BASIC DESIGN STUDY REPORT
ON
THE SMALL-SCALE FISHERIES DEVELOPMENT
AND
FISHING HARBOUR PREPARATION PROJECTS
IN
THE FEDERATED STATES OF MICRONESIA
(Vol.2 YAP FISHING HARBOUR PREPARATION PROJECT)

JANUARY 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

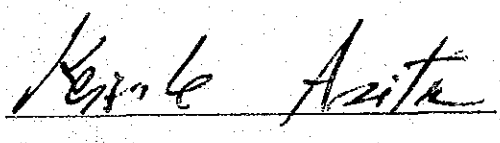
In response to the request of the Government of the Federated States of Micronesia, the Government of Japan decided to conduct a Basic Design Study on the Small-Scale Fisheries Development Project and Fishing Harbour Preparation Project, and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Micronesia a study team headed by Mr. Noboru Oshima from 30th September to 23rd October, 1985.

The team had discussions on the Project with the officials concerned of the Government of Micronesia and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

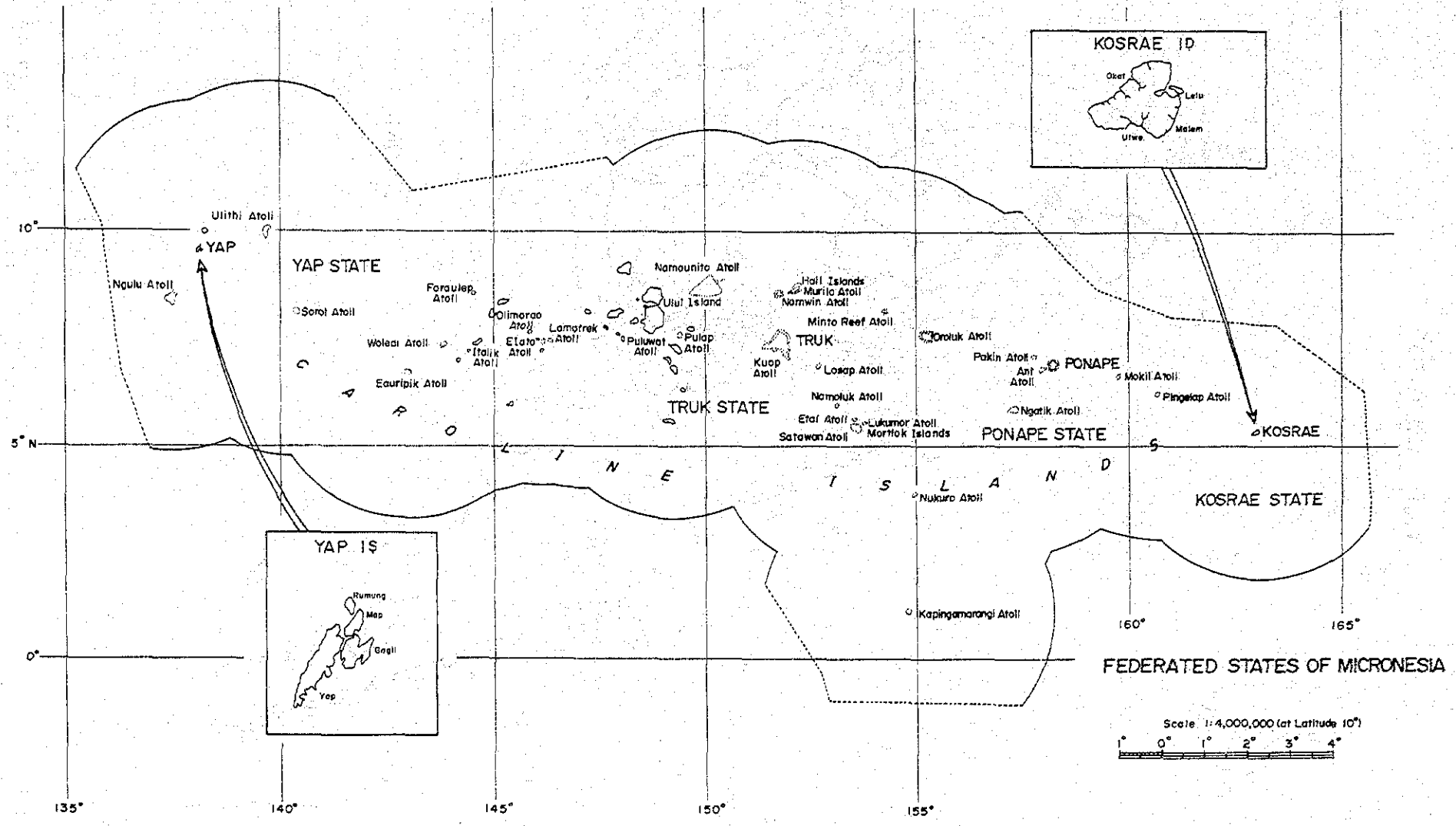
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Federated States of Micronesia for their close cooperation extended to the team.

January, 1986



Keisuke Arita
President
Japan International Cooperation Agency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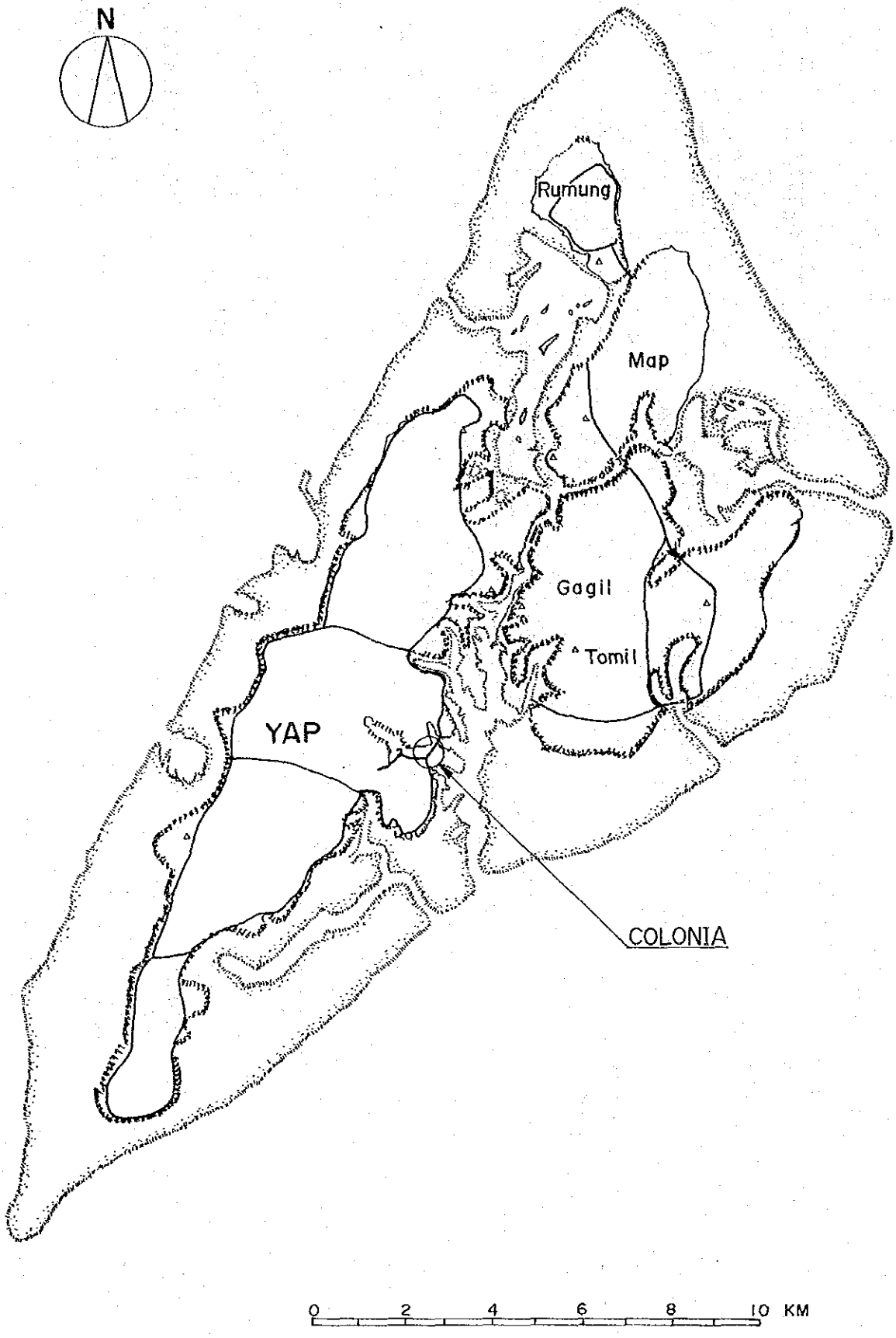

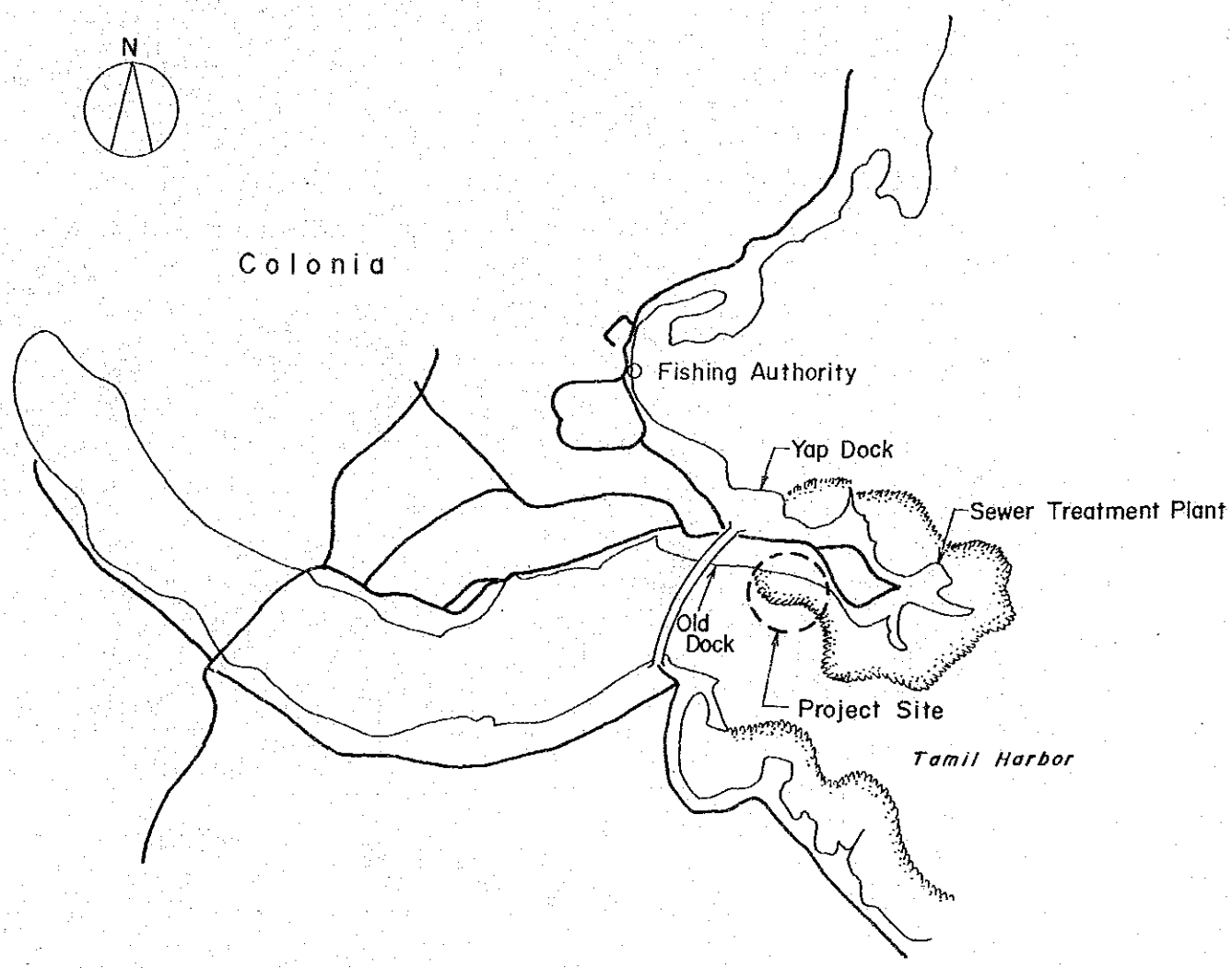
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Colonia
Fishing Authority
Yap Dock
Sewer Treatment Plant
Old
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Project Site
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SUMMARY

The economy of the Federated States of Micronesia [FSM] comprises both a subsistence and a money economy, with the former type dominant outside the nation's major towns and main islands. More than 40% of GDP is derived from agriculture and fisheries but the bulk of this represents subsistence production. There is very little else that could qualify as industrial activity in the country. The Government of the FSM relies on the U.S. for the bulk of its revenues. However, with the termination of Trust Territory status, this aid will henceforth be based on a Compact of Free Association with the U.S., and it is anticipated that per-capita aid will be reduced by about half over the next decade. There is, accordingly a compelling need to develop self-supporting industries and establish a viable industrial base that can withstand the future reduction in aid revenues.

