili Island : MIMRA should establish a sales system with the assistance of the local government to ensure that the sales revenue is collected without impediment, since an organized system of fish sales has never been implemented on this island.

The RMI government has been accumulated the operational know-how through operational experiences of similar projects such as between Majuro and Arno, and between Ibeye and three atolls (Likiep, Namu and Ailinglaplap). However, these projects had the nature of a pilot project because activities of these projects were focused on specific areas inside the atolls. In case of this Project, fisheries activities are planned to cover entire water areas in the Jaluit Atoll, therefore, it can be said this Project aims at more comprehensive nature for outer island fisheries development than those of the said projects. Accordingly, it is hoped that a technical assistance on

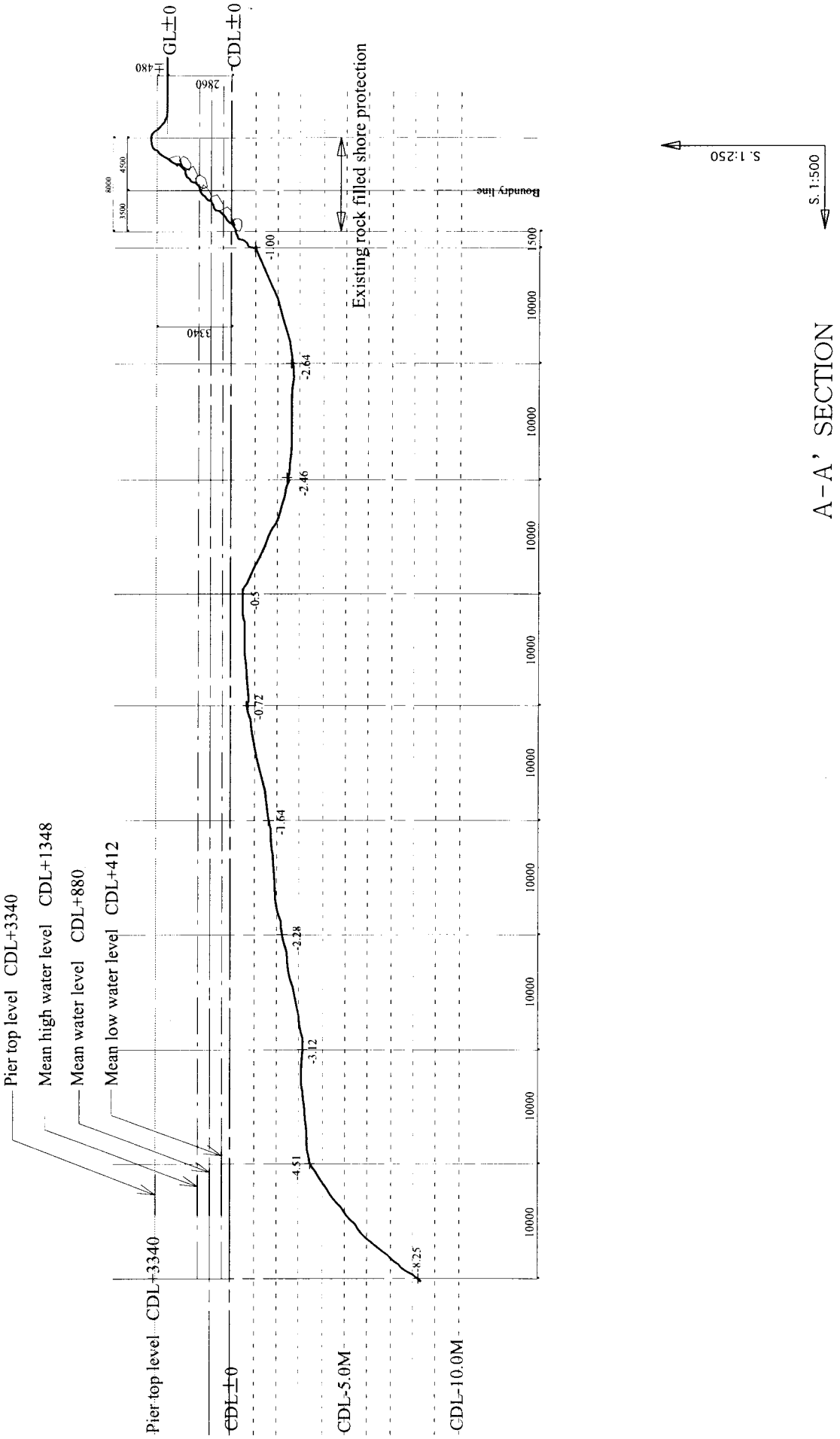
the operation aspects will be carried out to MIMRA in order to ensure above mentioned effects.

Appendix

Appendix 1 -1 Topographic and Sounding Survey Results (1/2)



Appendix 1 -1 Topographic and Sounding Survey Results (2/2)

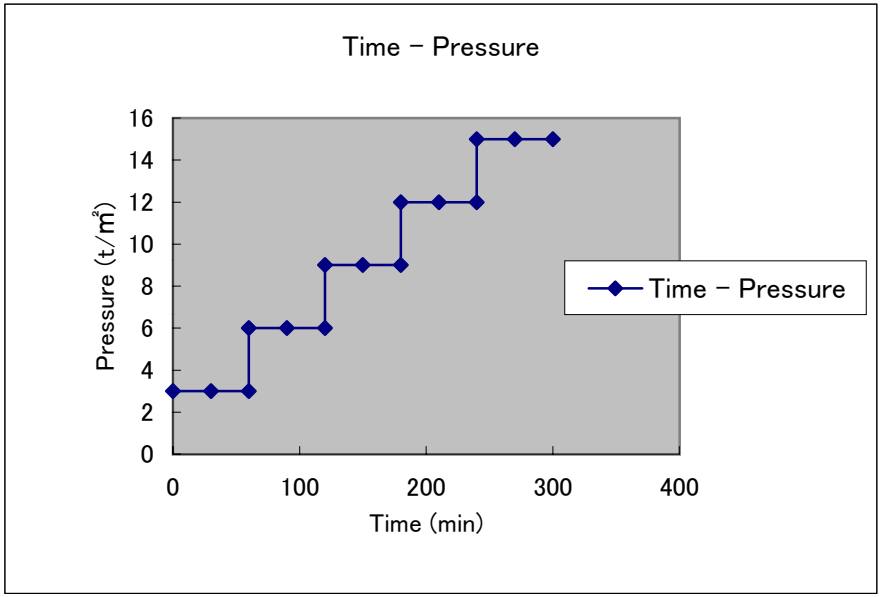


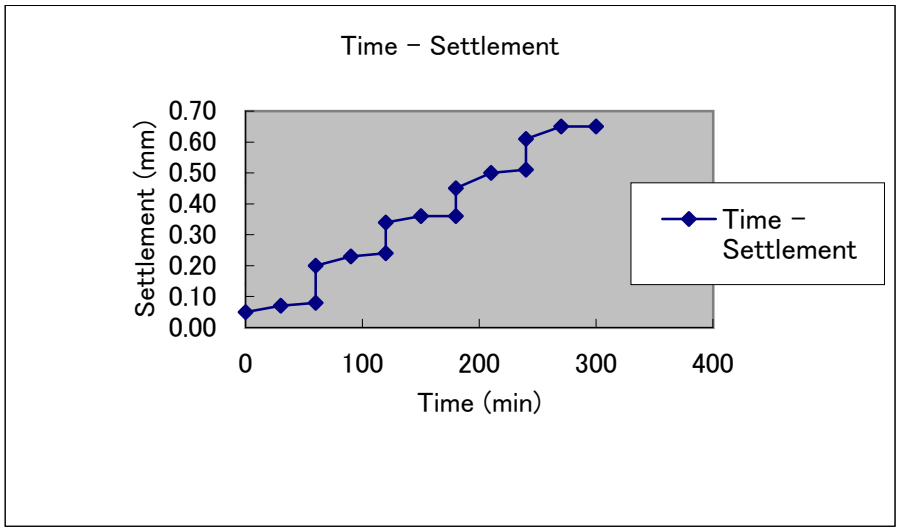
A-A' SECTION

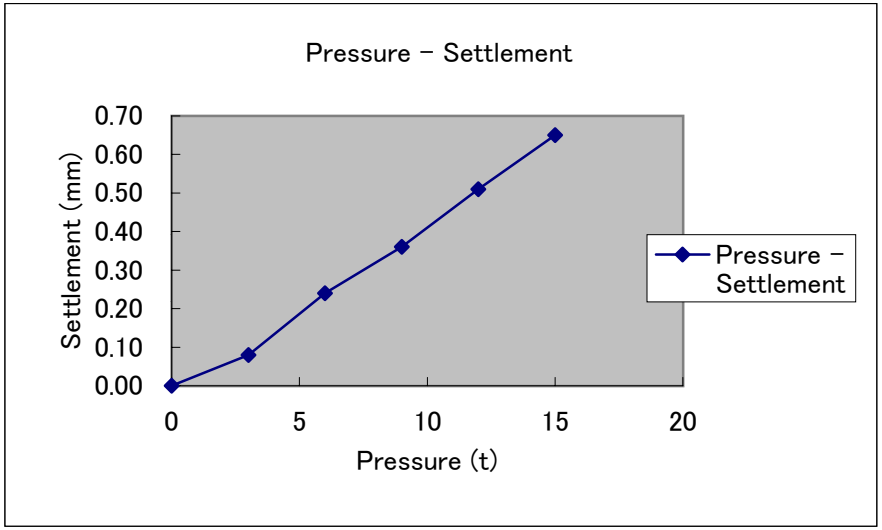
SETTLEMENT DATA

TEST PIT 1

Pressure	Time	Settlement	Settlement (subtotal)	Time (subtotal)
0	0	0.00	0.00	0
3	0	0.05	0.05	0
3	30	0.02	0.07	30
3	30	0.01	0.08	60
6	0	0.12	0.20	60
6	30	0.03	0.23	90
6	30	0.01	0.24	120
9	0	0.10	0.34	120
9	30	0.02	0.36	150
9	30	0.00	0.36	180
12	0	0.09	0.45	180
12	30	0.05	0.50	210
12	30	0.01	0.51	240
15	0	0.10	0.61	240
15	30	0.04	0.65	270
15	30	0.00	0.65	300



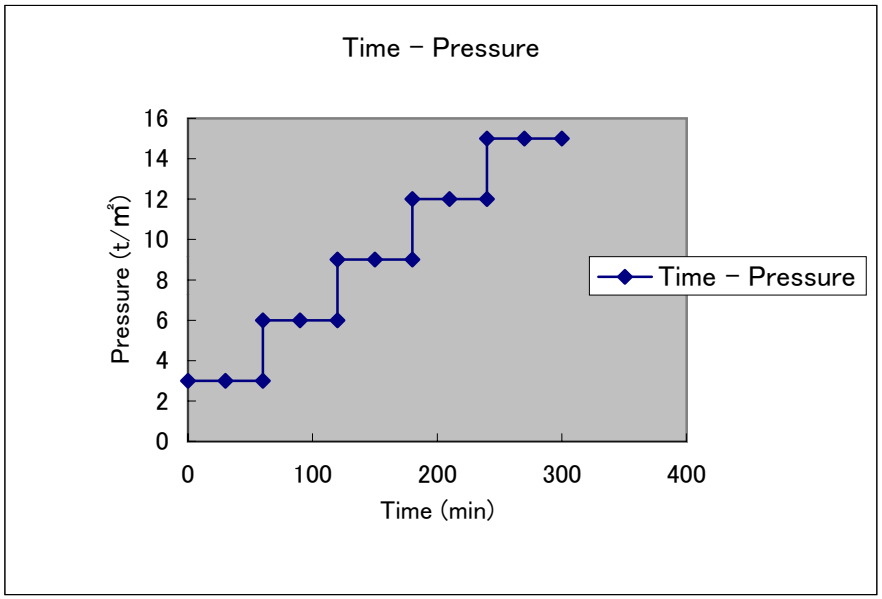


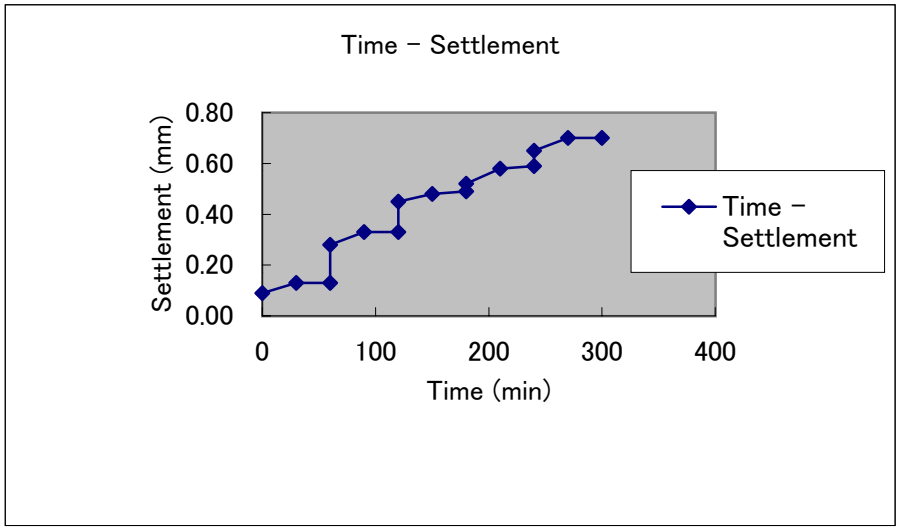


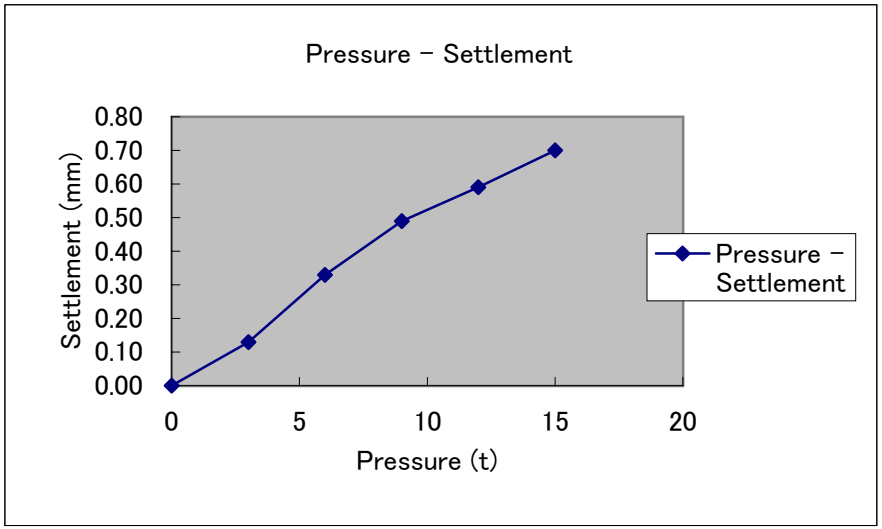
SETTLEMENT DATA

TEST PIT 2

Pressure	Time	Settlement	Settlement (subtotal)	Time (subtotal)
0	0	0.00	0.00	0
3	0	0.09	0.09	0
3	30	0.04	0.13	30
3	30	0.00	0.13	60
6	0	0.15	0.28	60
6	30	0.05	0.33	90
6	30	0.00	0.33	120
9	0	0.12	0.45	120
9	30	0.03	0.48	150
9	30	0.01	0.49	180
12	0	0.03	0.52	180
12	30	0.06	0.58	210
12	30	0.01	0.59	240
15	0	0.06	0.65	240
15	30	0.05	0.70	270
15	30	0.00	0.70	300



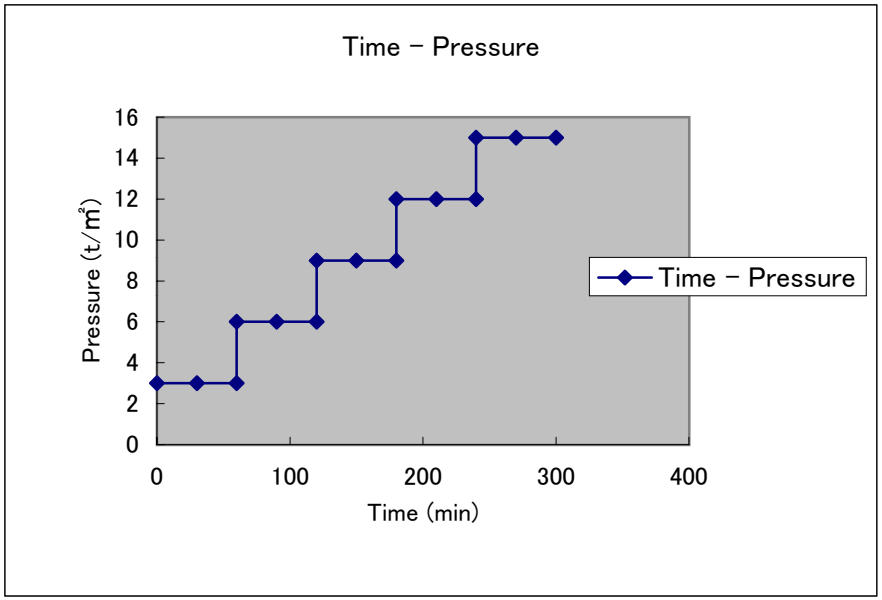


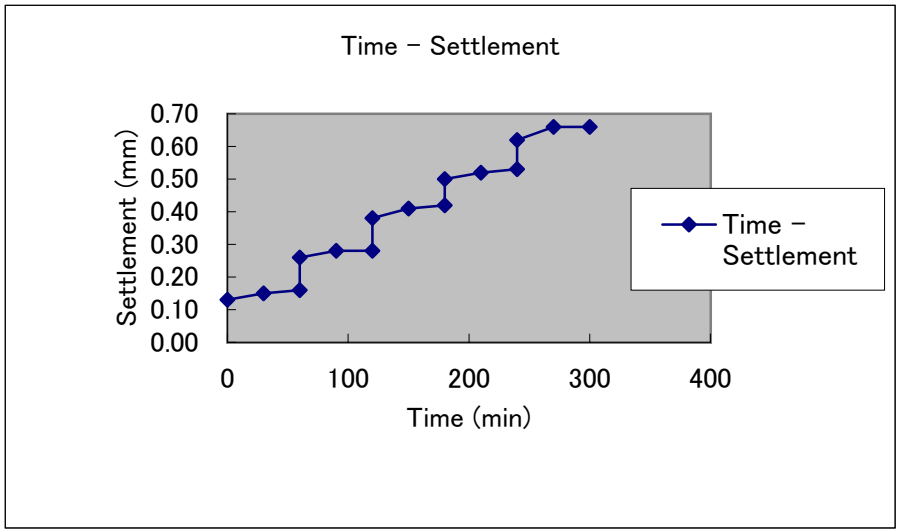


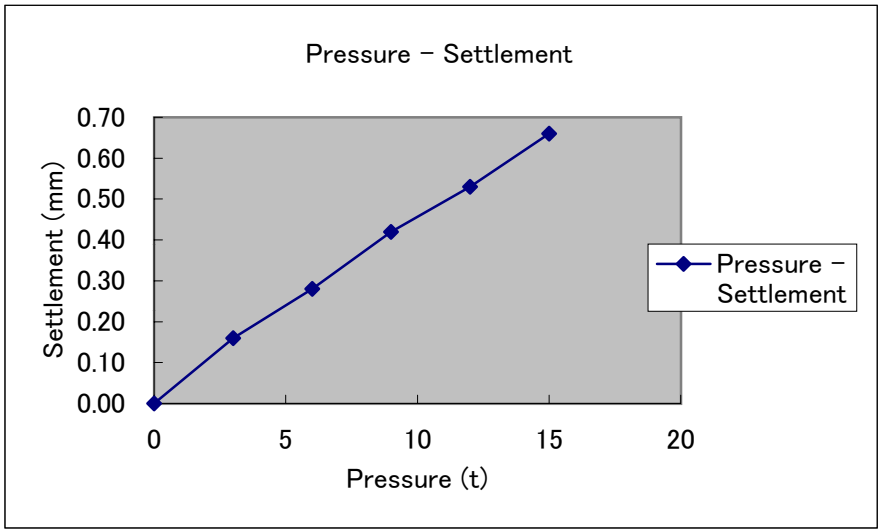
SETTLEMENT DATA

TEST PIT 3

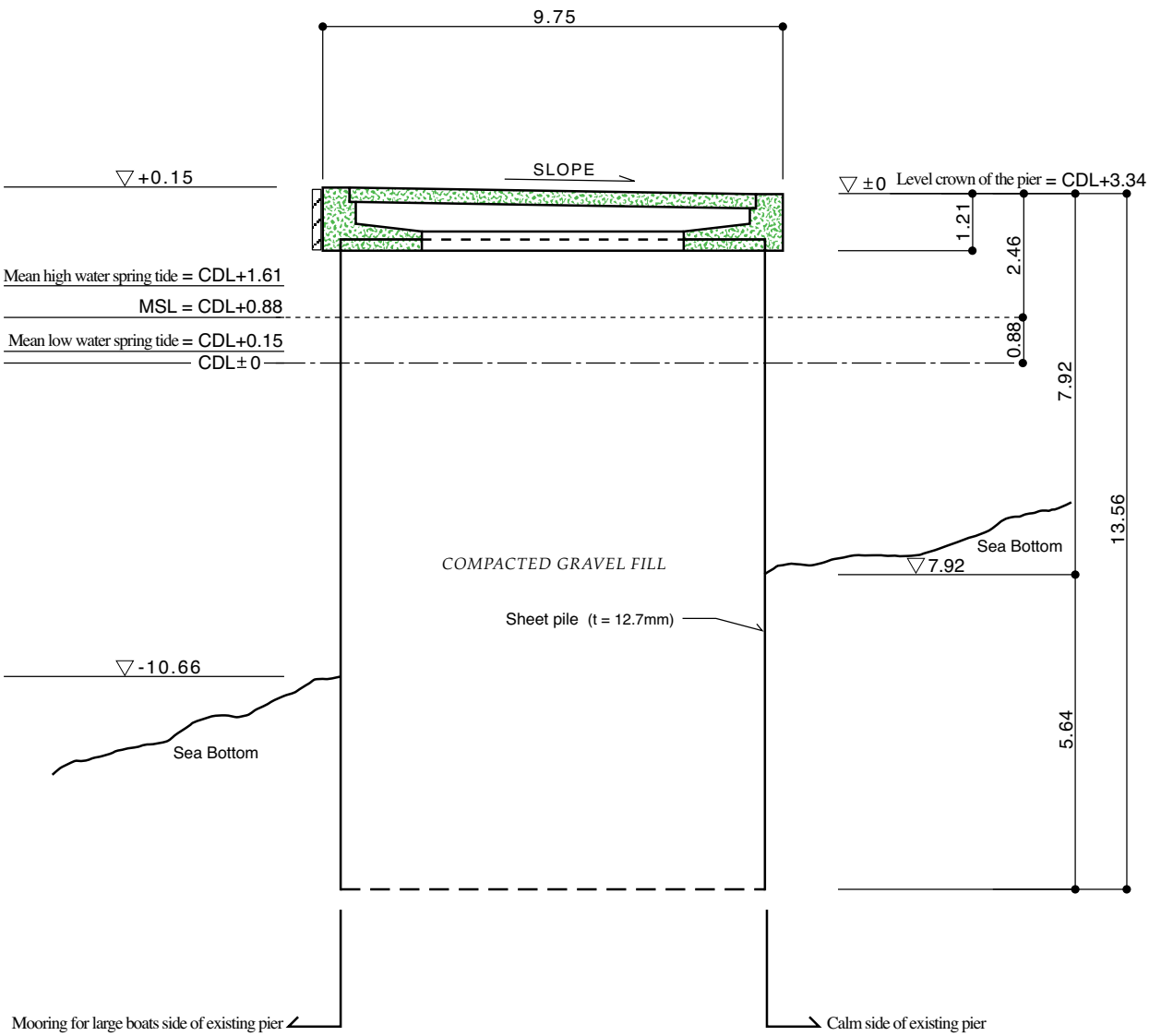
Pressure	Time	Settlement	Settlement (subtotal)	Time (subtotal)
0	0	0.00	0.00	0
3	0	0.13	0.13	0
3	30	0.02	0.15	30
3	30	0.01	0.16	60
6	0	0.10	0.26	60
6	30	0.02	0.28	90
6	30	0.00	0.28	120
9	0	0.10	0.38	120
9	30	0.03	0.41	150
9	30	0.01	0.42	180
12	0	0.08	0.50	180
12	30	0.02	0.52	210
12	30	0.01	0.53	240
15	0	0.09	0.62	240
15	30	0.04	0.66	270
15	30	0.00	0.66	300