Micronesian food imports constitute about 1/3 of the country's total imports. Despite the rich fish resource in Micronesian waters, there is a large volume of canned fish imports. The Government looks to industrial development to provide employment opportunities for the rapidly increasing population in the younger age brackets.

While the rich marine resources in Micronesian waters are being utilized by foreign vessels, few Micronesians themselves are benefiting from these activities. At a time when the establishment of a viable economic structure has become a matter of the most urgent priority with the termination of Trusteeship status, and in the absence of any other significant resources or industries, high hopes are held for fisheries development.

Accordingly, the Government of the FSM, in its "First National Development Plan (1985-1989)", has positioned fisheries development as a top-priority target for development investment, with 32% ($45 million) of the Nation's development budget allocated to this area.

Fishing is a vital part of the livelihood of the people on Yap. It has been conducted, since earliest times, as a key element of the subsistence economy, in traditional family groups.

Fishing boats have progressed, to some extent, from non-powered canoes to motorized vessels, but there has been no progress in the development of a small-scale commercial fishery in this area.

The Yap State Government has established the YAP Fishing Authority (YFA) to encourage the development of a commercial fishery. The YFA has been conducting fishing operations, using its own vessels, and has also been selling ice, produced at its ice-making facility, at low prices to the market and to commercial fishermen. The Authority has also been active in such areas as the development of distribution facilities for fresh fish, and fostering the growth of small-scale fisheries.

It is clear that Yap satisfies the basic conditions for fishery development: fishing is a major element in the livelihood of the local population; fish is a popular item in the local diet; and there is an abundance of fishing resources in the area. But the failure of a fishing industry to develop to date may be attributed to a lag in the development of commercial marketing and distribution facilities and to the absence of functional facilities, such as mooring, unloading, provisioning, and vessel repair facilities, which form the props for a fledgling small-scale commercial fishing industry.

For this reason, the Yap State Government has developed a program for building fishery complex and fishing port at Colonia, to include a freezer, refrigerator, and ice plant. The Government of the FSM has, accordingly, requested economic cooperation, in the form of a grant-in-aid, from the Government of Japan to carry out this program, with the YFA to serve as the implementing organ.

Based on this request, the Government of Japan decided to conduct a Basic Design Study via a Basic Survey Team dispatched by JICA. This Team surveyed the operations of YFA along with the present state of

the Yap fishery and, as a result of discussions with officials of both the National and Yap State Governments, concluded that, for purposes of developing Yap's fishing industry, there is a need to develop fish marketing and distribution facilities and to provide basic facilities in support of fishing activity. The Team, accordingly, decided that it would be highly appropriate, to this end, to construct the required fishing complex and port facilities and to donate various types of related materials and supplies.

Following is an outline of the facilities and equipment to be provided by the Government of Japan under the subject program:

1. Mooring facilities:

Wharf length	80 m
Planned depth	-3.0 m
Planned crown height	+2.5 m

2. Fuel and Water Supply Facilities:

Diesel tank	10 Kℓ
Gasoline tank	5 Kℓ

3. Fisheries Complex:

to be housed in a one-story steel-frame structure with a floor areas of about 364 m^2

(1) Refrigerated warehouse: 10 m^3

of prefabricated construction with a holding temperature of -5°C

(2) Freezer: 20 m^3

of prefabricated construction, with a holding temperature of -25°C

(3) Quick freezer:

Capacity 500 kg/day

(4) Ice-making unit:

Capacity	5 tons/day
Block ice	25 kg type

(5) Ice storage: 16 tons

of prefabricated construction

(6) Processing room, warehouse, office, and other facilities

4. Docking Facilities:

(1) Slipway:

Capacity (60 m x 4.5 m) 30 GT
with a winch house of 25 m^2

(2) Ramp:

13 m width

5. Workshop:

a one-story steel-frame structure with a net floor area of 336 m^2

6. Equipment for the Workshop

The required period of construction will be 20 months in all -- with 7 months covering the preparation of the Detail Design, bidding and contracting; and 13 months required for the procurement and shipping of materials and equipment and the actual construction work.

It is understood that the YFA will be responsible for operating both the Fisheries Complex and the Docking and Repair Facilities. The annual operating budgets for the proposed Fisheries Complex and Docking and Repair Facilities have been estimated at $31,840 and $9,770 respectively, and these requirements are expected to be funded from the YFA budget.

Based on implementation of this program, it will be possible to develop fishing port facilities within which to concentrate, in one location, all of the functions of YFA, which is the organization responsible for the development of Yap fisheries, particularly that of a commercial fishery.

We can anticipate, therefore, on the basis of YFA's efforts, a stable supply of fish products, based on the freezer and refrigeration facilities; the development of proper supply facilities for ice, fuel, and water; and the effective maintenance of the factors of production through the ship-repair facilities. We believe that, on the basis of these improvements, YFA activities will be considerably upgraded, thereby contributing to the development of both a commercial specialized fishery and a domestic fish distribution structure.

Major benefits, then, can be expected for the Yap economy from implementation of this project. We have concluded, accordingly, that there is ample justification for Japan lending its cooperation in the form of a grant-in-aid.

CONTENTS

CHAPTER 1 GENERAL INTRODUCTION

Section 1 Introduction

With a view to establishing an independent economic structure following the termination of trusteeship status, the Government of the Federated States of Micronesia has drawn up its First National Development Plan (1985-1989). In this Plan, emphasis is placed on fisheries development, using the rich resources within the country's Exclusive Economic Zone, and this sector is given the highest priority in the program of developmental investments.

The governments of Kosrae and Yap States, in developing their respective fisheries, are attaching urgent priority to the improvement of the artisanal fisheries and to the equipping of fishing ports. In order to carry out these plans, the FSM Government has asked the Government of Japan for cooperation in the form of a grant-in-aid.

The Government of Japan, in turn, decided to conduct a Basic Design Study and, under the auspices of the Japan International Cooperation Agency (JICA), dispatched a Basic Design Study Team to Micronesia headed by Mr. Noboru Oshima, Deputy Director, Fishing Port Planning Div., Fishing Port Dept., Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries. This team visited Micronesia from September 30 to October 23, 1985.

The survey involved studying the program for Improving Traditional Fisheries in Kosrae State and the request by the FSM Government regarding the development of a fishing port in Yap State with a view to establishing the appropriateness of both projects. The Team also gathered information on fishing conditions in order to establish the proper scale of the Kosrae program for improving the traditional fisheries and the functional scale of the fishery facilities in Yap. It also gathered data on current activities of the Marine Resources Division of Kosrae State and the Yap Fishing Authority as well as on the terrain and geology of the planned construction sites along with the program of the

FSM and States Governments for maintenance and operation of the target projects.

During the Team visit, various discussions were held between the Team and the FSM and States Governments; the results were compiled into a Minutes of Discussions, copies of which were signed and exchanged.

The Survey Team, after returning to Japan, was to analyze and evaluate the survey findings and prepare a Basic Design for the subject projects. This Basic Design Study Report has been prepared in order to present data required by the Government of Japan for grant-in-aid cooperation.

The names of the Team members, survey itinerary, and a list of discussants, along with a copy of the Minutes of Discussions are included as appendices to this report.

Section 2 A Socio-Economic Profile of the FSM

2.1 The Two-Tiered Structure of Micronesia's Economy

The economy of the FSM is composed of two different economic systems: the "product, or money, economy", where goods and services are bought and sold with money as the trading medium, and a subsistence economy based on "barter".

The former type of economy is centered in the principal islands and cities and incorporates merchants, government workers, and urban workers. The latter type functions in outlying villages on the main island and on the outer islands.

Examples may be seen in various parts of the world of economies in which barter plays a major role, but this characteristic is particularly strong in the FSM. It would be proper to say that over 50% of the population are under the influences of the barter, or subsistence economy. Excluding school age population, the subsistence population accounts for some 50% of the FSM total, with the share exceeding 55% in Kosrae State.

Of course, even in these so-called subsistence economies, a market-based economy is beginning to penetrate through the medium of imported products, but the unique features of the subsistence economy — based on status, village chiefs, village, land, and family — are closely interwoven with the subsistence economy. We believe, therefore, that a long period of transition, covering many stages, will be required to change the subsistence economy of Micronesia over to a money economy.

The breakdown of GDP for Micronesia shows that agriculture and fisheries account for 42.2% of total ($44.9 million), government services for 29.6% ($31.5 million); and wholesale and retail activities for 11.9% ($12.7 million). However, within the agriculture and fisheries section, subsistence operations contribute $40.6 million of the sector total. Subtracting these activities, the agriculture and fishery sector would comprise a mere 6.5% of GDP, well behind government services (47.8%) and wholesale/retail activity (19.2%) .

Apart from government expenditures and wholesale/retail business, supported by government payrolls, there are no industries as such in the FSM.

2.2 Need for Self-Supporting Industries

The greater part of the FSM's money economy is supported by government payrolls. Over 80% of total fiscal revenues are derived from U.S. aid, with domestic tax revenues contributing only 15-18%.

American policies toward Micronesia changed sharply during the early 1960's in a direction outlined in the "Solomon Report". In addition, U.S. assistance to this area, starting in 1963, began to register a sharp growth, and the subsequent inflow of aid funds greatly exceeded the sums given to neighboring nations. This aid, in 1977, represented 80% of total Micronesian GNP.

However, since the great bulk of this aid has been used primarily for educational and welfare services, it has been spent on government operations, particularly government salaries; thus, little, if any, has been used for infrastructure or industrial development.

In 1978, anticipating the end of the trusteeship era, the U.S. established a "Capital Improvement Program" with a view toward building infrastructure and providing employment opportunities to the Micronesian people. Based on this special aid program, Micronesia was, it is true, able to start building airports, roads, harbors, water supply and sewage, and other infrastructure facilities but the obligations resulting from the many years of negligence remain large and so, despite this rapid expansion of aid, the infrastructure gap has not yet been closed.

Micronesia, as a typical island state, is subject to many constraints and problems. Vast distances and time separate the main island from outlying islands, a fact which not only inhibits the flow of people and goods but also acts as a constraint on the speed and frequency of information transfer. In addition, total land area is small and, as a result of volcanic rocks and coral reefs, top soil is almost non-existent.

Thus, the soil is barren, capable of supporting only the production of such products as coconuts and taros. Since the islands are surrounded by the sea, however, they are well endowed with marine resources, but the nation lacks the means to effectively utilize them.

In order to solve these problems, capital, technology, and labor are required. The U.S. administration put its primary efforts into education and social welfare, but the development of a basic infrastructure, which could have formed the base for production activity, has been sadly neglected over a long period of time.

In the primary sector (agriculture and fisheries), there has been no significant introduction of capital or technology. For this reason, the islands have been unable to sustain even the levels of agriculture and fishery production attained during the 1930's.

In a comparison of 1930 and 1970 production levels in Micronesia, in terms of present value,* livestock and forestry output in the 1970's had declined to only 41% of the level of the 1930's and fisheries to only 9.3%, while agriculture had become virtually extinct at only 1.2%.

Micronesia, during the 1930's, was under the direct administration of Japan and production was mainly in the hands of the Japanese. Thus, in drawing comparisons with current levels of output achieved by Micronesians on their own, there were obviously major differences in terms of capital and technology, making a meaningful comparison impossible. However, with respect to acreage under cultivation (including palm tree forest area), for example, there was a decline of almost 50% from 54,446 hectares in 1936 to 31,008 hectares in 1979. Thus, it would be correct to say that the productivity of the 1930's had virtually disintegrated.

In connection with the termination of the trusteeship, the U.S. promised financial assistance to the various nations of Micronesia, based on

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* "Can Micronesia Become Economically Self-sufficient?" Micronesia #55, by Yasuhiro Takahashi

Compacts of Free Association with each country.