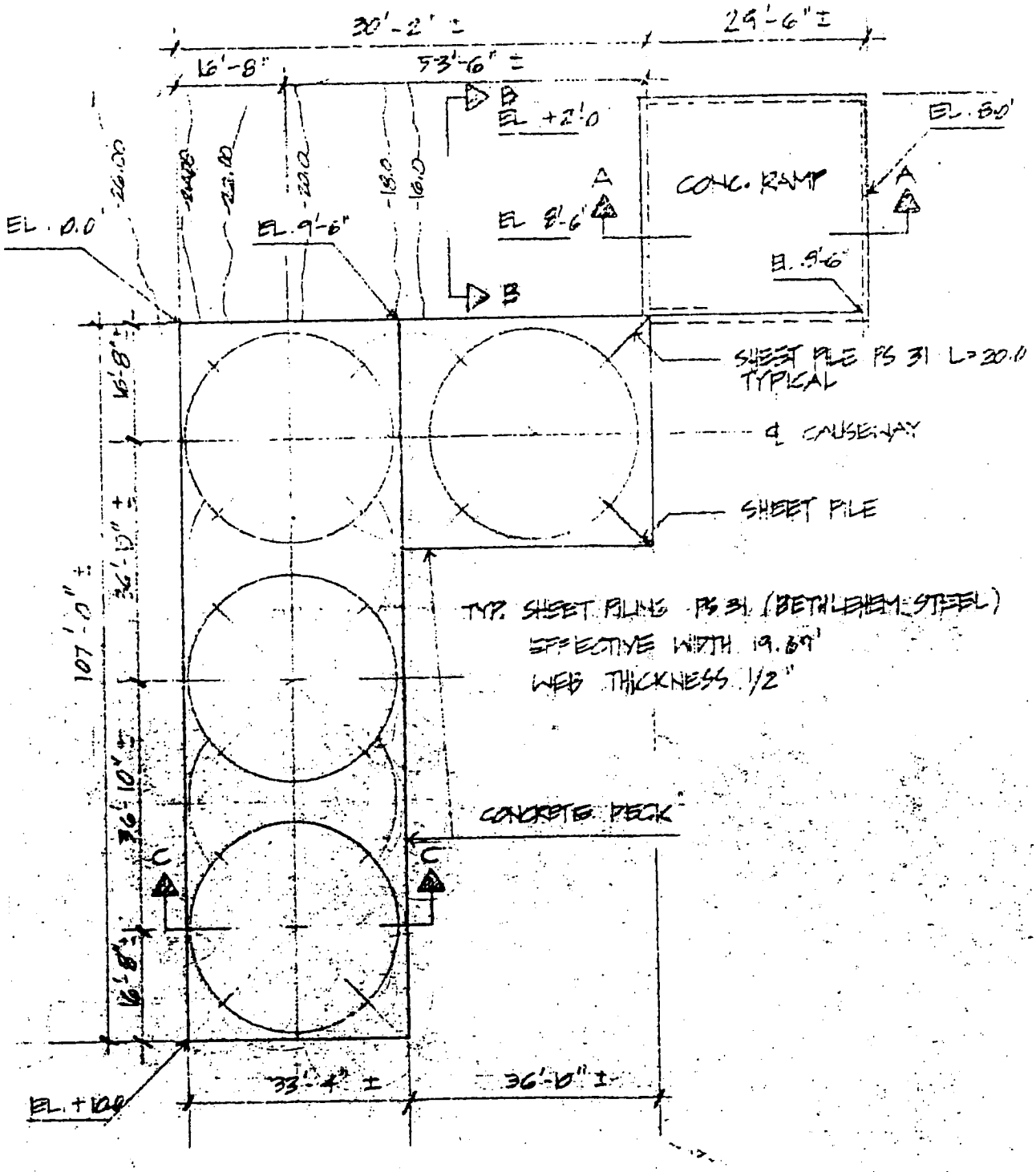


Appendix 2 Relation of Existing Pier and Tide Level



Appendix 3 Drawing of the Existing Pier (1/3)

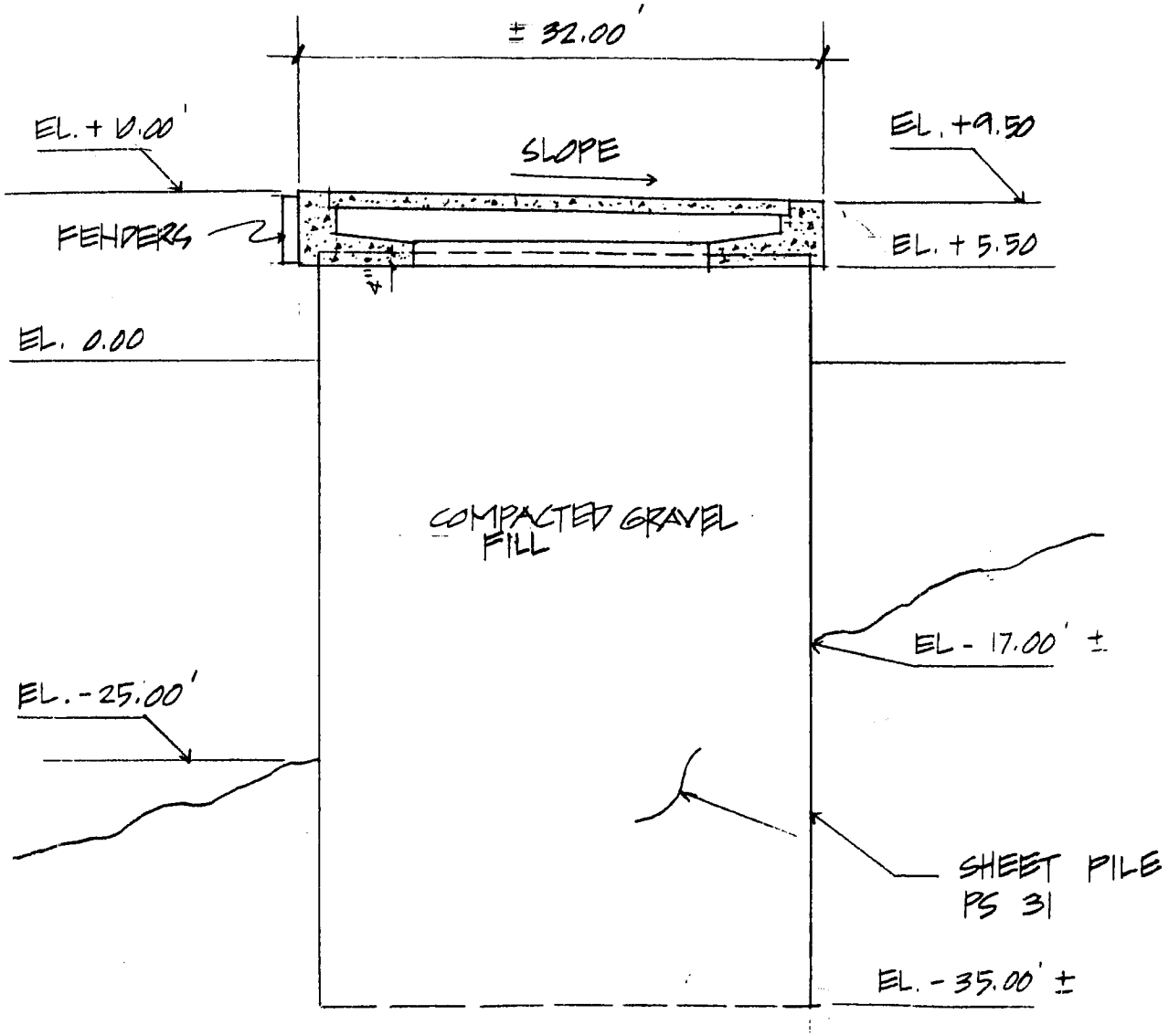
[Plan]



PLAN
SCALE: 1/2" = 10'-0"

Appendix 3 Drawing of the Existing Pier (2/3)

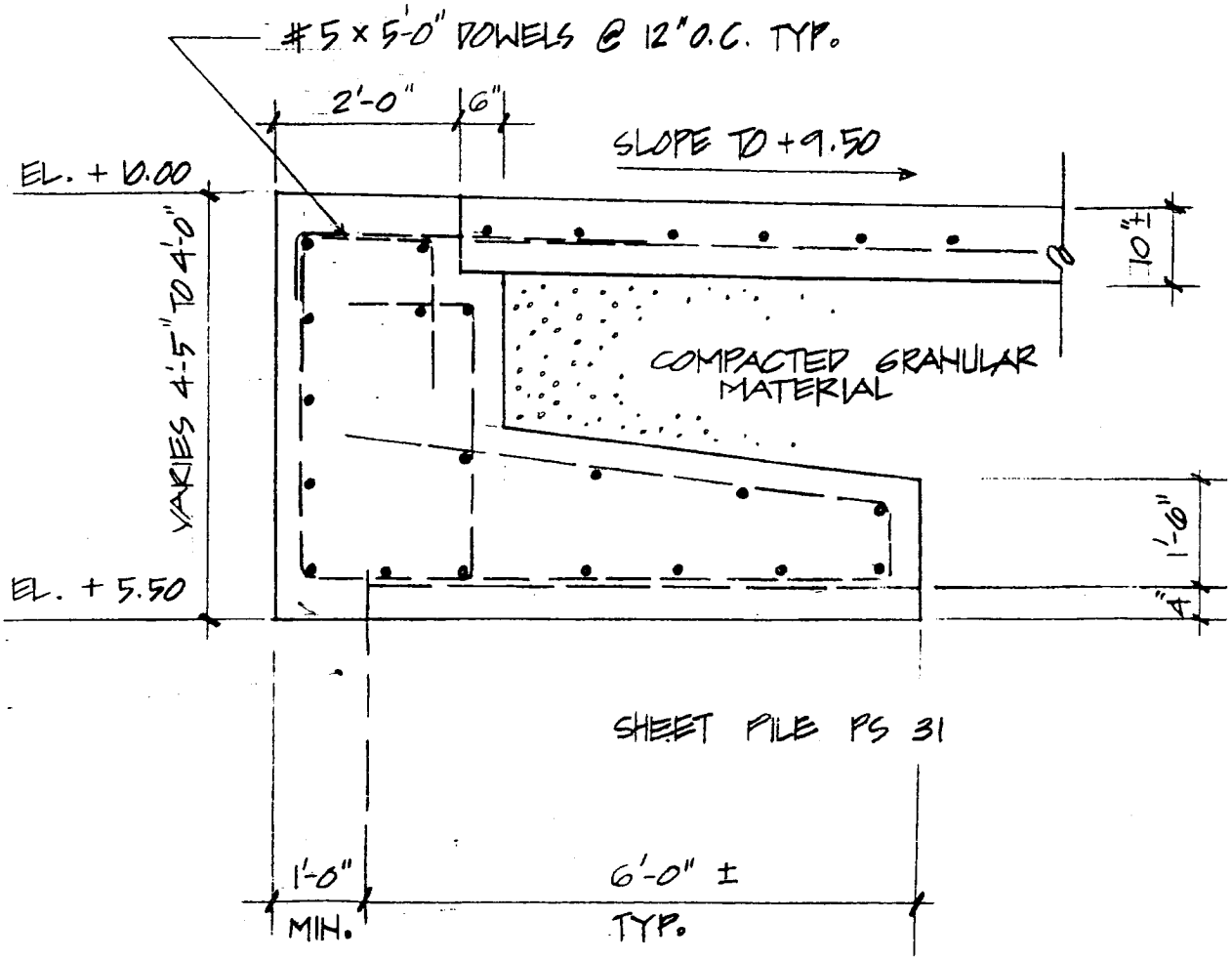
[Section]



SECTION C-C THRU PIER
SCALE : 3/32" = 1'-0"

Appendix 3 Drawing of the Existing Pier (3/3)

[Details of Deck Slab Portion]



TYP. BEAM (ALL AROUND) & DECK SLAB
SCALE : 1/2" = 1'-0"

Appendix 4 A Comparison of the Costs of a MIMRA and Chartered Boat for MIMRA Supervisory Activities

Number of Operating Days	Costs of a MIMRA Boat	Costs of a Chartered Boat
Survey to designate fishing zone (9 sites in 4 days, total of 36 days)	Roundtrip fuel cost + survey fuel costs ($123 + $62 x 3 days x 1 ward) + (62 + 62 x 3.5 x 4) + ($42 + 62 x 3.5 x 3) = $1,932	($300/day x 4 days x 1 ward + 150 x 4 x 4 + 90 x 4 x 3) = $4,680
Seminar on recording method for fish catch data: One visit to each site of project fishing boat. Initial 1 month (1 session/2days, total 16 days)	Roundtrip cost: $123 x 2 locations + 62 x 2 + 42 x 3) = 406	(300 x 2 x 2 + 150 x 2 x 2 + 90 x 2 x 3) = $2,340
Survey on fishing operation conditions: One visit to each site of project fishing boat will be made once every 2 weeks. 3 visits per site (1 trip/2 days, total 32 days). Monitoring activities two visits/ year (1 site/2 days, annual total 32 days)	Survey on fishing operation (roundtrip fuel cost + survey fuel cost for the first visit only): ($123 + $42 x 1 day x 3 visits) x 2 sites + (62 + 42 x 1 x 3) x 2 + (42 + 42 x 1 x 3) x 4 = $2,594 Monitoring (from next FY, roundtrip fuel cost + survey fuel cost): (($123 + $42 x 1 day x 2 trips) x 2 sites + (62 + 42 x 1 x 2) x 2 + (42 + 42 x 1 x 2) x 4 = $1,210	Survey on fishing operation conditions (for the first FY only): (300 x 6 x 2 + 150 x 6 x 2 + 90 x 6 x 3) = $7,020 Monitoring activities (after the next FY): (300 x 4 x 2 + 150 x 4 x 2 + 90 x 4 x 4) = 5,040
Survey to designate protection zone: Initial 6 months, assist JADA activity on proposed zones (total 12 days). After this period, site confirmation of designated zones within 6 months (1 site/2 days, total of 5 sites/10 days).	Assisting JADA: Receive payment for fuel cost + $40/day from JADA. Site confirmation (roundtrip fuel cost + survey fuel cost): ($123 + $42 x 1 trip x 1 site) + (62 + 42 x 2 x 2) + (42 + 42 x 2 x 2) = $521	Assisting JADA: not assist JADA in this case. Site confirmation: (300 x 2 x 1 + 150 x 2 x 2 + 90 x 2 x 2) = $1,560
Total Cost	First FY: $5,453 + depreciation cost of outboard engine $654 = $6,107 Following FY: $1,210 + depreciation cost of outboard engine $654 = $1,864	First FY: $15,600 Following FY: $5,040

Note 1: The costs of a chartered boat based in Jabwor and the roundtrip fuel cost are 300/day ($123) for Jitoken ward, 150/day ($62) for Imroj ward, 90/day ($42) for Imiej, Jaluit, Mejrirok wards, and zero cost for Jabwor ward.

Note 2: The distance navigated by the boat used in the survey to designate fishery regions is estimated at 50km/day (fuel cost about $62). The distance navigated by the boat used in the survey on fishing operation conditions is estimated at 35km/day (fuel cost about $42).

Appendix 5 Navigation Plan of Project Fishing Boats

(1) Fuel Consumption Volume of the Fishing Boats

When the distance between each ward and the fishery base is studied, it can be divided into two groups--Jitoken, on the northern atoll, and the other six wards. The navigation plan and fuel consumption volume of the fishing boats, that will be provided by the Project for these two groups, are shown in the table below.

Navigation Plan, Navigation Hours and Fuel Consumption volume

	Task	Distance (km)		Boat Speed (km/h)	Navigation Hours (min)		Fuel Consumption Volume		
		One way	Roundtrip		One way	Roundtrip	L× platform	One way (L)	Roundtrip (L)
Wards other than Jitoken	Purchase Ice	Average distance to Jabwor 20	40	24	28	56	13×2	12.1	24.2
	Fish Catch	To fishing area 10	20	24	14	28	13×2	6.0	12.0
		To other fishing area		24		30	13×2		13.0
	Fish landing	Average distance to Jabwor 20	40	24	28	56	13×2	12.1	24.2
	Total								73.4
Jetoken Ward	Pickup Ice	Average distance to Jabwor 50	100	24	69	138	13×2	30.0	60.0
	Fish Catch	To fishing area 10	20	24	14	28	13×2	6.0	12.0
		To other fishing area		24		30	13×2		13.0
	Fish landing	Average distance to Jabwor 50	100	24	69	138	13×2	30.0	60.0
	Total								145.0

Based on the table above, the one-way distance to the fishery base from the wards other than Jitoken is about 30 minutes and one hour for a roundtrip operation. The roundtrip fuel consumption volume is 24L and one time fishing operation will require about 74L or equivalent to four 24-liter plastic fuel tanks.

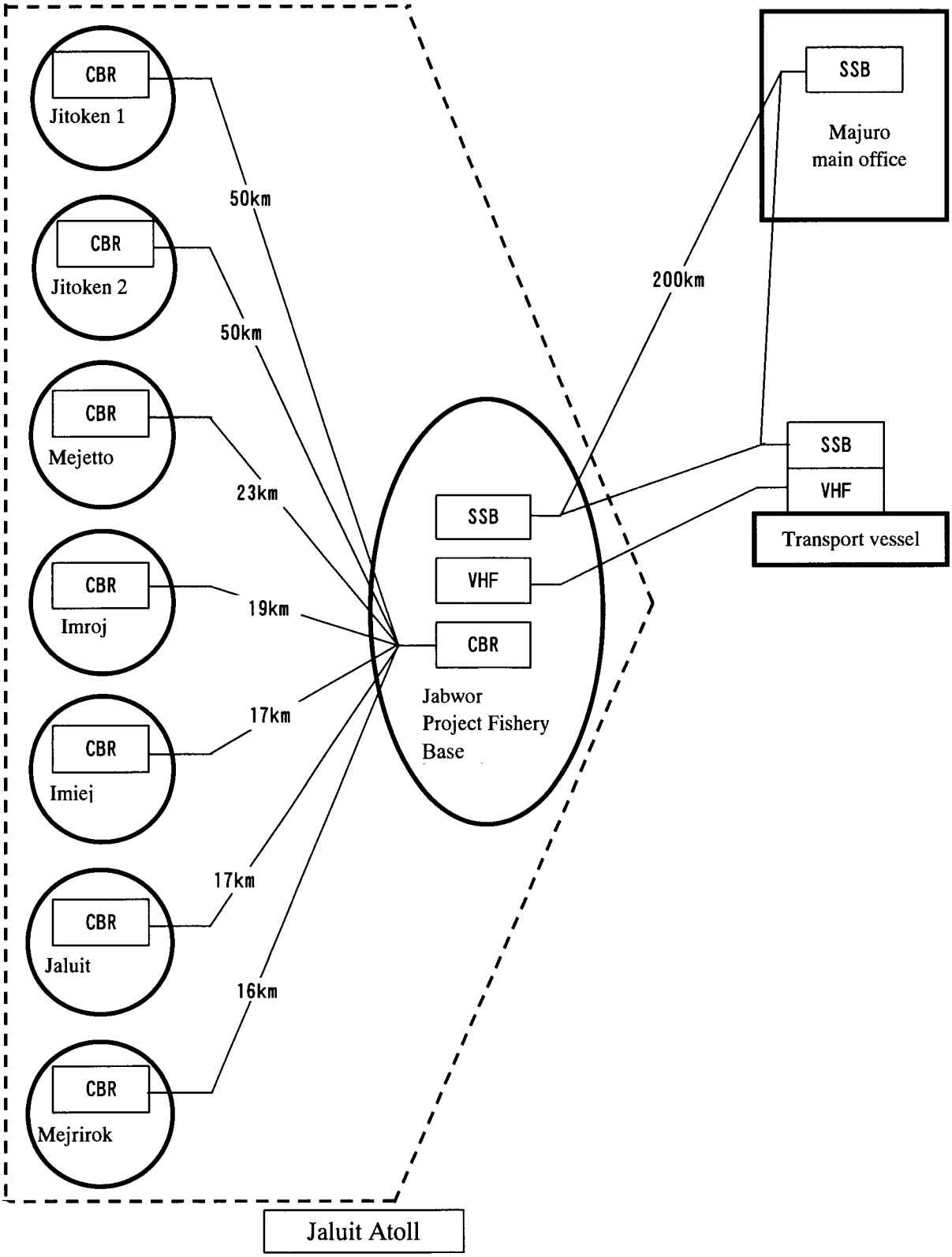
However, the one-way distance from Jitoken to the base is 1 hour and 10 minutes and the roundtrip distance is 2 hours and 20 minutes. The roundtrip fuel consumption volume is 60L and one time fishing operation will require 145L or equivalent to six 24-liter plastic fuel tanks. In conclusion, the fuel costs of the fishing boat from Jitoken ward will be twice that of the fishing boats from the other wards.

(2) Economizing Fuel Costs for the Project Fishing Boat from Jitoken Ward

The fuel consumption volume of the fishing boat from Jitoken ward is twice the consumption volume of the fishing boats from the other wards, and the fuel cost borne by the fishermen is double. As a result, this economic factor and a sense of unfairness will have the effect of reducing the production volition of the fishermen. If the fishermen from Jitoken deliver their insulated boxes and pick up their fuel tanks at Mejattol ward, which is located midway between the fishery base and Jitoken, and their fish catch is transported to the fishery base by the project fishery boat stationed at Mejattol,this measure will ensure that the fishermen in Jitoken are able to economize their fuel costs under the same conditions as the fishermen from the other wards.

Therefore, the fishing boat from Jitoken will utilize Mejattol ward as a midpoint fishery base.

Appendix 6 Concept of Communication System



Appendix 7 Ice/Fish Ratio in Fishing and Marketing Stage

1.Volume of melted ice due to heat loss from the insulated boxes

(1) Fishing Stage (the insulated boxes will be placed outdoors on the boat deck)

Dimensions of the box : 1.04m x 0.501m x 0.533m

Heat transmission area (A) : (1.04+0.501) x 2 x 0.533 + 1.04 x 0.501 x 2=2.7m^2

Heat transmission factor (K) : $\lambda/t = {}^{0.032}/_{0.04} = 0.8^{kcal}/m^2h^oC$

λ =0.032 $^{kcal}/m^2h^oC$ (heat conductivity)

t = 0.04m (insulation thickness)

Outdoor temperature (T_1) : 28^oC+10^oC (sun reflected heat)= 38^oC

Day: Equivalent temperature due to reflected heat under direct sunlight 20^oC

Night: No direct sunlight

Average temperature due to sun reflected heat is 10^oC.