However, according to one estimate of trends in this assistance taking into account rates of population growth and inflation, postulating an annual inflation rate of 6% and a population growth of 3% per annum, within 10 years, per capita aid receipts would fall, in real terms, to only half of their original levels.

For this reason, it has become an urgent priority for the people of Micronesia to develop self-sustaining industries and thereby establish an industrial base which can withstand the decline in economic aid.

2.3 Dependence on Food Imports and the Employment Problem

A distinguishing characteristic of the FSM balance of payments is that exports cover no more than 6.6% of imports, resulting in a serious trade imbalance and a persistent deficit in the balance of payments, which is more than covered by U.S. aid. The country, thus, has an enormous dependence on this aid.

54% of FSM exports are derived from tourism, followed by copra (38%). The two categories combined hold a commanding 92% share of total exports. However, revenues from exports do not offset even 1/3 of the amounts expended for food imports. These food imports account for 22.8% of total imports, second to fuels and oils. And, if tobacco and beverages are added, food and related products account for 37% of total imports.

In the First National Development Plan (1985-1990), one major problem area was felt to be the inadequacy of statistics on foreign trade. The Basic Survey Team requested a breakdown of food imports during its field study but, unfortunately, properly organized figures were not available.

The only figures obtainable were fairly old, relating to 1975/76, when the country was still a part of Trust Territory. In that year, rice accounted for 42% of total food imports, canned meats 20%, and canned fish 14%. The salient features were the large imports of the staple food, rice, and of canned fish, despite the abundant fish resources in

Micronesian waters. It may be presumed that these patterns have not changed since independence.

Looking next at the breakdown of national expenditures (1983), 73.5% are accounted for by foods and beverages, of which only $25.1 million (28.17%) pass through the money economy, with the barter economy dominant at $40.6 million (or 45.4%).

Micronesia's total population has been increasing rapidly since the 1960's, registering an average annual growth of 3% from 1970 to 1980. Kosrae State has shown the highest rate of growth, at 3.16%.

Reflecting this rapid population growth in recent years, the share of the younger age groups in the total population has been increasing conspicuously. In 1980, 44.5% of the total population was below 16 years of age; the male working population was 75.9% of total (16,140 persons) and the female 42.3% (8,940), with the number of unemployed at 2,980 and 2,540 respectively.

An unemployed person is defined as one who "has been looking for work to earn money during the past four weeks". Since the above figures exclude "under-employed" persons who, while having no steady employment, support themselves from the subsistence economy, they tend to understate the true magnitude of the unemployment problem in the FSM.

Only about 50% of the working population are active in the money economy, where government employees account for 56% (and over 60% in the States of Kosrae and Yap). Thus, the role of the government in the labor market can be said to be enormous from this standpoint. However, as a result of the decline in U.S. aid, government employment can no longer be counted on to expand; to the contrary, with the anticipated rationalization in this area hopes must now be placed on solving the unemployment problem by expanding opportunities in the private industrial sector so as to absorb the increasing number of young jobseekers. From this standpoint as well, there is an urgent need to develop self-supporting industries.

2.4 Expectations in the Area of Fisheries Development

The Congress of Micronesia, in 1976, adopted a "5-Year Development Plan" (1976-1981) in order to establish a viable economic structure following the end of trusteeship. The primary goal of this Plan was to raise production in agriculture and fisheries while curbing government-level expenditures so as to correct the serious fiscal imbalance. A secondary objective was to increase productivity with a view to raising per capita incomes.

The FSM then developed a "First National Development Plan (1985-1989)", which looks upon these years as a period of transition and reconstruction following the actual end of U.S. administration.

Though this Development Plan is an integration of the development programs of the individual States, particular emphasis has been placed on the development of fisheries so as to utilize the abundant fishery resources in the FSM Exclusive Economic Zone. As a result, the fisheries sector has been accorded the highest priority in development expenditures, accounting for $45 million, or a full 32%, of total investment.

In the FSM's off-shore waters, there are excellent prospects for the development of a commercial fishery for highly migratory species, centering on skipjack and tuna. The total catch of skipjack in the Pacific Ocean comes to around 400,000 tons annnually, standing well above production in the Indian and Atlantic Oceans. The great bulk of the Pacific catch is taken from the Western Pacific, including Micronesian waters.

Before World War II, there was a Micronesian tuna fishing fleet, based in Truk, which was composed of 66 Japanese skipjack pole-and-line vessels of between 10 - 15 tons, whole combined annual catches averaged about 5,000 tons. Despite this catch history, at the present time, the Truk fishery is comprised of only three 21-ton vessels belonging to the Truk State Government and 4 privately owned vessels of 15 - 19 tons. This fleet catches no more than 450 - 700 tons of skipjack annually.

The States of Pohnpei, Yap, and Kosrae have vessels that confine their activities to surveys and resource development, making only limited catches that are only a minute fraction of the pelagic catches by foreign countries (such as Japan and the U.S.) within the FSM Exclusive Economic Zone.

FSM's fishery resources inside the reef are considered to be the richest in the entire South Pacific. According to a 1980 study by the South Pacific Commission, the catch per hour, using bottom vertical long line, came to 9.6 kg in Kosrae and 6.9 kg in Yap, suggesting the abundance of the resources to be found inside the reef.

However, since inshore fisheries are subject to the restricted productivity of coral reef waters, there are inherent limits to these resources. If uncreasonable fishing pressure were to be placed on these reef areas, the inshore resources might conceivably be completely depleted.

At present, in American Samoa, where motorization of fishing vessels has been underway since 1972, there has been an increase in fishing pressure on coastal waters. As a result, there has been a decided trend toward smaller-sized fish, as evidenced by a decline in the resource base and catch efficiency for demersal fish in particular (e.g., Lethrinidae, Epinephelus septemfasciatus, Scomberomorus sinensis). Thus, in only a few years after vessel motorization, controls had to be imposed on reef fish fishing to give the resource a change to recover.

The same sort of development has taken place in Western Samoa, where powered vessels have lost interest in operations within the reef and a movement has developed to restrict catch effort — i.e., to limit the number of fishing vessels (FAO, 1978).

Even from the standpoint of developing the present subsistence fishery in the FSM into a strong commercial fishery with a view toward generating stable supplies of fish proteins for its populations care must be taken not to exceed Maximum Sustainable Yields (MSY) and to avoid a concentration of fishing effort in particular locations.

The rich fishery resources in FSM waters are at present being exploited to only a negligible extent by the Micronesian people. Not only are the bulk of these resources being taken by foreign fishing vessels, but there has been an inundation of imported fish products onto the tables of the Micronesian people, who have traditionally been a fish-eating people.

At a time when there is an urgent need to develop a viable economic structure, owing to the end of trusteeship, and considering the almost total void of other resources or industries, we can only say that there is an increasingly pressing need for fishery development in the FSM.

CHAPTER 2 A PLAN TO DEVELOP A FISHING PORT IN YAP

Section 1 Background of the Plan

1.1 Yap's Traditional Society and Its Fisheries

Yap is the most conservative state in the FSM, and its people continue to follow the customs of a traditional society. Yap's population is 6,615 on the main island and 3,649 on the outer islands (1983 estimate), and the bulk of its residents engage in both agriculture and fisheries on a subsistence basis.

Yap's traditional society is an economically closed subsistence society with its own unique structure based on class, chief, village, land, and family. It also has its own unique stone moneys.

The village is the primary unit of Yap society and each village and village chief follow a set hierarchy. The authority of the village chief is enormous and, at the village level, may well supersede that of the State itself. The family is the basic unit for food production and distribution owning a certain amount of land for various types of subsistence activity. These lands, for example, are divided into taro farms, yam farms, reef fishing grounds, stone traps, palm trees, forests, mountains, and so forth. In terms of the division of work within the family unit, the women are primarily concerned with farming, while the men handle fishing activities. Any surplus production is shared willingly within the community.

The bulk of Yap's fishing activities fall within the framework of this subsistence economy. Fishing is done as one phase of subsistence production; the catches are distributed among the family, with any surpluses shared with members of the community. So long as one lives wholly within such a subsistence society, there is no need for a market mechanism for the buying and selling of fish catches as "commercial" products.

In recent years, however, imported products have begun to make inroads

into the deeply rooted traditional society of Yap Island, and so a life-style requiring some money has now penetrated deeply into the village economy. Thus, a portion of the surplus fish catches are now sold to the village stores or even directly to consumers.

Ownership rights to the fishing grounds inside the reef are clearly delineated by family unit, with outsiders strictly prohibited from fishing in these grounds. For this reason, fishing within the reef is limited to these proprietary grounds, and this has also been one of the factors inhibiting the development of a commercial fishery.

There are no statistics on Yap's fishermen population or on the number of fishing vessels. Or perhaps it would be more to the point to say that, up to now, there has been no clear concept of a fisherman or a fishering boat. If, for example, any person engaged in fishing activity may be called a fisherman, then it can be said that all of the adult male population are engaged in fishing activity.

Vessels too are used both for fishing and for transporting goods and people. It might be correct, then, to say that all of the canoes on the island are engaged to some extent in fishing operations. It is our understanding that virtually all families own one or more canoes. And, according to a 1973 census, there were 1,027 families on the Yap Proper. We may presume, therefore, that the number of canoes in use in that year were close to this number.

Population and Number of Households on Yap (1973)

Municipality	Population	No. of Households	No. of Persons per Household
Rumung	129	35	3.7
Map	377	74	4.6
Gagil	537	102	5.3
Tomil	666	122	5.5
Fanif	367	74	4.9
Weloy	1,020	188	5.4
Rull	1,463	302	4.8
Giilman	217	44	4.9
Kanifay	235	53	4.4
Dalipebinau	169	33	5.1
Total	5,140	1,027	5.0

1.2 Present State of the Yap Fishery:

The Yap fishery may be broadly divided into: subsistence, small-scale commercial, and industrial fisheries.

The subsistence fishery is the dominant type. While, as previously noted, there are no data on the number of fishing vessels, we can estimate they total at least, 1,000, mainly unpowered canoes.

The fishing grounds for the unpowered canoes are located principally inside the reef. Fishing methods are quite traditional, including net, spears, hand fishing, traps, and the like. The fish catches are consumed within the family group, and any surplus production is almost always distributed within the local village community.

Even on Yap proper, however, where activity centers around these subsistence fisheries, vessel motorization has been making some headway and, at present, the number of boats on the Yap Proper with outboard engines total about 200. In the Colonia area, some 30% of these motorized vessels are registered with the Yap Fishing Authority (YFA), which will be discussed in detail in the following section. Vessels registered with YFA are able to buy ice and fishing gear at below-market prices. In addition, there is a strict regulation that only icepacked catches may be sold on the fish market. These fishing vessels, then, may be generally considered to be "in the fishing business" and form the core of Yap's small-scale commercial fishery.

Fishing methods inside the reef comprise mainly: gillnet, hand-fishing, and diving with spear; outside the reef, trolling and handline fishing. Each vessel has a crew of 2 - 6 persons. On the average, the vessels make 4 trips a week, with hauls per trip generally around 40 kg, though at times they may run as high as 400 kg.

Presumably reflecting guidance from YFA, ice is liberally used, and ice chests are invariably taken on board when going out to fish. Catches are sold to the public market, supermarkets, and village stores at an average of 50 - 75 cents/lb.; these stores retail this fish for 95 cents/lb.

Even granting that fishing vessel motorization has been making strides, it should be noted that motorized vessels still represent only some 20% of total and so motorization is obviously still in an early stage. Furthermore, only 15% of these motorized vessels fish commercially — a very low ratio indeed.

Even in the case of powered vessels, the bulk of the catches are consumed within the family or village community, with sales to stores occurring only when cash is needed to purchase fuel and gear.

In the Colonia area, fish is presently retailed at only 7 locations: 6 supermarkets and 1 fish market. However, the quantities sold to these outlets are quite limited. And, when the commercial fishermen bring in large catches, and/or when the YFA vessels have a good run, this fish can hardly be sold in its entirely to these few outlets. For this reason, the fishermen will, at such times, solicit institutional buyers, such as schools and hospitals, in an effort to dispose of their catches, another factor that impedes the development of a commercialization.

While the use of ice is wide-spread, when the YFA vessels leave for the fishing grounds, they require a large amount of ice at one time, which may empty out ice storage supplies, making it difficult for other fishermen to obtain ice for their boats. At such times, commercial fishermen may even resort to making ice in their home freezers.