Temperature in the box (T_2) : 0^oC

Latent heat of ice (L) : $80^{kcal}/_{kg}$

Loss due to heat = A x K x (T_1-T_2) =

2.7 x 0.8 x (38–0)=$82.1^{kcal}/_{h}$

Volume of melted ice per hour = 82.1÷80=$1.03^{kg}/_{h}$

(2) Marketing Stage (Insulated boxes are placed indoors at the Fish Handling Hall)

Dimensions of the insulated box: 1.04m x 0.501m x 0.533m

Heat transmission area (A) : (1.04+0.501) x 2 x 0.533 + 1.04 x 0.501 x 2 =2.7m^2

Heat transmission factor (K) : $\lambda/t = {}^{0.032}/_{0.04} = 0.8^{kcal}/m^2h^oC$

λ =0.032 $^{kcal}/m^2h^oC$ (heat conductivity)

t = 0.04m (insulation thickness)

Outdoor temperature (T_1) : 28^oC

Temperature in the box (T_2) : 0^oC

Latent heat of ice (L) : $80^{kcal}/_{kg}$

Loss due to heat = A x K x (T_1-T_2)

$= 2.7 \times 0.8 \times (28-0) = 60.5^{kcal}/_{h}$

Volume of melted ice per hour $= 60.5 \div 80 = 0.76^{kg}/_{h}$

2. Volume of melted ice in the fish hold of the transport vessel

Dimensions and capacity of the fish hold: 3m x 1.6m x 0.8m, $3.84m^3$

Heat transmission area (A) : $(3+1.6) \times 2 \times 0.8 + 3 \times 1.6 \times 2 = 17m^2$

Heat transmission factor (K) : $0.8^{kcal} / m^2h^oC$

Ocean water temperature (T_1) : 28^oC

Temperature in the fish hold (T_2) : 0^oC

Latent heat of ice (L) : $80^{kcal}/_{kg}$

Loss due to heat $= A \times K \times (T_1 - T_2)$

$= 17 \times 0.8 \times (28-0) = 380.8^{kcal}/_{h}$

Volume of melted ice per hour $= 380.8 \div 80 = 4.8^{kg}/_{h}$

3. Volume of ice required from the time of ice procurement before fishing operation to the time of fish catch landinb at the fishing base (fishing stage)

(1) Volume of melted ice due to heat loss from the insulated boxes

Number of insulated boxes: 24 boxes (19 boxes for Majuro, 5 boxes for Kili)

Number of hours: 24 hours

Volume of melted ice per hour: 1.03kg/h/box [1, from (1)]

Total volume of melted ice: $1.03 \times 24 \times 24 = 593kg$

(2) Volume of ice for cooling fish

Fish catch volume: 1320kg

Specific heat of fish and fish body temperature: 0.8, 28^oC

Cooling temperature: 5^oC

Latent heat of ice: $80^{kcal}/_{kg}$

Volume of required ice: $1320 \times 0.8 \times (28-0) \div 80 = 370kg$

Total (1) + (2) = 593+370 = 963kg

This is the volume of ice that is estimated to have completely melted when the boat arrives in Jabwor. Generally, ice equivalent to about 20 percent of the fish volume will remain. The ice volume is 1320kg x 20 %=264kg and there is a 5

percent loss due to spillage during handling. Therefore, the volume of ice required during the fishing stage is:

(963+264) ÷ 0.95 = 1292kg.

The ice/fish ratio is 1320:1292 = 1:0.98 and it is about 1:1 during the fishing stage.

4. Volume of ice needed to transport the fish from the fishery base to Kili Island

(1) Volume of melted ice due to heat loss from the insulated boxes

Number of insulated boxes : 5 boxes

Hours : 4 hours

Volume of melted ice per hour: 1.03kg/h/box [1, from (1)]

Total volume of melted ice : 1.03 x 5 x 4 = 21kg

(2) Volume of ice needed to cool the catch during handling at the base when temperature rises

Fish volume for Kili : 270kg

Specific heat of fish and fish body temperature: 0.8, 15^{o}C or 0^{o}C

Required volume of ice : 270 x 0.8 x (15–0) ÷ 80 = 41kg

Total (1) + (2) = 21 + 41 = 62kg

The above calculation signifies that all of the ice has melted when the boat arrives in Kili. However, in actuality, if it is assumed that ice equivalent to about 20 percent of the fish volume remains, the volume of remaining ice is

270kg x 20% = 54kg.

If a 5 percent loss is estimated, the volume of ice needed during the marketing stage is as follows.

(62 + 54) ÷ 0.95 = 122kg

The ice/fish ratio is 270:122 = 1:045 and it is about 1:05 during the marketing stage.

5. Volume of ice needed to transport the fish from the fishery base to Majuro

(1) Volume of melted ice due to heat loss from the fish hold.

Volume of melted ice: 4.8 kg/h

Hours : 24 hours (from Wednesday evening to Thursday evening)

Volume of melted ice: 4.8 x 24 = 115 kg

(2) **Volume of melted ice due to heat loss from insulation box during stack at fish handling hall before loading on to transport vessel**

The fish catch that is landed at the fishery base is sorted and packed in ice and kept at the Fish Handling Hall. Half of the daily volume of fish handled by the base arrives in the morning and the remaining half is landed in the afternoon. The fish catch that is handled in the morning will be stored at the hall from 10 a.m. to 4 p.m. for about six hours and the fish catch that is processed in the afternoon will be kept at the hall from 2 p.m. to 4 p.m. or about two hours. The entire fish catch volume that is handled by the hall for the day will be kept at the hall in insulated boxes for about four hours. The volume of ice that is estimated to melt during this time is shown below.

Number of insulated boxes : 19 boxes for Majuro, 5 boxes for Kili = 24 boxes (total)

Hours : 4 hours

Volume of melted ice per hour: 0.76kg / h box [from section 1, (2) of the report]

Total volume of melted ice : 0.76 x 4 x 24 = 73kg

(3) Volume of ice needed to cool the catch during handling at the base when the temperature rises

Volume of ice for Majuro : 1,050kg

Specific heat of fish and fish body temperature: 0.8, 15^{o}C or 0^{o}C

Required volume of ice: 1,050 x 0.5 x 0.8 x (15–0) ÷ 80 = 158kg

Total (1) + (2) + (3) = 115 + 73 + 158 = 346kg

The above calculation signifies that all of the ice has melted when the boat arrives in Majuro. However, in actuality, if it is assumed that ice equivalent to about 20 percent of the fish volume remains, the volume of remaining ice is

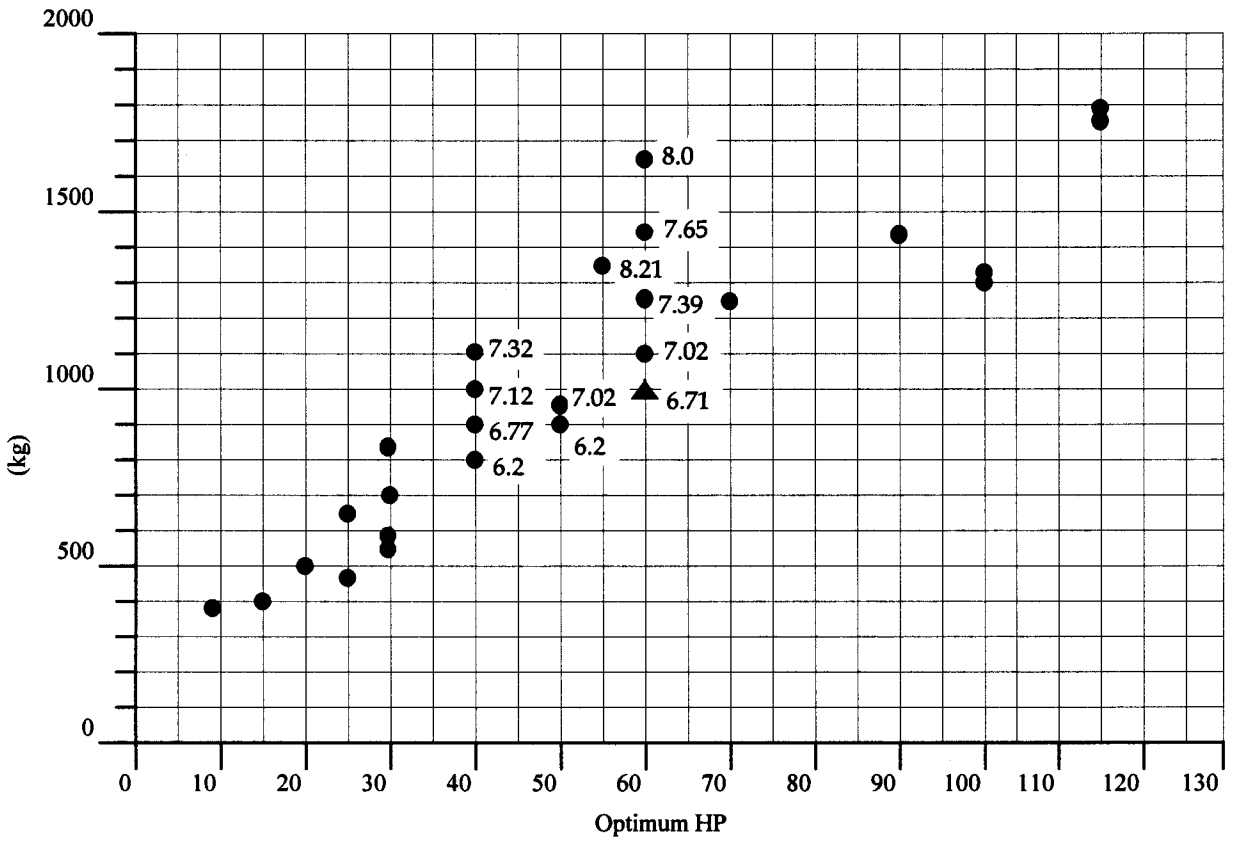
1,058kg x 20% = 210kg.

If a 5 percent loss is estimated, the volume of ice needed during the marketing stage is as follows.

(346 + 210) ÷ 0.95 = 585kg

The ice/fish ratio is 1050:585 = 1:55 and it is about 1:05 during the marketing stage.

Appendix 8 Correlation Between the Length of the FRP Fishing Boat, the Full Loading Capacity, and Outboard Engine HP



Remarks: The figures shown in the right side of ● marks indicate overall length of the FRP fishing boats.

▲ indicates overall length of the project boat.

Appendix 9 Planning the Required Minimum Boat Length of the Transport Vessel

1) Given Conditions onto the Project Transport Vessel

The required minimum boat length of the transport vessel that will be provided by the project was determined according to the following factors and conditions.

- Full load navigational speed: 13 knots
- Required engine horsepower: about 230 to 260HP (fuel consumption; 60liters/within given time at 13 knots)
- Number of navigational days:
  - ・One way from Majuro to Jaluit (130 nautical miles) 1 day (10 hours during the day)
  - ・Roundtrip between Jaluit and Kili Island after loading at Jaluit (70 nautical miles) 1 day (6.5 hours during the day)
  - ・Loading/unloading fish at Jaluit 1 day
  - ・One way from Jaluit to Majuro (130 nautical miles) 1 day (10 hours during the day)

  Total: 4 days
- Navigation range: Round trip distance between Majuro and Jaluit is 520 nautical miles (260 nautical miles x 2 = 520)
- Number of crew members: 3 permanent members (captain, mechanic, deck hand), 1 MIMRA officer once a month, total of 4 members
- Fish hold capacity: about 3.15m^3, occupied area of foredeck, length 3.6m x 1.8m

[**Explanation**]

In order to transport the total shipment volume of 1,058kg of fresh fish packed in ice, an ice volume one-half the fresh fish volume is required. In the case of plate ice, the estimated bulk specific gravity is 0.5, therefore, the fish hold capacity must be 3.15m^3. The fish will be packed in ice according to the four classes of A, B, C, and D. The sales volume ratio of each class of fresh fish that is shipped from Arno and sold in Majuro is A:B:C:D= 1.5:3.0:1.5:4.0 (see table on Sales Volume According to Fish Price in the Teron Fish Market in section 1.2.2(1)5)). Since the fishery resources of Jaluit are similar to the resources in Arno, the fish classifications have also been assumed to be similar. Therefore the fish hold capacity of 3.15m^3, has been divided according to the following breakdown.

- Fish hold for Class A fish: 0.47m^3
- Fish hold for Class B fish: 0.94m^3 (0.47m^3 x 2)

- Fish hold for Class C fish: 0.47m^3
- Fish hold for Class D fish: 1.26m^3 (0.63m^3 x 2)

Due to design factors, the fish hold will be located on both sides of the center line of the hull; and four fish holds, each about 0.5m^3, and two fish holds, each about 0.7m^3, will be installed on the transport vessel. The draft of an FRP boat of this size is about 1 meter and shallow. Thus, the depth of the fish hold will be about 80cm and it will be insulted with 100mm thick polyurethane. Based on these conditions, an area of 3.6mL x 1.8mW from the navigation room to the bow must be created in the foredeck.

Breadth: Both sides of the boat are comprised of a gunwale 0.2m wide and an aisle 0.7m wide that will allow people to move between the foredeck and afterdeck. A total width of 1.8m is needed for both sides of the boat. Boat equipment must also be installed on both sides of the center of the hull. As explained above, since the width of the fish hold is 1.8m, the width required for the boat is about 3.5m (1.8m for the two sides of the boat + the fish hold width of 1.8m = 3.6m).

2) Fixing the minimum boat length based on the layout of the required equipment

The layout of the equipment , that is needed to meet the requirements explained above and to ensure safe navigation of the boat , is given below. The required equipment, in conjunction with the boat width (3.6m), will be installed as much as possible within the range of 1.8m on both sides of the boat (1.8m width of both sides of the boat has been subtracted).

- **Foredeck storage**: Storage will be installed next to the fish hold on the foredeck. Only one storage will be created since the hull tapers off abruptly at the bow. Two 30kg Danforth anchors (200mm x 100mm), an 8mm x 5m anchor chain, two sets of 20mm x 20m mooring line will be kept in the storage. The required dimensions are 1.2mL x 1.0mW.
- **Capstan and gin pole**: An electric capstan (0.85m x 0.65m) to operate the anchor will be installed on the port side, in addition to the storage. In addition, the gin pole will be installed on the center line and the storage will be placed next to the foredeck.
- **VOID**: The bow area under the foredeck containing the storage will be left empty. It is a closed area that functions to secure bow buoyancy. It is a triangular area and

although its dimensions will differ according to the configuration of the bow, the usual length for a boat of this size is about 1 meter.

- **Bow deck**: The bow deck is an area that is used for mooring and washing work by the deckhand. Bits (mooring pole) will be installed on the center line of the foredeck and an anchor roller will be installed on the port side. The surface configuration will be triangular since it is located in the bow and the dimensions are 2.0mL x lower area of 3.0m ($3.0m^2$ area). The dimensions of the anchor roller are 0.65m x 0.2m.

- **Flare**: This is bulwark around the bow deck. Its dimensions differ according to boat design. For ocean-going boats, the length of the end section is about 0.5 to 0.7m. Due to the design, the length for the transport vessel will be 0.7m.
- **Wheelhouse**: The wheelhouse will be installed in the rear adjacent to the foredeck, comprised of the fish hold and storage space. It will contain a dashboard, control console, engine remote control box, navigation and wireless communication table, chair, handrail, standing space to operate the controls, inspection hole of the main engine, and others. The area required to install the equipment is 2.5mL x 1.8mW. The navigation equipment is the radar, GPS, sounding equipment, magnetic compass, etc. and the wireless equipment will be comprised of an SSB and VHF radio to ensure that a means of communication is secured.
- **Crew's quarters**: The crew's quarters which will be comprised of resting space and toilet facilities will be located next to the rear end of the wheelhouse. The are of the resting space will be $1.5m^2$ per person and an area of $4.5m^2$ will be created to accommodate four people. The toilet will be comprised of a commode, sink, and handrail and the dimensions are 1.0mL x 0.9mW. A total area of $5.4m^2$ is needed; therefore, the estimated dimensions are 3.0mL x 1.8mW.
- **Galley**: The galley will be located at the rear of the crew's quarters and it will contain a sink, cooking counter, and a propane stove. The estimated dimensions are 0.8mL x 1.0mW.
- **Inspection hole of rudder skeg**: It will be located at the rear of the crew's quarters like the galley. The estimated dimensions are 0.6mL x 0.6mW and will be able to accommodate one crew member.

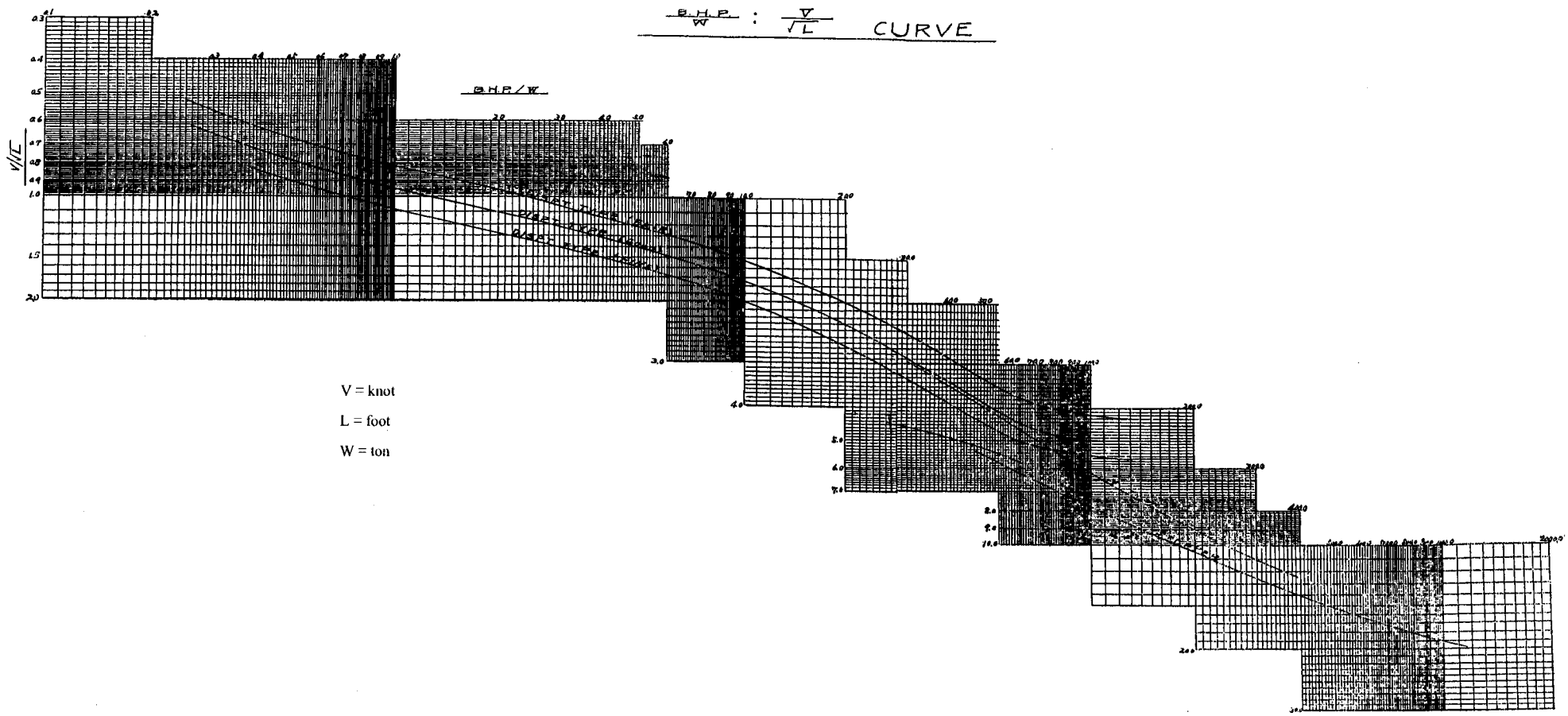
- **Water tank space**: The area for the water tank will be created at the rear adjacent to the galley and under the transom deck. The dimensions of the installation frame, including the water tank (130 liters) are 0.45mL x 0.45mH x 1.2mW. The area for the water pump and plumbing is 0.8mL x 3.2mW.
-**Rear of the deck**: Space to carry out the mooring works and loading/unloading work for the deckhand will be created at the rear of the galley next to the transom. To enable the work to be carried out safely, the space will encompass an area of 2.0mL x 3.2mW. In addition, the inspection hole for the water pump will be located on the deck (approximate dimensions 0.6mL x 0.6mW).
- **Engine room**: The engine room will be located in the area under the wheelhouse and in part of the crew's quarters. The main engine, fuel oil/water separator, general use pump, manual bilge, electric bilge, sea water filter, exhaust pipe, etc. will be located in the engine room. The estimated area for the engine room is 0.3mL x 1.8mW.
- **Fuel tank**: Two 1,200 liter tanks are needed to navigate 520 nautical miles. The tanks will be installed below the deck on both sides of the boat under a segment of the crew's quarters and wheelhouse. The total estimated area required for the installation frame and fuel tank, fuel pump and exhaust pipe, inspection work, etc. is 3.9mL and 0.7mW for one tank.

The grand total of the amount of space needed for the minimum amount of space for the boat length and bow, based on the conditions explained above, is shown below.
Required minimum water line length: VOID (1m) + storage space in the foredeck (1.2m) + fish hold (3.6m) + space under the wheelhouse (2.5m) + space under the crew's quarters (3.0m) + space under the galley (0.8m) + water tank (0.8m) = 12.9 about 13m.

Minimum required overall length: Flare–(about 0.7m) + work table bow (2m) + storage space in the foredeck (1.2m) + fish hold (3.6m) + space under the wheelhouse (2.5m) + space under the crew's quarters (3.0m) + space under the galley (0.8m) + transom deck (2.0m) + gunwale (0.2m) = 16.0m

Appendix 10

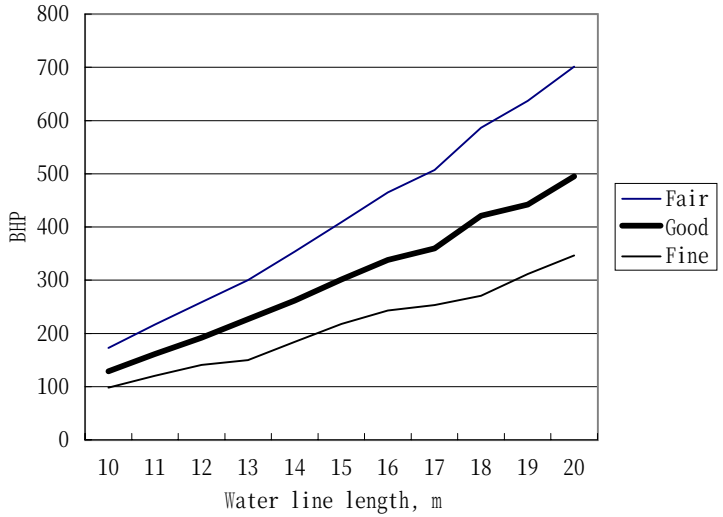
Correlation Between the B.Hp ratio and $V/L^{1/2}$ in Term of the Displacement Water Volume(W)



Appendix 11　Relation of Required Horse Power and Ship Shape with Planned Speed

	Length (L)	Breadth (B)	Depth (D)	LxBxD	Gross Tonage	No Load Displacement	Max.Load Displacement	$\sqrt{L'}$	V	$\frac{V}{\sqrt{L'}}$	Ship Shape					
											Fair		Good		Fine	
											BHP/W	BHP	BHP/W	BHP	BHP/W	BHP
Unit	m	m	m	m^3	ton	ton	ton		knot							
	10	2.174	0.455	9.881	2.668	3.488	5.158	5.727	15	2.619	33.5	173	25.0	129	19.0	98
	11	2.391	0.500	13.152	3.551	4.643	6.865	6.007	15	2.497	31.5	216	23.5	161	17.5	120
	12	2.609	0.545	17.075	4.610	6.028	8.913	6.274	15	2.391	29.0	258	21.5	192	15.8	141
	13	2.826	0.591	21.709	5.862	7.663	11.332	6.530	15	2.297	26.5	300	20.0	227	13.2	150
	14	3.043	0.636	27.115	7.321	9.571	14.154	6.776	15	2.214	25.0	354	18.5	262	13.0	184
	15	3.261	0.682	33.350	9.004	11.772	17.409	7.014	15	2.138	23.5	409	17.3	301	12.5	218
	16	3.478	0.727	40.474	10.928	14.287	21.128	7.244	15	2.071	22.0	465	16.0	338	11.5	243
	17	3.696	0.773	48.547	13.108	17.137	25.342	7.467	15	2.009	20.0	507	14.2	360	10.0	253
	18	3.913	0.818	57.628	15.560	20.343	30.082	7.684	15	1.952	19.5	587	14.0	421	9.0	271
	19	4.130	0.864	67.777	18.300	23.925	35.379	7.894	15	1.900	18.0	637	12.5	442	8.8	311
	20	4.348	0.909	79.051	21.344	27.905	41.265	8.099	15	1.852	17.0	702	12.0	495	8.4	347

Remarks：Ship shape is divided into 3 types of fair, good and fine based on goodness of ship　shape to speed.



Relation of BHP with Water Line Length(at 15 knot) by Boat Type

Speed	Full scale keel was installed to the boat to reduce rolling angle for ocean navigation. Ship speed is reduced to 87% by installing full scale keel according to experiences. To secure service speed of 13 knot, design speed was adopted 15 knot.