Also, since there are no wharfs at which the motorized vessels can dock, the movement of catches to market as well as the supply of fuel from gasoline stands involve considerable inconvenience.

The industry fishery is operated by YFA, which owns one 33 foot FRP vessel and 3 FRP vessels in the 30-ton class, two of which are long-line vessels confiscated from Taiwan. The latter two are presently inoperable but, within the current year, engine repairs on these vessels are expected to be completed, permitting their return to operation.

The average number of fishing days per trip registered by the 30-ton Crocodile-Maru total 3 - 4 days, with 3 - 4 trips made per month. The

total 1984 catch by this vessel came to 26 tons — 6.5 tons of reef fish and 19.5 tons of skipjack and tuna. Following are catch data, by month, for the Crocodile-Maru over the past year:

Fish Catch (Crocodile-Maru)

(in kg)

Month	Reef Fish	Skipjack	Total
1984:			
October	447	1,342	1,789
November	571	1,713	2,284
December	509	1,526	2,034
1985:			
January	557	1,671	2,228
February	552	1,657	2,209
March	539	1,616	2,155
April	608	1,824	2,433
May	519	1,557	2,076
June	581	1,742	2,322
July	654	1,962	2,617
August	406	1,219	1,026
September	581	1,742	2,323
Total	6,523	19,571	26,094

Since the domestic market has been slow to develop, the industry fishery has been turning its attention toward foreign markets. However, in view of the undeveloped distribution facilities, export market development has proved difficult. There is a strong demand in Guam for reef fish, in particular; making exports quite promising, and some fish have actually been shipped stored in old refrigerated containers. However, since these containers have worn out, exports have had to be suspended.

The industrial fishery requires a certain minimum size of vessel, but, given the lack of drydock facilities in Yap, these vessels are operating without benefit of proper maintenance. There are drydock facilities in

nearby Guam but this is a considerable distance for a 30 GT vessel to cover, inflating repair costs and making it difficult to establish a regular servicing program for these vessels. In one case, we understand, the quotation for shaft repairs was three times the original cost of the component, forcing the vessel to abandon the job.

Port facilities in Colonia include a "Commercial Dock" and an "Old Dock". When container vessels and inter-island freighters enter the Commercial Dock, there is no place to moor fishing vessels, and in any case, the wharfs are quite high, making it difficult to use this port for fish unloading operations. There are, moreover, no fishing port amenities, such as ice, fish handling, or refrigeration facilities.

In the case of the Old Dock, over half the area around the wharf is sand-filled and so unusuable, while fishing port facilities are also lacking. Thus, in the case of 30-ton vessels, the taking on of fuel, ice and water as well as the landing of catches are most inconvenient.

1.3 The Yap Fishing Authority (YFA)

The two organizations responsible for fishery administration in the State of Yap are the Division of Marine Resource (MR) of the Department of Resources & Development and the Yap Fishing Authority (YFA).

The MR is responsible for basic research, resource conservation surveys, and long-term planning, while YFA is in charge of the conservation and development of fishing rights inside the 12-mile zone and for the promotion of fishing-related activities, particularly commercial fishing.

The YFA was established in accordance with the Fishing Authority Act of 1979. It has a staff of 15 persons, including a General Manager, 4 office workers, 3 workshop technicians, and 8 fishermen, and owns an ice plant, warehouse, and four fishing vessels. The organization conducts its own fishery operations, using its owned vessels and staff fishermen, and also leases small fishing boats to fishermen with a view to developing a commercial fishery. It sells ice at low prices to fishermen and at no charge to the market, promotes the development of

a fish market and small-scale fisheries, and is active in organizing local fishermen. YFA also owns a workshop and a fishing gear store offers a repair service for engines and freezer units, and distributes fishing gear and supplies.

Ice and gear are sold at prices 50% below market to fishermen who are registered with YFA, and in this way a strenuous effort is being made to organize fishermen and maintain the freshness of catches. With regard to freshness in particular, 55 kg blocks of ice are sold to fishermen at 50 cents and a considerable effort is also placed on distributing ice chests. The YFA will not purchase fish from fishermen who do not use ice and provides ice at no charge to the market. It is, thus, most conscientious about maintaining freshness at the distribution level, and we may note, in this connection, that the freshness of the fish sold at the local market is extremely good.

As to financial performance, based on the provisional accounts for the 11 month period from October, 1984 to August, 1985 inclusive, the assets of the Authority are $532,000 — including $83,000 of liquid assets and $449,000 of fixed assets. Revenues included $375,000 of government appropriations; $74,000 of operating income; $8,000 of miscellaneous income. Direct operating expenses was $91,000 and general administrative expenses $205,000, leaving a net income for the period of $161,000.

1.4 Request Plan

In the First National Development Plan of the FSM, a total of 27 separate projects have been incorporated in the Fishery Development Plan for the State of Yap, including a Fishing Port Construction Plan and a Fishery Complex Plan which are the two most urgently needed projects for Yap fishery development. The Fishing Port Construction Plan involves the construction of mooring space for fishing vessels and dry-dock facilities, and the Fishery Complex Plan provides for the construction of refrigeration and freezer facilities for handling the catches.

Since these programs would be difficult to finance out of the developmental budgets of the FSM or Yap State Governments, the FSM Government

has made a request to the Government of Japan for a cooperation in the form of a grant-in-aid.

The Fishing Port Construction Plan anticipates the building of fishing port facilities in Colonia, including: a wharf (90 m long and 7 m wide) able to accommodate 100 GT vessels; facilities for the supply of fuel, water, and power; and dry-dock facilities for vessels up to 100 GT.

The above Fishing Port Plan has been consolidated with the Fishery Complex Plan, which would provide for the construction of a Fishery Complex adjacent to the fishing port facilities incorporating: a workshop for repairs on engines, electrical equipment, and refrigeration and freezer equipment; 2 ice-making units with a capacity of 5 tons per day; refrigeration and freezer facilities to handle fish catches; and a processing room.

The objectives of the above programs would be to improve the operational efficiency of the existing fishing fleet as well as to properly serve the expanded fleet that is expected to develop in the future.

In the original Yap State Plan, the fishing port and dry-dock facilities were intended to handle vessels of up to 100 GT. However, in the course of discussions with the Basic Design Study Team, the Yap Government indicated that, since it had no plans in the near future to purchase any 100 GT fishing vessels, there was no-need to be bound by the original 100 GT requirement.

Section 2 Details of the Plan

2.1 Plan Objectives

At the present time, the Yap fisheries are in a transitional stage from subsistence to commercial operations. While some progress has been made in vessel motorization, the prop of this industry remains the traditional subsistence fisheries. And, as a result of the lack of market demand, there has been very slow development in small-scale fisheries conducted for cash income. Even the industrial fishery, oriented to exports, has only started on the road to development under the aegis of YFA.

The people of Yap are traditional fish eaters with a deep-rooted demand for fresh fish. However, since domestic distribution channels for fresh fish are as yet undeveloped, supply and prices remain unstable, so that fresh fish cannot satisfy the demand. Accordingly, under present conditions, canned and frozen fish from other countries come closer to meeting consumer needs by virtue of their lower prices, ready availability, convenience of storage, and taste, with the result that consumption of this imported fish continues to expand. Based on 1977 data, imports of canned and frozen fish amounted to $209,000 in that year.

The principal fishing grounds for subsistence production are inside the reef, where ownership rights are clearly defined and outsiders cannot conduct unauthorized fishing operations. But, since only limited production is possible within the reef, no matter how much fishing effort is applied, production cannot exceed a certain level. In order to increase domestic fish production, therefore, it is clearly necessary to develop fishing grounds outside the reef.

The fishing grounds outside the reef are relatively distant, making the use of powered vessels a necessity. Use of powered vessels, in turn, necessarily entails the purchase of fuel, thereby creating a need for cash income to pay for this fuel. Accordingly, the development of fishing grounds outside the reef is intimately related to the development of a commercial fishery, and so the Yap State Government has adopted a policy of promoting this development as a means of expanding

overall fish production.

In order to develop a commercial fishery, the creation of a domestic fish market is a vital necessity. Only when there are outlets prepared to deal continually in locally-caught fish, can there be stable production.

With respect too to industrial fisheries geared to export, stable and continuous production and supply are the requisites for export market development and, for this purpose as well, there is a need for a domestic marketing structure for species without export potential.

The major impediment to the developing of fisheries in Yap has been the lag in the development of commercial fishing, owing to the absence of local market and functional facilities. Thus, there is a pressing need to provide facilities which support YAF's efforts to promote ice use and develop commercial fisheries.

The objectives of the Project are to provide distribution facilities, such as ice plant, freezer and cold storage, and fishing port facilities, such as mooring, unloading, provisioning and vessel repairing for YAF in order to promote commercial fisheries and develop local market.

2.2 Discussion on Plan Objectives and the Required Facilities

2.2.1 Distribution Facilities

The most important requirement for the development of Yap fisheries is the creation of a market mechanism. With the slow growth of a money economy, the Yap market remains undeveloped, with the distribution system also lagging far behind, while export markets have still not been secured. However, for the people of Yap, who already consume large amounts of canned fish and have a traditional fondness for fish products, if a distribution structure can be established and low-priced local fish can then be supplied on a stable basis, we may expect an increase in the consumption of fresh fish and in the volume of fish passed through these distribution channels. And with the

development of distribution facilities, it should be possible to generate stable supplies for the export market as well.

YFA, thus, seeks to develop a fresh fish distribution system by establishing a fish market and providing fish to it at low cost. What is presently needed is a complex of back-up facilities for such a market — viz., cold storage and freezer facilities to provide stable supplies of fresh fish and a strengthening of the presently inadequate ice-making capacity.

The distribution function will involve the following: processing of landed catches from the 30 GT and small fishing vessels belonging to YFA and other local boats equipped with outboard engines; temporary cold-storage of these catches until released to the fish market and, in the event of large catches, storage in the freezer facility; long-term storage with a view to releasing supplies to stabilize prices when vessels are unable to fish due to poor fishing conditions or inclement weather; and distribution of ice to vessels departing for the fishing grounds for use in maintaining the freshness of their catches.

The functions required for the above purposes include:

1. A refrigerator for temporary storage
2. A freezer and quick freeze facility for long-term storage
3. Ice-making unit and ice storage facility
4. Processing room

The management function will involve management services and facility maintenance services to assure the smooth operation of the fishing port as a whole. The main requirements for this purpose are:

1. A management office
2. A staff room
3. Warehouse and other facilities

The major requirement for Yap fishery development is the creation of a fishery infrastructure. While Colonia has built a Commercial Dock and an Old Dock, the former is too small to accommodate fishing vessels

when scheduled cargo vessels are in port, and, at both ports, wharves are too high to accommodate small fishing boats and are inconvenient as well in terms of landing catches and taking on supplies. Also, since there are no local facilities for vessel maintenance or repairs, the existing facilities are clearly inadequate, forcing the fishing vessels to go to far-off Guam, at great expense, for their repair work.

For the above reasons, there is a compelling need for a wharf at which the 30-ton vessels of YFA and other small fishing boats can land their catches and take on ice, water, and fuel. There is also a requirement for a slipway to provide simple repair and maintenance services on YFA and other local fishing boats and for a workshop for simple repairs on outboard and diesel engines.

(1) Mooring Facilities:

At the present time, foreign fishing vessels do not regularly use Yap harbor. Those that do enter the harbor with the objective of seeking safe have from weather. Nor is there any plan to introduce large-scale fishing vessels in the near future. Thus, the target vessels to be served by the mooring facilities will be small-scale commercial fishing boats based in the Colonia area and fishing vessels belonging to YFA. The expected breakdown of these target vessels is as follows:

30 GT class	3 vessels
5 GT class	2 vessels
20 ft. class with outboard engines	30 vessels

(2) Dry-dock Facilities:

Since the 30 GT fishing vessels operating in Yap are quite small, it is dangerous for them to travel to Guam for repairs and inspection. And, in the present circumstances, where maintenance remains slipshod owing to the lack of repair facilities, thus shortening vessel life, the construction of repair facilities is very much desired.

The dry-dock facility will be targeted at present vessels in the 30 GT class or below.

(3) Workshop:

The operational scope of this facility will be as follows:

1. To inspect and repair 30 GT and 5 GT fishing vessels
2. To inspect and repair outboard engines
3. To repair freezer and other facilities

The basic thinking with respect to the repair of 5 and 30-GT vessels is to continue to use the facilities of neighboring countries for repairs requiring large-scale facilities and equipment as well as a large force of highly-skilled labor. Operations at the plan facility will be directed to regular inspections, parts replacement, simple repairs, painting of vessel bottoms, and temporary repairs.

Repair work on outboard engines may be divided among engines, propellers, shafts, and electrical repairs, but, in all cases, the methods of dealing with such repairs — i.e., parts replacement — are well established in the FSM, and Yap is no exception. Accordingly, disassembly for purposes of parts replacement will be the primary work at the plan facility.

The intent is to offer a wide variety of fishery-related repair services, including those on the freezer, ice-making unit, and other machinery and equipment as well as repairs on the hulls of the small FRP fishing vessels operated by local fishermen.

The various rooms comprising the Workshop will include:

1. A repair area for outboard engines
2. A general work area
3. An administrative office
4. A staff room
5. A storage room and a washroom with shower

Section 3 Profile of Plan Site

3.1 Location and Topography of the Plan Site

Yap State belongs to the Western Caroline Islands and is situated 850 km southwest of Guam and 1,850 km east-south-east of Manila at 9°N 138°E. The Yap Island is made up of 4 islands: Yap Proper, Gagil-Tomil, Map, and Rumung, which are closely grouped, separated only by narrow channels. The length of the islands from north to south is about 30 km, and the east-west width is a maximum of 13 km. The islands are of volcanic origin and surrounded by reef 2 - 3 km wide.

3.2 Selection of the Plan Site

The government and economy of Yap State are concentrated in the Colonia area on the east-central coast of Yap Island, and this is the only urban area in the State deserving of the name. The area extends in a southerly direction from Tomil Bay and is about 1.5 km long and 80 m wide at its narrowest point. The area is connected to the sea by a channel with a minimum depth of 20 m. The bay is not subject to wave action at sea and so is quite appropriate as the site for a fishing port.

A peninsula of some 600 m extends east-south-east from the heart of Colonia, and the Yap Government has secured a reclaimed area of some 6,000 m^2, at an altitude of +2.5 m, as the proposed site for the fishing port.

North of the site, there is a road leading to the tip of the peninsula on which are located the Administration and Legislature. The western side borders on a Community Center. On the eastern side, there are the Sewage Treatment Plant and an embankment running to an area in which coral is dredged for paving use. As a result of an on-the-ground survey of the entire Colonia area, it was established that the waters facing the site have sufficient depth. also, the northeast tradewinds that dominate Yap become a land breeze at this point and, since the fetch from other directions is 2 km or less, wave effect is small. In addition, power, water supply and drainage are provided to the area. Accordingly,

the site was deemed to be ideal for the construction of a fishing port.

3.3 Summary of Existing Port Facilities in the Area

400 m to the northwest of the plan site is YFA, a government agency, with offices, equipment repair area, and ice-making plant (2.5 tons/day). To the east is an unloading wharf. Water depth in front of this wharf is almost the same at that at low tide and so can barely be used even by the small outboard boats.

Adjoining the YFA is a market which deals in fruits and fresh fish.

To the north of the State Legislature is the Commercial Dock -- Yap Docks, with a total length of 210 m and a depth of -10 m. 10,000 ton container vessels plying Pacific routes call on this port twice a month, while 1,000 ton cargo vessels serving the Micronesian islands enter port 2 - 3 times a month carrying general cargos. While the Commercial Dock has a rather low rate of utilization, there are no ice-making, fish-handling or storage facilities, while the crown height of the wharf is +3.1 m, making it difficult for the small boats to unload their catches.

To the west of the Community Center is a 60 m long Old Dock, which is presently used as a mooring wharf and fish-landing area for 30 GT fishing vessels. However, the area in front of the wharf has been filled with sand and dirt, and so over half of the wharf is unusable. In addition, the area behind the wharf is being used as an auto repair facility and warehouse.

Since there are absolutely no fishing port amenities, ice must be brought to the vessels from the YFA, while catches must be transported to the market.

3.4 Natural Conditions

3.4.1 Weather

Yap's climate is a typical tropical climate with high temperature and

humidity. From July to October, there is a rainy season during which southeast winds predoninate; from November to June, there is a dry season in which northeast tradewinds predominate.

The Yap Weather Bureau has been making meteorological observations since 1948. Based on these observations, the general weather pattern is as follows:

(1) Temperature and Humidity:

The mean annual temperature is 27°C, with only a narrow monthly deviation of not over 1°C. The daily temperature range is only 7°C or less. Humidity is generally high, reaching 85% during the rainy season and never dropping below 80% even during other times of the year.

(2) Weather and Rainfall:

The average number of clear days per year is 8; partly cloudy days 74, and cloudy 259. Generally speaking, even when the night and early morning are clear, the day will usually be cloudy.

Average annual rainfall is 3,090 mm. Average monthly rainfall exceeds 300 mm during the rainy season from July to October. During the dry season from February to April, it is 150 mm or less.

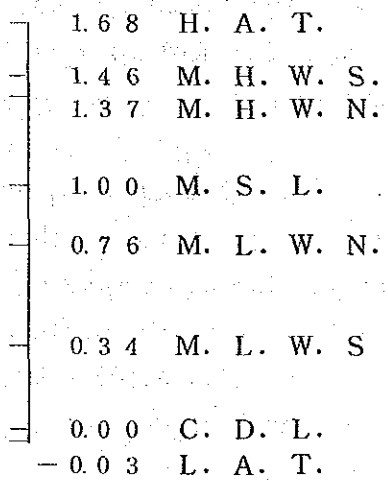
(3) Wind Direction and Velocity:

Average annual wind velocity is 3.6 m/second. From November to June, the area is dominated by northeasterly tradewinds of 3.5 - 4.5 m/sec. and, from July to September, the prevailing winds are from the southwest at 3 m/sec. From June to December, the islands sometimes suffer the effect of typhoons passing to the north but, being at a low latitude, most of these are small, in the first stage of development. the fastest recorded wind velocity was a southwest wind of 32.2 m/sec. in 1960.

3.4.2 Oceanographic Conditions

(1) Tides:

Tidal observations are available for a point 1 km away from the plan site on the opposite side of the bay. The tidal conditions are as shown below. A notable characteristic is the fact that variations between M.L.W.S. and M.L.W.H. are over 4 times those between M.H.W.S. and M.H.W.N.



H.A.T.	Highest Astronomical Tide
M.H.W.S.	Mean High Water (Springs)
M.H.W.N.	Mean Low Water (Neaps)
M.S.L.	Mean Sea Level
M.L.W.N.	Mean Low Water (Neaps)
M.L.W.S.	Mean High Water (Springs)
C.D.L.	Chart Datum Level
L.A.T.	Lowest Astronomical Tide

(2) Current Velocity and Direction:

Tidal current is toward the inner bay during rising tide and toward the mouth of the bay during ebb tide. However, the tidal flow at the projected site area is small and presents no problems in terms of docking, sailing, or mooring.

(3) Waves:

Tomil Bay is at the inner part of a grown coral reef and so is virtually entirely protected from wave action at sea. The projected construction site, moreover, is located in a broad channel on the southern side of the peninsula and, since it receives trade-winds (that prevail from November to June) from the rear side, waves do not develop in the area.

Also, vis-a-vis the southwest winds that prevail from July to September, the area lies in the lee of the Worwor area on the opposite bank. Even imagining a period of strong winds, a road is being reclaimed from the tip of the peninsula toward the south, and, since the maximum fetch is about 2 km, waters would remain calm within the bay at the time of such winds.

3.4.3 Geology

The southern part of Yap island is a relatively flat terrace with an altitude of 70 m or less. The lower part is soft volcanic breccia.

The northern portion is an area of hills and mountains with a maximum altitude of 180 m. The lower section is green schist. The outer edge of the island is completely surrounded by grown coral reefs.

The planned site area is reclaimed land located in the center of the peninsula jutting out into Tomil Bay from the Colonia district. The geology at this point shows hard, weathered green schist as the base foundation, on top of which there has been a natural accumulation of sand mixed with coral, covered by a layer of fill material.

3.4.4 Earthquakes

Seismic observations are not taken on Yap Island. However, since the island is of volcanic origin and a strong earthquake was reported in 1911, we have allowed for seismic vibrations in our design plan.

3.5 Construction Conditions

3.5.1 General Conditions

The planning and design of public works projects in Yap are under the control of the Division of Planning Management and Statistics, which is a part of the Yap State Government. Construction is carried out by Public Utilities and Contracts whose main projects relate to road construction and repair and the construction and improvement of government buildings. This Section owns various types of construction equipment, such as trucks, graders, and rollers, and conducts inspections and repairs on this equipment. However, since this equipment is in limited supply, it would be difficult to use it for the subject construction plan.

Combining both local and foreign-capital firms, there are less than 10 private construction firms in Yap. According to Public Utilities and Contracts, only 3 firms (Black-Micro Construction, Jasman Construction, and United Builders of Yap) would have the capability to serve as subcontractor for a project of the scope of the subject program. Of these, Black-Micro is the largest, with some 30 employees; however, its staff can hardly be considered skilled workers.

The applicable legislation governing construction work in the State conforms to U.S. standards. And, with respect to landfill, dredging, and discarding projects in the water areas, permits and approvals must be obtained from the U.S. Navy.

3.5.2 Construction Materials

The only construction material presently being produced in Yap is coral

sand. But even this material can only be used after it has been left to stand for a number of months to remove salts through rainwater action. In addition, since grain diameter is small, it can hardly be termed a superior material for use as fine aggregate for concrete.

As may be seen from the high value that has been traditionally attached to stone moneys from Palau, Saipan, and other neighboring islands, building stone is not produced on Yap. All other materials, such as wood, steel, cement, and resins, must be imported.

Imported materials can be transported only on container vessels (10,000 GT class) that serve Yap from the U.S. and Japan twice a month and cargo-passenger vessels (1,000 GT), serving the Micronesian islands, which call at Yap 2 - 3 times a month. Thus, ample lead time must be allowed for the procurement of construction materials.

3.5.3 Labor Conditions

Construction workers can be procured from the 3 construction firms mentioned above, but, since their skill level is low, engineers and machinery operators must be dispatched from Japan.

At Public Utilities and Contracts, estimating is done by first establishing the unit cost by type of construction and then adding on 30 - 40% of unit cost for labor. The private companies also follow this practice in their estimating work.

3.5.4 Construction Equipment

There is a pool of heavy construction equipment on Yap Island, such as cranes, trucks, and bulldozers, that belong to Public Utilities and Contracts and the private construction firms.

However, the amount of such equipment is extremely limited and the available equipment is presently being used for road construction and other public works projects. Thus, it would be difficult to tie this

equipment up via rental contracts for a number of months, as required for the subject project.

Accordingly, the principal items of construction equipment will have to be brought in from Guam or Japan.

Section 4 Basic Design

4.1 Basic Policy

In carrying out fishery development in Yap, it will be necessary to mount a persistent effect from a long-term perspective. Yap's economy and society are in a period of transition from a subsistence to a money economy. Fishermen come from various villages where they continue to be based.

It is not difficult to see that the propagation of the concept of a commercial fishery, which involves inherently the production of a "commercial" product, among fishermen who maintain their bases in a village society still dominated by a subsistence economy could give rise to many serious distortions.

The sudden breakdown of a traditional society brings in its wake disruptions in the value system of that society and so may well lead to major social problems. In view of the close link between the traditional society and fishing activity in Yap, it is vital to seek a path to fisheries development that will harmonize with this traditional society.

In implementing this plan, we shall take steps to avoid the forced development of a domestic marketing structure. By providing a step-by-step improvement in present conditions, we hope to encourage the fishermen to select fishing as an occupation of their own volition and out of a natural desire to improve their living standards. It is necessary, then, to provide a base which can nurture a fishing industry capable of contributing to the State's economic viability. Accordingly, the basic design has been developed in accordance with the following policies:

(1) In order to give full play to the functions of a central fishing port in expanding fish production and developing a production and distribution structure in Yap, we have developed a plan to establish fishing port facilities that will make possible the concentration in one location of all of the functions carried out by the YFA, which has prime responsibility for the development of

Yap's fisheries -- particularly a commercial fishery. These functions include a stable supply of fish products through freezer and refrigerator facilities; the development of a suitable supply structure, based on ice-making, fuel supply, and water supply facilities; and maintenance of the factors of production through a dry-dock and repair facilities.