Water line: L	Usually, water line length is used for structure ruling factor. Unit: m
Water line: L'	Water line length. Unit: ft（m=3.28ft)
Breadth: B	Obtained from L/B=4.60 of fish transport vessel（FRP）, Unit: m
Depth: D	Obtained from L/D=22.00 of fish transport vessel(FRP), Unit: m
Gross tonnage	Obtained from L×B×D×0.27(specific coefficient of FRP fish transport vessel. Unit: m^3
Light loaded displacement	Obtained from L×B×D×0.353(specific coefficient of FRP fish transport vessel. Unit: m3
Full loaded displacement	Obtained from L×B×D×0.522(specific coefficient of FRP fish transport vessel. Unit: m3
$\frac{V}{\sqrt{L'}}$	Speed by water line ratio(ft basis): desirable to be within 1.2
B.H.P	Break Horse Power: Unit HP

Remarks: B.H.P is obtained from standard curve indicating relation of (W)/(BHP) ratio and $\frac{V}{\sqrt{L'}}$ ratio. (See Appx. 13)

Speed test based on boat inspection rule(good type; water line length 13m and 14m under 13 knot)

BHP of fish transpot vessel within 15m L to satisfy following formula. $\frac{V}{\sqrt{L}} < (1.55+0.004L)\sqrt[3]{\frac{P}{5L}}$

V=knot
L=w. line length
P=BHP

Water line length:13m

$\frac{V}{\sqrt{L}}$　4.2

$(1.55+0.004L)\sqrt[3]{\frac{P}{5L}}$　13.4

Water line length:14m

$\frac{V}{\sqrt{L}}$　4.0

$(1.55+0.004L)\sqrt[3]{\frac{P}{5L}}$　14.5

Appendix 12 Explanation of Revenue and Expenditure of the Project

The Project will be basically operated and maintained by the Coastal Department of MIMRA. The balance of income and expenditure of each project is being controlled by project basis. The anticipated balance of income and expenditure of this Project is explained below.

1. Revenue

Revenue of the Project is estimated based on the income from sales of fish and ice

(1) Sales income of fish.

-According to the Project implementation plan, 1,050 kg of fresh fish will be transported per trip by the fish transport vessel from Jaluit to Majuro and 270 kg of fresh fish per trip from Jaluit to Kili Atoll. Revenue from the transportation of other goods and passengers will not be included in the estimation.

-Number of transportation of fish will be one trip per week and 40 trips per year taking in to consideration the cancellation of trips due to bad weather conditions.

-Fresh fish sales price in Majuro and Kili is assumed to be the current fish price by fish grade in Majuro set by MIMRA shown in the following table.

Sales Price at Majuro and Kili

Grade	Selling Price	
	US$/lbs	US$/kg
A	2	4.40
B	1.65	3.63
C	1.4	3.08
D	1.1	2.42

- Fish sales volume ratio by grade is based on the same ratio obtained actual sales result at the Teron Fish Market in Majuro.

Under above mentioned conditions, estimated fish sales amount per shipment in Majuro and Kili is shown in the following table.

Grade	Majuro			Kili		
	Volume (kg/trip)	Price (US$/kg)	Amount (US$/trip)	Volume (kg/trip)	Price (US$/kg)	Amount (US$/trip)
A	131	4.40	576	34	4.40	150
B	394	3.63	1430	101	3.63	367
C	131	3.08	404	34	3.08	105
D	394	2.42	954	101	2.42	244
Sub-total	1050		3364	270		866

Accordingly, the total sales income per fish shipment = 3,364 + 866 = US$4,230.
Therefore, annual fish sales income = US$4,230/time x 40times/year = US$169,200

(2) Sales income of Ice

Ice sales will cover the expenditures corresponding to the consumption of electricity.

- Annual ice production: 2.49tons/time x 40times /year = 99.6tons/year
- Annual electricity consumption: ice maker; 29,700 kwh/year
  ice storage;11,797 kwh/year
  total 41,497 kwh/year
- Electricity charge: US$ 0.13/ kwh
- Annual ice sales income = 41,497 kwh/year x US$ 0.13/ kwh = US$ 5,395

Accordingly, overall annual income of the Project = (1) + (2) = 169,200 + 5,395 = US$174,595/year

2. Expenditure

Expenditure items of this Project are the costs of fish purchase, salary/wages, electricity, fuel and maintenance of facilityies / equipment, etc.

(1) Purchase of fish

Purchase volume : 1,320 kg/time
Buying price : US$0.55/pound = US$1.21/kg
Purchase amount/trip : 1,320 x 1.21 = US$1,597.2/time
Purchase amount/year : US$1,597.2/time x 40 time/year
= US$63,888/year

(2) Salary/Wages

1) Fishery base

Manager (Permanent)	:	US$5,830/year
Mechanic (Contract)	:	US$3,590/year
Worker (Contract)	:	US$2,560/year
Sub-total		US$11,980/year

2) Transport Vessel

Captain	:	US$10,190/year
Boat Mechanic	:	US$5,820/year
Deck hand	:	US$4,370/year
Sub-total		US$20,380/year

3) Teron Fish Market in Majuro

Sales woman : US$4,200/year

Accordingly, total of annual salary/wages = 1) + 2) + 3) = 11,980 + 20,380 + 4,200 = US$36,560/year

Newly recruited staff for the Project will be employed by MIMRA, therefore the salary/wages is arranged by the MIMRA budget. Therefore, this cost is not included in the calculation of the project expenditure.

(3) Electricity

Annual electricity consumption:

Ice maker/storage:	41,497 kwh/year
Cold storage	: 38,122 kwh/year
Workshop	: 340 kwh/year
Air conditioning	: 5,790 kwh/year
Lighting	: 6,096 kwh/year
Total	: 91,505 kwh/year

Electricity charge : US$0.13/Kwh (Government Rate at Jaluit)

Consumption charge : 91,505 kwh/year x US$0.13/ kwh = US$11,896/year

(4) Fuel

1) Transport vessels

Distance from Jabol to Majuro	: 130 N miles
Distance from Jabol to Kili Atoll	: 35 N miles
Sailing speed	: 13 Knot/Hr
Fuel consumption	: 60 L/Hr
Fuel cost (Diesel oil)	: US$1.05/Gallon = US$0.277/L
	(Government rate at Majuro)
Fuel charge/time	: [(130+35)/13]x2x60x0.277
	= US$421.9/time
Number of trips per year	: 40 times/year
Fuel consumption charge per year	: 421.9 x 40 = US$16,876/year

2) Supervisory Boat

A supervisory boat will visit each of the areas every three months.

Fuel consumption is as follows.

5 wards(average 20km distant from fishery base) x 74 L/time x 4 times/year
= 1,480 L/year

2 wards(average 50km distant from fishery base) x 145 L/time x 4 times/year
= 1,160 L/year

Total 2,640 L/year

Fuel cost (gasoline) = US$2.03/Gallon = US$0.536/L (government rate at Jaluit)

Fuel consumption charge = 2,640 x 0.536 = US$1,415/year

3) Truck with crane

Fuel consumption	: 227 L/year
Fuel cost (Diesel)	: US$1.672/Gallon = US$0.442/L
	(Government rate at Jaluit)
Fuel consumption charge	: 227 x 0.442 = US$100/year

Accordingly, total fuel consumption charge = 1) + 2) + 3) = 16,876 + 1,415 + 100
= US$18,391/year

(5) Maintenance of facilityies/equipment

1) Facility (building, electric facilities / utilities, landing facilities)

US$15,000 for every 5years will be required of painting and repairs of the Project facilities.

2) Transport vessel

- Cleaning of hull bottom: US$1,500/year
- Lubricant oil : US$500/year
- -.Spare parts : US$600/year from 3years after the start of the operation
- Engine overhaul : US$15,700 at 7years after the start of the operation
- Propeller : US$2,000 at 7years after the start of the operation

3) Supervisory boat

- Painting of hull : US$50/year
- Engine maintenance: US$50/year for 2 years after the start of the operation
- Engine spare parts : US$50/year for 2 years after the start of the operation

4) Truck with crane

- Maintenance/spare parts: US$2,000 at 5years after the start of the operation
  US$5,000 at 7years after the start of the operation

5) Ice maker

- Maintenance: US$100/year from 3 years after the start of the operation
- Overhaul: US$7,000 at 7years after the start of the operation

6) Ice storage

- Maintenance: US$100/year from 3 years after the start of the operation
- Overhaul: US$1,200 at 5 and 10 years after the start of the operation

7) Cold storage

- Maintenance: US$100/year from 3 years after the start of the operation
- Overhaul: US$2,000 at 5 and 10 years after the start of the operation

Overall annual maintenance costs are shown in the following table.

Maintenance Cost for 10 years after the Start of the Project Unit：US$100

Year	1	2	3	4	5	6	7	8	9	10
Facility	—	—	—	—	150	—	—	—	—	150
T.vessel	20	20	26	26	26	26	197	26	26	26
S.boat	1	1	3	3	3	3	3	3	3	3
Truck	—	—	—	—	20	—	50	—	—	—
Ice Maker	—	—	1	1	1	1	70	1	1	1
Ice storage	—	—	1	1	12	1	1	12	1	1
Cold Storage	—	—	1	1	20	1	1	20	1	20
Total	21	21	32	32	232	32	322	62	32	212

(6) Replacement

Schedule and costs of replacement of the equipment are shown in the following table.

Schedule and Costs of Replacement Unit：US$100

Year	5^{th} year	7^{th} year	10^{th} year
Air conditioner	—	5,600	—
Outboard engine	2,500	2,500	2,500
Fish box	300	400	—
Radio antenna	—	—	1,400
Scale for 500kg	—	—	1.100
For 10kg	—	—	900
Truck with crane	—	—	49,600
Bicycle trailer	—	1,400	—
Total	2,800	9,900	55,500

Annex

Annex 1 Member Lists of the Study Team

Basic Design Study

Name	Title	Institution
Hiromoto Watanabe	Team Leader	National Research Institute of Fisheries Science, Fisheries Agency of Japan
Makoto Imamura	Project Coordinator	Grant Aid Management Department
Tamotsu Tomiyama	Project Manager/ Fisheries Development Planning	System Science Consultants Inc.
Teruo Yabana	Fishery Equipment Planning	System Science Consultants Inc.
Kazuaki Tani	Fishery Facility Planning/ Natural Condition Survey	System Science Consultants Inc.
Takehide Seki	Construction Planning/ Cost Estimation	System Science Consultants Inc.

Draft Basic Design Study

Name	Title	Institution
Hiromoto Watanabe	Team Leader	National Research Institute of Fisheries Science, Fisheries Agency of Japan
Makoto Imamura	Project Coordinator	Grant Aid Management Department
Tamotsu Tomiyama	Project Manager/ Fisheries Development Planning	System Science Consultants Inc.
Teruo Yabana	Fishery Equipment Planning	System Science Consultants Inc.