(2) The plan will be of sufficient scope to eliminate deficiencies in the present facilities. However, the facilities have been laid out in such a way as to make possible their expansion in a way that will be fully compatible with the existing facilities. This is in anticipation of a possible future need for such expansion as a result of an increase in the size of the fishing fleet and the value of fish catches.

(3) The facilities will fully respond to the climate and natural conditions of Yap. They will harmonize with existing facilities in the area and have been planned with a view to ease of maintenance and operation.

(4) Full consideration has been given in the construction plan to local construction conditions. The plan will utilize, to the maximum extent, local labor resources and building materials and is expected to provide a stimulus to the area's economy through the construction program.

(5) With respect to construction laws and standards, having consultation with the Yap State Government, the design plan will conform to all applicable Japanese laws, regulations, and standards relative to engineering works, construction, and equipment.

With regard to environmental laws and regulations, such as those on landfill and dredging, we will implement the plan on the basis of permits and authorizations from the authorities concerned.

4.2 Determination of the Size of the Required Facilities

4.2.1 Mooring Facilities

The construction site is located in the inner portion of Tomil Bay, which is in turn surrounded by coral reefs. Since calm waters are, therefore, assured, breakwaters will not be necessary. The narrowest width of the channel leading from the sea to the site is 80 m, with an assured depth of 20 m. The water area in front of the site has a depth of about 20 m for a distance of 100 m toward open waters, and there is ample area for anchorage and maneuvering.

The mooring facilities are to include a wharf for landing catches, sailing preparations, and supply functions. Its scale has been established as follows, based on maximum assumed use:

Landing of Catches	Vessel Type (GT)	No. of Vessels	LOA (Breadth) (m)	Length per Vessel	Required Length of Wharf (m)
	30	1	23	23 x 1.15 (Safety margin)	26.5
	Boats with Outboard Engines	10	1.5	1.5 + 1.0	25.0
Preparation and Provision	30	1	23	23 x 1.15	26.5
Total					78.0

Accordingly, the length of the wharf will be 80 m. With regard to width, in the Japanese "Standards for Design of Fishing Port Structures", the width of an apron for fishing preparations is set at 10 m. And, in the case of the fish landing wharf, where cars are expected to run on the apron, the apron width has been set at 10 m.

As to plan depth, the draft for a fully loaded fishing vessel of 30 GT is 2.3 m; adding a safety margin of 0.7 m, we have set this depth at 3.0 m. Plan crown height has been set at +2.5 m, after adding 1.0 m to the mean high water springs.

The required supply facilities for fishing vessels will include those for fuel and water. In the fuel supply facility, a diesel tank will be provided for use by 30 GT vessels and a gasoline tank for use by boats equipped with outboard engines. An underground pipe will carry diesel fuel to the preparation wharf.

The capacities of the respective tanks will be as follows:

Diesel Tank:

On the assumption that the 3 target vessels will each make one trip per week, the tank will provide one week's fuel:

5 Kℓ/vessel x 2 vessels = 10 Kℓ

Thus, the tank will have a 10 Kℓ capacity.

Gasoline Tank:

30 fishing boats with outboard engines are to be supplied with sufficient fuel for 3 days' operations.

24 ℓ/engine x 2 units x 30 boats x 3 days = 4.3 Kℓ

Thus, the capacity of the gas tank will be 5 Kℓ.

4.2.2 Fishery Complex

The Fishery Complex is to comprise a refrigerator, freezer, quick-freeze unit, ice-maker, ice storage, processing room, office, staff room, and storage room.

(1) Refrigerator:

The storage facilities are intended to handle catches landed at the planned fishing port by the outboard boats belonging to fishermen in the Colonia area as well as by the 30 GT and 5 GT fishing vessels owned by YFA.

In establishing the capacity of the refrigerator, based on interviews and data on local catches, we have assumed that the number of fishing vessels returning to port on a given day will comprise: two 30-GT vessels, one 5-GT vessel, and 30 outboard boats.

Assuming that the maximum catch of the 30 GT vessel is 1,000 kg, of the 5 GT is 400 kg, and of the outboard boats is 30 kg, we calculate that the maximum receipts per day would be 3.3 tons.

30 GT	1,000 kg x 2 vessels	= 2,000 kg
5 GT	400 kg x 1 vessel	= 400 kg
Outboards	30 kg x 30 vessels	= 900 kg
	Total	3,300 kg

If we set the effective capacity of the facility at 80% and the stowage factor of bulk fish at 0.4, the required capacity becomes:

$$3.3 \text{ tons} \div 0.8 \div 0.4 = 10.31 \text{ m}^3$$

This has been rounded to 10 m^3.

The refrigerator structure will be prefabricated panel type, which has many advantages for a small refrigerator in terms of construction time, price, and performance.

With ceiling height within the refrigerator compartment set at the standard 2.2 m for prefabricated panels, the required floor area becomes 4.6 m^2. Accordingly, we will use a 3.4 x 1.6 type, with a panel thickness 100 mm according to the standard. The standard temperature within the refrigerator will be within a range of +5° ~ -5°C.

(2) Freezer:

This facility is intended to freeze and store fish that has been caught in large quantities at a given time. This fish will be released to the market in times of bad weather or poor fishing conditions in order to maintain price stability.

There are various ways for setting freezer capacity, but, in this project, as a general rule of thumb, we have assumed the need to store a week's supply of fish, based on the average daily consumption of fresh fish by residents of the Colonia area.

At present, the daily consumption of fresh fish in the Colonia area is presumed to correspond to the supply of fish from the area's fishing vessels. That is to say ---

Consumption = Catch

Based on the number of target fishing vessels, the average catch volume, and the average number of fishing days, we have calculated a week's catch volume to be 6,188 kg.

Outboard boats (registered with YFA)	
30 boats x 30 kg/trip x 4 days/wk	= 3,600 kg
Outboard boats (for self-consumption)	
30 boats x 30 kg/trip x 2 days/wk	= 1,800 kg
30 GT	
2 vessels x 32 kg/trip x 1 trip/wk	= 658 kg
5 GT	
1 vessel x 65 kg/trip x 2 trips/wk	= 130 kg
Total	6,188 kg

Accordingly, if the maximum volume of fish to be stored in the freezer is set at 6,188 kg, the required freezer capacity, at an 80% effective usable area and a 0.4 stowage factor for fish bulk, becomes:

6.188 tons ÷ 0.8 ÷ 0.4 = 19.33 m^3

From this figure, the required floor area, based on a ceiling height of 2.2 m, becomes 8.8 m^2. We have specified 3.4 x 3.4 panels with a thickness 100 mm according to the standard.

The temperature range in the freezer has been set at -25°C to permit long-term storage of fish for a 2 - 3 month period.

(3) Quick Freezer Unit:

It goes without saying that, from the standpoint of freezer management, it is highly desirable that the fish temperature at the time of entering the freezer be close to that of the freezer. This is

good both for the fish itself and in terms of lessening freezer load. In addition, the life of frozen fish after thawing depends on how quickly the fish was frozen. From this standpoint, it is hardly desirable to put normal temperature fish directly into the freezer and subject it to slow freezing. In this project, then, we will quick-freeze such fish prior to its entry into the freezer.

If we limit storage time in the refrigerator (+5 ~ -5°C) to no more than one week, a volume equal to the maximum daily capacity of 3.3 tons, less the daily volume of sales to the fish market, will have to be processed in the quick freezer unit within the span of one week. The volume to be processed per day will be approximately:

3,300 kg - 630 kg ÷ 6 days = 445 kg/day

Thus, a total of 500 kg per day will be processed in the quick-freeze unit in two 10-hour freezing cycles of 250 kg each.

(4) Ice-Making Unit:

The YFA has been making a determined effort to preserve the freshness of its fish. Using its ice-making plant, which was completed a few years ago (with a daily capacity of 2.5 tons), it has been supplying ice to its registered fishing boats prior to departure for the grounds and has been selling only ice-packed fresh fish to the market, where it is sold at all times at a temperature of 15 ~ 20°C.

This ice at present is being supplied only to YFA owned vessels, the fish market, and other privately owned vessels registered with the Authority. However, if we assume that, in order to promote freshness retention on a broader basis, YFA will now provide ice to another 30 fishing vessels in the area, the maximum ice demand may be calculated as follows;

30 GT

5 tons x 1 trip/week ÷ 6 x 2 vessels = 1.70 tons

5 GT

1 ton x 2 trips/week ÷ 6 x 1 vessel = 0.33 tons

Outboard boats (registered)

60 kg x 30 vessels = 1.80 tons

Fish market

1.5 tons x 1 location = 1.50 tons

Fishing vessels in area

60 kg x 30 vessels = 1.80 tons

Total 7.13 tons

The existing ice-making capacity is 2.5 tons.

Thus, the shortfall will be:

7.13 tons - 2.5 tons = 4.63 tons

Accordingly, we have provided in this plan for a new ice-making facility with a daily capacity of 5 tons. The ice will be produced in two 12-hour cycles of 2.5 tons each. The ice will be block ice, in view of the high ambient temperatures and the relatively long storage requirement based on the wide dispersion of fishing grounds. The ice will be provided in 25 kg blocks, capable of being carried by one person.

(5) Ice Storage:

The maximum daily ice demand has been calculated on the basis that two 30 GT, one 5 GT, and 60 outboard vessels will be departing for the fishing grounds simultaneously. Thus,

30 GT

5 tons x 2 vessels = 10.0 tons

5 GT

1 ton x 1 vessel = 1.0 ton

Outboard boats

0.06 ton x 60 vessels = 3.6 tons

Market

1.5 tons x 1 location = 1.5 tons

Total 16.1 tons

In order to accommodate 16.1 tons of ice, the ice storage area, based on 80% effective usable area, a 0.92 specific gravity of ice, and 1.0 m high stacks, becomes 21.9 m^2.

$$16.1 \div 0.8 \div 0.92 \div 1.0 = 21.9 \text{ m}^2$$

Accordingly, we shall use panels of 6.1 x 3.4 m size, with a thickness 100 mm according to the standard. Also, in view of the high ambient temperatures and the shortness of storage time, we have provided a freezer in this ice storage compartment that is capable of maintaining a holding temperature of about 0°C.

(6) Processing Room:

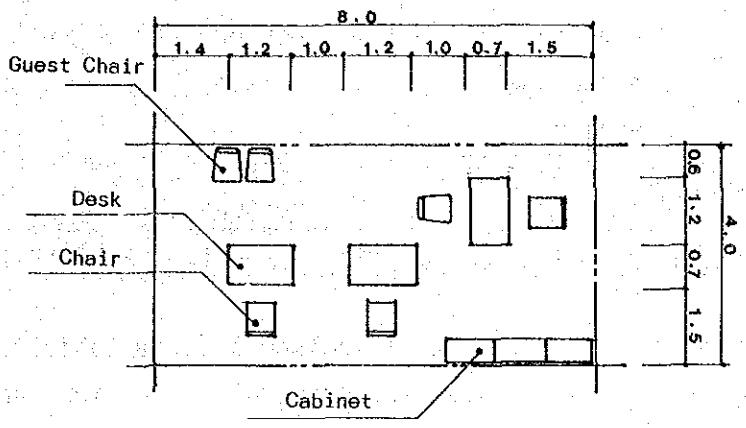
The processing operations in this area will be mainly gutting prior to freezing or refrigeration. This processing function will make it possible for the fish to be stored for longer periods and thereby compensate for the instability of fish production. it will also play an important role in grading the fish and so add value to the product. There will also be major benefits from the standpoint of food sanitation deriving from the processing facility.

(7) Administrative Office:

This office will be responsible for overall administration of the fishing port and its staff will include a manager, a foreman, and one assistant.

Furniture and fixtures will include desks and chairs for staff, file cabinets, and chairs for guests. Ample space will be provided for all these items.

Based on the following layout plan, the required floor area will be about 32.4 m^2.



Office space will be provided for a manager, a foreman and general office support. Based on a compilation of available building design data, this set-up would require a floor area of between 24 - 33.5 m^2.

Manager		13.0 - 18.0 m^2
Foreman		6.5 - 8.5 m^2
Office Staff		4.5 - 7.0 m^2
	Total	24.0 - 33.5 m^2

According to the above data, the proper density per unit of area is set at 0.11 - 0.28 persons per m^2. The plan density for the office area would be only 0.09 persons / m^2, even less than the acceptable range.

We have set the total space requirement at about 32 m^2, the upper end of the above range, in consideration of the fact that this will be the only area that can serve as a reception area for guests.

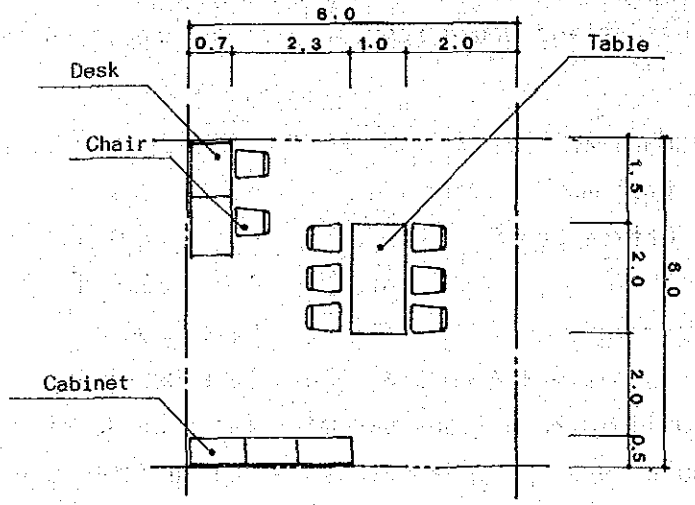
(8) Staff Room:

This room will be used as both a dressing room and a rest area for the employees. It will accommodate a total of 9 persons.

Personnel required for ice, freezer, and refrigeration operations

Ice delivery	2	persons	(2 shifts)
Operation	1	person	
Ice storage	1	person	
Freezing refrigeration	(to be handled by above staff)		
Processing	5	persons	
Total	9+4	persons	(night shift)

Furniture and fixtures will include a large table and chairs for rest periods, an office-type desk, office chairs, and lockers. If the required spacing is allowed for these items, the total floor area for this room, as shown in the following layout plan, would be 31.36 m^2, yielding a density of 3.5 m^2 per person.



This figure comes fairly close to the maximum end of the acceptable density range, as shown in the building design data, but we feel that this density would be appropriate here considering the nature of the work to be performed and the short time that the staff will spend in this room. We have thus set 30 m^2 as the approximate required floor area.

(9) Other Facilities:

The other facilities will include:

(a) A Storage Room:

We have provided a room of approximately 30 m^2 for the storage of components for the various facilities and equipment, freezing pans, fish boxes, and fishing gear for 30 GT and 5 GT vessels.

(b) Lavatory:

We have provided lavatories for both sexes, and a shower room. The required floor area, in line with the size of the facility, will be about 15 m^2.

4.2.3 Shiprepair Facility

The vessels to be served by the shiprepair facility will be divided into a 30 GT class and a 5 GT class.

The standard dimensions of a 30 GT vessel are approximately as follows:

$$L \times B \times D = 23 \times 4.5 \times 1.8 \text{ m}$$

The displaced weight in light condition is approximately 60 tons.

Various types of shiprepair facilities are available, depending on vessel size, locational conditions and launching conditions. However, the most prevalent types are the slipway, dry-dock, and floating dock.

The floating dock requires highly skilled operators and the dock itself must be put in repair facility for inspection and repairs. The closest area to Yap for this kind of service is probably Guam, but it would not be logical to incur such high travel costs to repair a facility that is used only a few times a year. Based on these factors, we have decided to eliminate the floating dock as candidate for the plan facility, confining our comparative evaluation to the slipway and drydock types, as shown below:

Comparative Evaluation of Slipway and Drydock

Item		Slipway	Drydock
Drydock operations	Safety	Δ	O
	Ease of use	O	O
Repair operations	Operability	Δ	O
	Safety	Δ	O
Operating costs		O	X
Maintenance and control		O	X
Construction		O	X

Although the slipway is inferior to the drydock from an operational standpoint, it is a good deal cheaper in terms of initial outlay and operating costs. And the slipway method is most prevalent for servicing small vessels of 30 GT. For the above reasons, we have selected the slipway type for this project.

From a construction standpoint, it is desirable that the length of the slipway -- particularly the portion in the water -- be short. It is also desirable, in terms of repair and inspection operations, that the height of the shore-based portion not protrude greatly above the surrounding terrain and that the slope gradient be gradual. As a means of satisfying these two conditions, we have designated a structure providing a gradual slope from the water onto the land portion. This slope will be 1/10 in the water and 1/16 on land, with an intermediate value of 1/13, subject to gradual change.

In the following Chart, we have shown the daily frequency of high and low-tide levels in Tomil Bay. Considering the numbers of vessels to be catered on this facility and the need to keep the water portion short, we have set the number of days of possible use per year at about 70%. We had considered a design tidal level of CDL + 1.40 m but, since the

Number of Days of High Tide (1985)

Tide \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Total	%
(cm)														
170 <	0	0	0	0	0	0	0	0	5	5	6	2	18	5
160 <	0	1	1	2	3	3	0	6	11	15	8	6	56	15
150 <	6	5	6	7	5	7	10	15	17	20	18	13	129	35
140 <	19	17	17	17	19	21	23	26	27	29	27	24	266	73
130 <	27	22	23	22	28	27	31	31	30	31	30	31	333	91
120 <	31	28	28	28	31	30	31	31	30	31	30	31	360	99
110 <	31	28	31	30	31	30	31	31	30	31	30	31	365	100

Number of Days of Low Tide

Tide \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Total	%
(cm)														
80 >	31	28	31	30	31	30	31	31	30	31	30	31	365	100
70 >	31	28	31	30	31	30	31	30	29	29	30	31	361	99
60 >	29	28	31	30	31	28	28	26	23	24	21	27	326	89
50 >	24	25	29	30	25	24	23	20	17	15	16	23	271	74
40 >	21	20	23	20	19	20	19	15	8	7	11	19	202	55
30 >	16	13	11	11	14	15	15	10	0	3	4	12	124	34
20 >	10	9	4	4	7	10	11	3	0	0	3	5	66	18
10 >	2	2	0	0	3	4	4	0	0	0	0	3	18	5

drydock operations will not involve a high degree of skill and, by local custom, all work must be done during the day, we have adopted an MSL + 1.0 m as the design tidal level, one which will positively be reached twice per day during periods of low tide.

After giving due consideration to the above conditions as well as to the draft and terrain, and to permit inspection and repair operations to be made above water at times of high tide, we have set the rail length at 30 m below CDL in the water and at 40 m above CDL on shore -- for a total of 70 m. The heights of the rail ends will be -3 m and +2.8 m respectively.

The maximum operating load for the winch will be during the winding of the vessel onto the land portion, and so we have established the winch capacity on the basis of a 1/13 gradient. The winding power has been calculated as follows:

$$F = W (\sin \theta + u \cos \theta) + Fl$$

where:

W = winding weight = 60 t + 7 t x 2 = 74 t

θ = cradle slope angle = 4°40'

u = moving friction coefficient (in the case of wheels) = 0.025

Fl = other friction resistance (pulleys, guides, etc.) = 1 t

$F = 74 (0.077 + 0.025 \times 0.997) + 1 = 8.5$

If we assume that, with the use of pulleys, the winding power will be reduced to a third of the above figure, this value becomes 3 tons. Allowing a safety margin, we have set the winding capacity of the winch at 5 tons.

In the case of 5 GT vessels and under, including the outboard-powered boats, we feel it appropriate to use a concrete slope without rails, as is normally used in Japan for this type of vessel. Space that would allow two 5 GT vessels to be handled at once would, we believe, be quite adequate. Accordingly the required width would be:

[2.5m + 2.0m (work space) x 2] x 2 vessels = 13 m

4.2.4 The Workshop

(1) Area for Outboard Engine Repairs:

The design elements for the repair area, in terms of required equipment and floor area, are determined on the basis of the number of outboard engines to be simultaneously serviced.

In Yap, the present system for repairing outboards involves the use of the repair yard at YFA and auto repair shops in the vicinity. In this plan, the present repair function at YFA would be moved to the new facility.

The kinds of work to be performed on the engines brought to this facility will include both inspections and ad-hoc repairs. With regard to inspections, since there are no local inspection laws, these are done irregularly -- some vessels may undergo inspection a few times a year, while others may have no inspection until an actual breakdown occurs.

Similarly, with respect to ad-hoc repairs as well, given the unpredictability of such breakdowns, there are many different ways of estimating repair frequency.

Since the existing repair shops do not maintain accurate service records, we have estimated the volume of repair work on the basis of the standards set for spare parts supply by the various engine manufacturers.

The required number of spare parts comes to some 1,500 parts per 100 engines over a 2-year period, with about 3 parts required per individual repair. These are, however, average figures inferred from the past experience of engine manufacturers.

If we assume that a total of 60 engines will be served by the plan facility (30 belonging to YFA and 30 belonging to other small boats in the area), the number to be repaired per year would be:

$$\underbrace{\frac{1{,}500 \text{ parts} \div 2 \text{ years}}{\begin{pmatrix}\text{parts required}\\ \text{per year}\\ \text{per 100 engines}\end{pmatrix}}} \div \underbrace{3 \text{ parts}}_{\begin{pmatrix}\text{parts per}\\ \text{individual}\\ \text{repair}\end{pmatrix}} \times \frac{60 \text{ engines}}{100 \text{ engines}} = 150 \text{ engines}$$

On the basis of 250 operating days per year, it could be expected that 0.6 engines would be brought into the facility each working day. Assuming that 4 days are needed per repair job, the number of engines in the shop on any one day would be:

0.6 x 4 days = 2.4 engines

If we further assume that 60 engines will be inspected and that 2 days will be required per inspection:

60 engines ÷ 250 days x 2 days = 0.48 engines/day.

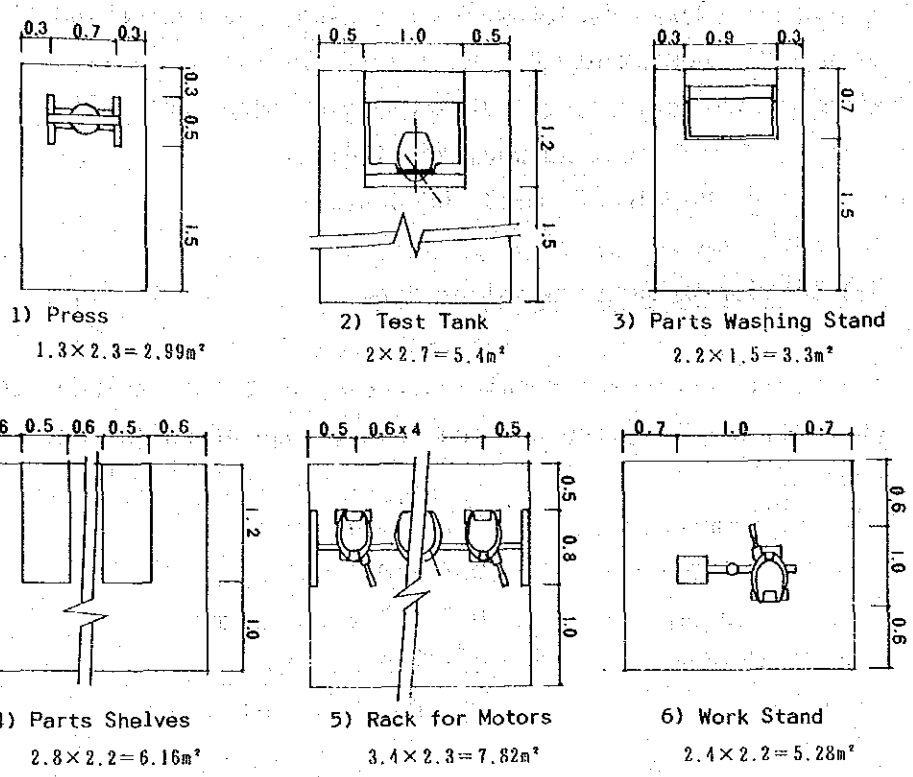
Therefore, the total number of engines tied up in the shop on any one day will be:

2.4 engines + 0.48 engines = 2.88 engines.

Accordingly, we have assumed in this plan simultaneous repairs on 3 engines.

Calculation of Required Floor space:

The repair equipment requiring dedicated space include the press, test tank, parts cleaning stand, parts shelf, and the rack (for 5 units). We have set the following space requirements for these items:



The floor area required to repair one outboard engine, based on use of the rack system, comes to:

2.4 x 2.2 x 3 units = 15.8

Total space for all equipment	25.67 m^2
Total repair space	15.80 m^2
Total	41.47 m^2

An area of 41.47 m^2 has been allocated for equipment repairs. Considering also the space requirements for receipt and dispatch and for access to the equipment, the required floor area for proper equipment deployment comes to about 50 m^2.