Annex 2 Survey Schedule

Basic Design Study

	Date	Day	Itinerary
	2000		
1	9-Jul	Sun	Departed Narita for Guam. Departed Narita for Honolulu.
2	10-Jul	Mon	Arrived in Majuro
3	11-Jul	Tue	Courtesy Call on Embassy of Japan Courtesy Call to the Government of Marshall and Discussion with MIMRA
4	12-Jul	Wed	Discussion with MIMRA and/or JALG, JADA, JAFF
5	13-Jul	Thu	Discussion with MIMRA and/or JALG, JADA, JAFF
6	14-Jul	Fri	Discussion with MIMRA, JALG, JADA
7	15-Jul	Sat	Discussion with MIMRA, JALG, JADA
8	16-Jul	Sun	Data analysis
9	17-Jul	Mon	Discussion with MIMRA, JALG, JADA
10	18-Jul	Tue	Discussion with MIMRA, JALG, JADA
11	19-Jul	Wed	Signing of "Minutes of Discussion".
12	20-Jul	Thu	Official member departed for Japan
13	21-Jul	Fri	Majuro→Jaluit
14	22-Jul	Sat	Site Survey、Infrastructure survey
15	23-Jul	Sun	Data analysis
16	24-Jul	Mon	Site Survey、Infrastructure survey
17	25-Jul	Tue	Site Survey、Infrastructure survey
18	26-Jul	Wed	Site Survey、Construction survey
19	27-Jul	Thu	Site Survey、Construction survey
20	28-Jul	Fri	Jaluit→Majuro、Construction survey
21	29-Jul	Sat	Similar Project Survey、Construction survey
22	30-Jul	Sun	Data analysis
23	31-Jul	Mon	Marketing Survey、Construction survey
24	1-Aug	Tue	Marketing Survey、Construction survey
26	3-Aug	Thu	Marketing Survey、Construction survey
27	4-Aug	Fri	Report to Embassy of Japan
28	5-Aug	Sat	Departed for Japan
29	6-Aug	Sun	Arrived in Tokyo

Explanation of Draft Final

	Date	Day	Itinerary
	2000		
1	14-Oct	Sat	Departed Narita for Guam.
2	15-Oct	Sun	Guam
3	16-Oct	Mon	Arrived in Majuro
4	17-Oct	Tue	Courtesy Call on Embassy of Japan Courtesy Call to the Government of Marshall and Discussion with MIMRA
5	18-Oct	Wed	Discussion with MIMRA and/or JALG, JADA, JAFF
6	19-Oct	Thu	Discussion with MIMRA and/or JALG, JADA, JAFF
7	20-Oct	Fri	Discussion with MIMRA, JALG, JADA
8	21-Oct	Sat	Discussion with MIMRA
9	22-Oct	Sun	Meeting of team members
10	23-Oct	Mon	Signing of "Minutes of Discussion".
11	24-Oct	Tue	Official member departed for Japan、Data collection on the pier
12	25-Oct	Wed	Data collection on the pier
13	26-Oct	Thu	Depart for Japan
14	27-Oct	Fri	Related Survey
15	28-Oct	Sat	Arrived in Tokyo

Annex 3　List of Persons Concerned with the Study

Marshall Side

Hon. Brenson Wase	Acting President/Acting Minister of R＆D/ Minister of T&C
Hon. Litokwa Tomeing	Speaker of the Nitijela (Parliament)
Hon. Gerald Zackious	Minister in Assistance to the President
Hon. Alvin Jacklick	Minister of Foreign Affairs/Trade
Hon. John M. Silk	Minister of R&D
Hon. Rien Morris	Minister of Public Works
Albert Alberttar	Board Member of MIMRA(Private sector)
Mr. Danny Wase	Director of MIMRA
Mr. Danny Jack	Vice Director of MIMRA
Mr. Capitol Bani	Chief Fishery Officer of MIMRA
Mr. Terry Keji	Deputy Director of Policy and Planning, R&D
Mr. Diem Robert	Acting Mayor of Jaluit Local Government
Mr. Meath John	Jaluit Local Government
Mr. Neimat Reimers	Leroij, Jaluit Atoll
Mr. John Bungitak	President of JADA
Mr. Jefferson Butuna	Director of JADA
Mr. Kam Wase	Director of JADA
Mr. Takeo Miyano	Director of JAFF

Japan Side

Embassy of Japan

Takashi Suzuki	Ex-Charge d' Affaires ad Interim

JICA／JOCV

Hiroshi Saitoh	Coordinator, JOCV Marshall Islands Office
Emiko Izukura	Coordinator, JOCV Marshall Islands Office
Hiroyuki Yoshida	JICA Fishery Expert

OFCF

Katsumi Kira	Fishery Expert
Ryo Nishii	Fishery Expert
Touma Hayashi	Fishery Expert

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL IN THE REPUBLIC OF THE MARSHALL ISLANDS

Based on the results of the Preparatory Study, the Government of Japan decided to conduct a Basic Design Study on the Project for Development of Fishing Communities in Jaluit Atoll (hereinafter referred to as "the Project"), and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of the Marshall Islands (hereinafter referred to as "the Marshall") the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Hiromoto Watanabe, Senior Fisheries Research Officer, National Research Institute of Fisheries Science, Fisheries Agency, and is scheduled to stay in the country from July 10 to August 4, 2000.

The Team held discussions with the officials concerned of the Marshall and conducted a field survey at the study area.

In the course of the discussions and field survey, both parties have confirmed the main items described on the attached sheets.

The Team will proceed to further works and prepare the Basic Design Study Report.

Majuro, July 19, 2000

Hiromoto Watanabe
Leader
Basic Design Study Team
Japan International
Cooperation Agency(JICA)

Danny S. Wase
Director
Marshall Islands Marine
Resources Authority(MIMRA)
Ministry of
Resources and Development

ATTACHMENT

1. Objective of the Project
The objectives of the Project are as follows ;

1-1. to manage and enhance the development of fishing communities in Jaluit Atoll through construction of the fishery complex and procurement of concerned equipment.

1-2. to supply marine products in principle from Jaluit Atoll to Majuro and Kili through procurement of a transportation vessel.

2. Project Site
The site of the Project is located at Jabor in Jaluit Atoll and Majuro as shown in ANNEX-1.

3. Responsible Agency and Implementing Agency

3-1. The Responsible agency is the Ministry of Resources and Development.

3-2. The Implementing agency is the MIMRA in collaboration with Jaluit Atoll Local Government(JALG), Jaluit Atoll Development Authority(JADA) and Jaluit Atoll Fisheries Federation(JAFF).

4. Items requested by Government of Marshall
After discussions with the Team, the items described in ANNEX-2 were finally requested by Marshall side.
JICA will assess the appropriateness of the request and will report the findings to the Government of Japan.

5. Japan's Grant Aid Scheme
Marshall side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Marshall as explained by the Team and described in Annex II and III of the Minutes of Discussions signed by both parties on March 15, 2000.

6. Schedule of the Study

6-1 The consultants will proceed to further study in Marshall until August 4.

6-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around October, 2000.

6-3. In case of that the contents of the report is accepted in principle by the

H.W.

Government of Marshall, JICA will complete the final report and send it to the Government of Marshall by January, 2001.

7. Counterpart Fund System

The Team explained that in case of selling or lease-to-own arrangement for procured components, Government of a recipient country was obliged to open a bank account and deposit local currency equivalent to the FOB value of the procured components within a period of 4 years from the date of the signing of the E/N (Exchange of Notes). The fund is called the "counterpart fund" and it is to be used for the purpose of social economic development including fisheries development in consultation between Government of a recipient country and Government of Japan.

8. Other Relevant Issues

8-1. Marshall side understood the explanation given by the Team regarding the Counterpart Fund System. Marshall side expressed the concern and difficulties about the rationale behind the conditions associated with Counterpart Fund System.
Both sides agreed on further clarification of this matter based on mutual understanding.

8-2. The Team recommended Marshall side to secure and allocate necessary budget and manpower for the Project and found that MIMRA was represent the Marshall side as the Implementing Agency and it would be responsible for coordination of the Project with JALG, JADA and JAFF.

8-3. Marshall side expressed the necessary legal procedures for securing the site for the Project has already completed. The Team required further confirmation with official document during the consultants stayed in Marshall.

8-4. Both sides reconfirmed the importance of conservation of fishery resources and enlightenment of the fishermen in this regard and agreed that those aspects should be incorporated into the Project and assessed by both sides. Moreover, both sides confirmed that those conservation program would enhance the sustainability of the Project

8-5. Both sides agreed that MIMRA would distribute the Minutes of Discussions for reference to the Ministry of Foreign Affairs, Ministry of Finance, Ministry of Resources Development, Ministry of Public Works, and other relevant institutions and took coordination among these institutions, if necessary.

H. W.

Annex 4 Minutes of Discussion (2) Draft Basic Design Study

MINUTES OF DISCUSSIONS
ON
THE PROJECT
FOR
DEVELOPMENT OF FISHING COMMUNITIES IN JALUIT ATOLL
IN
THE REPUBLIC OF THE MARSHALL ISLANDS

(EXPLANATION ON DRAFT REPORT)

In July 2000, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the project for Development of Fishing Communities in Jaluit Atoll (hereinafter referred to as "the Project") to the Republic of the Marshall Islands (hereinafter referred to as "Marshall"), and through discussions, site surveys, and technical examination of the results in Japan, JICA prepared the draft report of the study.

In order to explain and to consult the Marshall side on the components of the draft report, JICA sent to Marshall the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Hiromoto Watanabe, Senior Fisheries Research Officer, National Research Institute of Fisheries Science, Fisheries Agency, from October 16 to October 28, 2000.

As a result of discussions, both sides have confirmed the main items described on the attached sheets.

Majuro,October 23, 2000

Hiromoto Watanabe
Leader
Draft Report Explanation Team
JICA

Danny S. Wase
Director
Marshall Islands Marine Resources
Authority (MIMRA)
Ministry of Resources and Development

ATTACHMENT

1. Components of the Draft Report
   Marshall side agreed and accepted in principal the components of the draft report explained by the Team.

2. Japan's Grant Aid System
   Marshall side understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Marshall as explained by the Team and described in Annex II and III of the Minutes of Discussions signed by both parties on March 15, 2000.

3. Schedule of the Study
   JICA will complete the final report in accordance with the confirmed items and send it to the Government of Marshall around January, 2001.

4. Other Relevant Issues

   4-1. Marshall side agreed that a beacon light, drum cans and their storage facility were not included in the Project.

   4-2. The Team explained that Plan B (in Draft Report) would be adoptable and suitable as the landing facilities for transportation vessel and fishing boats and Plan C' would be taken as the alternative plan in case of the existing pier could not be utilized because of its shorten life span by rust progress. Marshall side understood the idea and agreed that the final decision would be made by the Japanese side after the detailed survey.

   4-3. Marshall side assured the Team of the need for providing a transportation vessel and the avoidance of any competition with private sector by introduction of the vessel, and agreed to make coordination if necessary.

   4-4. Both sides confirmed that cast net had higher priority than encircling net as one type of fishing gears according to the needs for fishermen.

   4-5. Marshall side agreed to allocate enough budget to operate and maintain properly the Project.

   4-6. Both sides agreed that Marshall side was responsible for the management, administration, finance and personnel matters for the Project.

4-7. Marshall side agreed that in case of selling or lease-to-own arrangement for the procured equipment and materials, Marshall side was obliged to open a bank account and deposit local currency equivalent to the FOB value of the procured equipment and materials within a period of 4 years from the date of the signing of the E/N (Exchange of Notes). Moreover, Marshall side understood it is to be used for the purpose of social economic development including fisheries development in consultation with the Government of Japan.

4-8. Marshall side expressed the wish to sell the procured equipment and materials as described in ANNEX.

4-9. The Team required Marshall side to utilize the procured equipment and materials for sale as described in ANNEX for the purpose of fisheries development properly and effectively.

4-10. Both sides agreed that following matters are required to be executed by Marshall side prior to the start of the building work on the Project site by Japanese side.

i) to carry out land clearance including removal of facilities and obstructions,
ii) to install electric power, and
iii) to secure an access road.

Annex 5 List of References Collected

Title	Source
(1) 1999 CENSUS OF POPULATION AND HOUSING, 2000	OPS
(2) Report for the Future Plan of Arno Project, 1993	OFCF Expert
(2) Daily Fish Catch Record (1989 Sept.～1991 June)	Arno Atoll Fishery Association
(3) Daily Fish Sales Record (1998 June～2000 June)	Teron Fish Market
(4) Daily Fish Sales Record (2000 Apr.～2000 July)	Outer Island Fish Market
(5) Operation Record in Jaluit (1999 Aug.～2000 May)	OFCF COFDAS
(6) Monthly Fish Sales Record of RRE (1999 June～2000 May)	RRE
(7) Annual Sales Record of Animal Oriented Food (1998～1999)	RRE
(8) General Arrangement of 7.1M Single Outrigger Canoe	FAO
(9) Fish Consumption Survey in Majuro, Jaluit and Kili, 2000	BD Study Team
(10) Collected environmental regulations, 1997	R&D
(11) Compact of Free Association and Related Agreement, 1982	RMI & USA
(12) Historic Preservation Legislation, 1992	Historic Preservation Office
(13) Fisheries Policy,	RMI
(14) National Fisheries Development Plan(Draft), 1996	ADB
(15) Multi-subject Household Survey, 1994	ADB
(16) MIMRA Budget Summary, 1999/2000	MIMRA
(17) Jaluit Atoll Fishing Federation by Law,, 1997	JAFF
(18) Jaluit Atoll Development Association by Law,, 1995	JADA
(20) Meteorological Data, 1997, 1998, 1999	NOAA
(21) Regulations Governing Marine Resources, 1997	RMI
(22) MIMRA Interim Report, 1999	MIMRA
(23) Artisanal Coral Reef Fisheries and Sustainable Development, 1998	UOC Irvine
(24) Marshall Islands Guide Book	Office of President
(25) MEC Annual Report, 1999	MEC