(2) Work Area:

This is to be a work area for repairs on 30 GT and 5 GT vessels. However, since the bulk of these repairs will be done on the

slipway, the repair operations contemplated for this area will include:

1. Parts replacement, cleaning, and repairs on detachable equipment.
2. Fabricating and assembly of pipes and parts.
3. Fabricating work on rigging.
4. Repair of small FRP boats.

Calculation of Required Floor Area

The repair equipment requiring dedicated space includes compressors, cutters, benders, and welding units, none of which requires a large area.

Compressor	0.7 x 1.0 = 0.70 m^2
Cutter	0.5 x 0.7 = 0.35 m^2
Bender	0.5 x 1.0 = 0.50 m^2
Welder	0.7 x 0.7 = 0.49 m^2
	Total 2.04 m^2

We will next calculate the required area for the above-designated operations:

Parts Replacement on Machinery and Equipment

The larger items to be repaired at this facility include engines, generators, and deck machinery, whose maximum dimensions can be estimated at about:

1.5 W x 1.5 L x 1.5 D m

Allowing an extra 1 m in both directions for each dimension, the space for the repair operations becomes:

3.5 m x 3.5 m = 12.25 m^2

Fabrication and Assembly of Pipes and Components

Based on a standard length of 4 m for piping material, the required space becomes:

5 m x 5 m = 25 m^2

Fabrication Work on Rigging

The space required to permit the diverse repairs on rigging, such as wooden items in the interior finish and on decks, should be sufficient to permit 2 persons to simultaneously conduct woodworking operations.

Considering, for example, repairs on the hold hatches, the hatch is 1 x 2 m. Adding 1 m in both directions to each dimension for repair and operating space, we have:

$$3 \text{ m} \times 5 \text{ m} \times 2 \text{ persons} = 30 \text{ m}^2$$

Repairs on small FRP Boats

The space needed to make repairs on 20 ft. FRP boat is about:

$$8 \text{ m} \times 3.5 \text{ m} = 28 \text{ m}^2$$

Accordingly, the total space requirement for all of the above functions works out to:

$$12.25 \text{ m}^2 + 25 \text{ m}^2 + 30 \text{ m}^2 + 28 \text{ m}^2 = 95.5 \text{ m}^2$$

However, it is most unlikely that these repairs would be done simultaneously. In this plan, therefore, we have allotted space on the basis of only 2 of the repairs being conducted at the same time.

The two repair functions requiring the most space are:

$$25 \text{ m}^2 + 28 \text{ m}^2 = 53 \text{ m}^2$$

After allotting extra space in the layout plan for equipment storage, entry and dispatch of materials, and lead lines to the machinery and equipment, we have arrived at a total requirement of 69 m^2 for this area.

(3) Management Office:

This office will supervise the repair and maintenance operations

at the repair facilities -- vis., the slipway and workshop. Personnel requirements will include a general manager, technical supervisor, and one assistant. Thus, the office would be the same size as that for the Fishery Complex.

We have allowed a floor area of some 33 m^2 for this office.

(4) Staff Room:

The technical staff at the workshop will involve, by the nature of the work, the following job skills: electrical and freezing equipment, engines, outboard engines, FRP hull work, and drydock repairs. However judging from the workloads, it will be possible to use the same staff for similar jobs -- e.g., engines and outboard engines, and rigging and FRP hulls. Accordingly, the personnel requirements for this facility may be set as follows:

Technical staff	7 persons
Rigging, FRP hull work	2 persons
Engines; outboards	3 persons
Electrical	1 person
Freezer	1 person
Drydock	(to be handled by above)

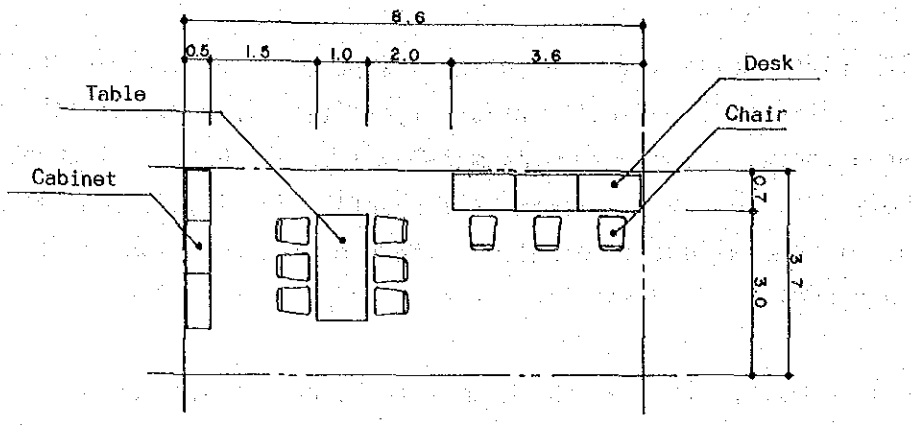
The staff room is intended to be used for the preparation of technical data, storage, relaxation, and changes of clothing and has been designed to accommodate 7 persons. The furniture to be incorporated in the room will include office desks (3), chairs (3), file cabinets (3), a rest table and chairs, and locker.

Allowing for proper layout and spacing, we have set the required floor space for this room at:

$$8.6\ m \times 3.7\ m = 31.82\ m^2$$

This works out to a density of 4.5 m^2/person, which we feel is appropriate in view of the nature of the work and the short periods the room will be used by any one individual. Accordingly, we are

allowing approximately 32 m^2 for this area.



(5) Storage Room and Lavatory/Shower

1) Storeroom for Materials

This space has been provided for the storage of outboard engine parts and spare engines; glass wool and resin liquid for use in FRP repairs; and materials needed for other repair work, such as piping and wood.

We have allotted 40 m^2 of floor area for this purpose, divided as follows:

10 m^2 for outboards, 10 m^2 for FRP, and
20 m^2 for other repair functions

2) Lavatory and Shower

We have provided a combined area for these purposes, in accordance with the size of the facility. This room will contain lavatories for both sexes and a shower room, with a total space requirement of about 15 - 20 m^2.

4.3 Layout Plan

4.3.1 The Concept

The plan facilities have entirely separate functions -- one is a fishing port, the other a vessel repair facility. In addition, the surrounding area contains various government buildings, the Legislature, and a Community Center (a basket ball court). The layout concept has been developed, as outlined below, with due consideration for these surroundings.

(1) Compatibility of the Plan with Future Requirements:

The west side of the planned site area faces the Community Center. The eastern side is reclaimed land leading to the sewage disposal plant, and there are no present plans to use this area. For this reason, we have located the vessel repair facility on the western side of the site, with a view to expanding this facility on the eastern side, should future fishery development render present wharf length inadequate.

(2) Holding Construction Expenses to a Low Level:

The proper grade for the slipway is about 1/10, and it would be desirable for construction to be done with minimum excavation and the minimum introduction of materials.

Based on soundings, we have located the facility so that the contour line will extend on a slant from the west side of the yard toward the sea. Since there is a considerable height variation of the supporting base foundation, we have arranged the layout and the base line of the wharf in such manner as to permit the use of construction methods entailing a minimum volume of work and so as not to impede the functions of the shore facilities.

(3) Layout based on Items to be Handled:

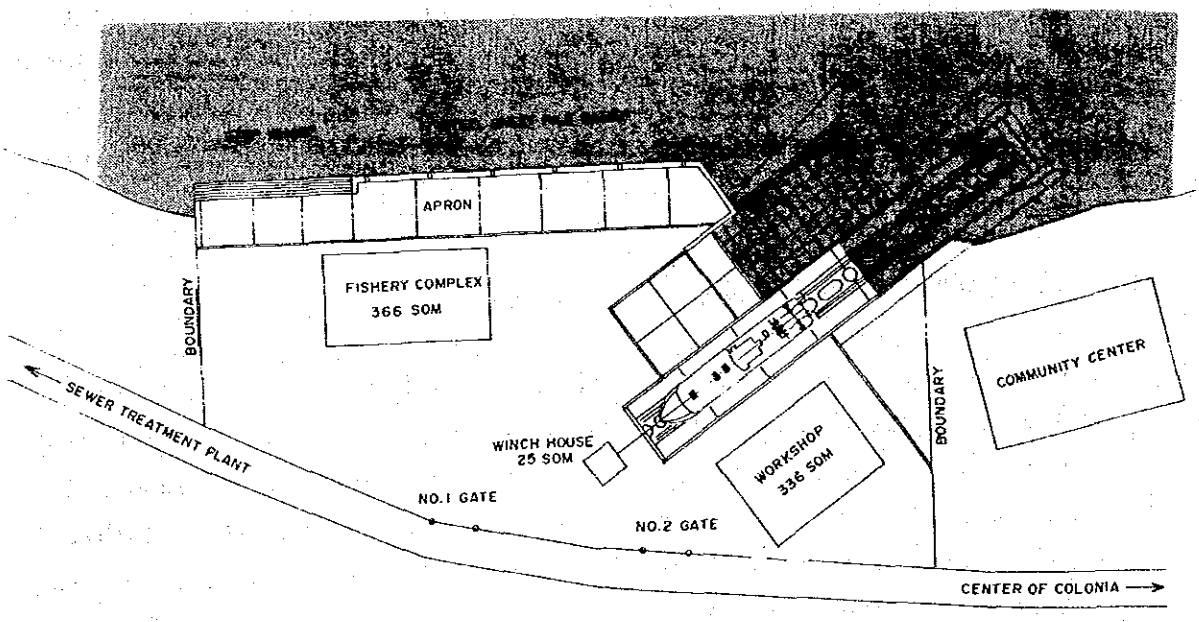
Facility functions are to be divided between a fishing port and

vessel repairs. The fishing port function may be further subdivided into the landing of catches and preparations for fishing. Fresh fish will be handled on the fish landing wharf but, since the wharf dedicated to fishing preparations will handle water, ice, and fuel, it has been located adjacent to the repair facility handling oils. In addition, the preparation jetty will require facilities on the jetty for water and fuel supply. However, since such facilities will not be needed on the landing wharf, the latter has been located on the eastern side to avoid the necessity for relocation in the event of fishing wharf extension in future.

(4) Smooth Handling of Materials:

The layout plan has given careful consideration to the flow of fish, ice, and other materials among the various facilities, including the existing market.

The layout plan is shown below.



Location Plan

4.4 Selection of Construction Scheme for the Fishing Port Facilities

The alternative types of mooring wharf include:

1) Gravity type
2) Steel sheet pile type
3) Steel pipe pile pier type
4) Step type
5) Floating pier type

Whichever the type used, the materials required for constructing the facility in Yap will, with the exception of coral sand for use in concrete and backfill materials, have to be imported from Guam, Palau, Japan, or other areas. We have, therefore, selected the optimum type of wharf based on a consideration of local building conditions and maintenance and management capabilities in Yap.

(1) Gravity Type:

With this type, construction is simple and no special equipment or construction methods are required, but, with the exception of fine aggregate for concrete use and backfill materials, large quantities of cement, coarse aggregate, and foundation stone would have to be brought in from outside, thereby raising construction costs to very high levels.

(2) Steel Sheet Pile Types:

Here, construction facilities would be relatively simple. The 2 - 4 m upper layer foundation at the construction site is hard reclaimed soil, while the soil below this layer is a blend of rough sand and fragment of coral. By removing the top layer, it becomes possible to drive in the steel sheet piles. Being fabricated of steel, this type of mooring wharf is subject to corrosion from seawater but, by additional thickness of steel sheet pile and anti-corrosion painting on surface, this problem can be dealt with.

(3) Steel Pipe Pile Pier Type:

Specialized machinery and large heavy equipment would be necessary to drive the piles.

The forms and reinforcement of the upper section are quite complex while the spray hitting the upper steel pipe section would require complex anti-corrosive treatment such as mortar coating.

(4) Step Type:

The construction conditions would be the same as with the steel sheet pile type.

This type would be appropriate for a fish landing wharf when boat size is small vis-a-vis the differences between rising and falling tides.

(5) Floating Pier Type:

This type is appropriate when tidal variations are large and the water is deep. However, in the plan location, these constraints do not exist and so the special feature of this type jetty cannot be given full play.

In terms of the connection with the shore facilities, since a restricted corridor is to be used, movement of materials would be inconvenient. Construction in Yap would also be difficult from a technical standpoint, and so the pier would have to be brought in from outside, with all the risks that this would entail. Also, this type pier would be serviced on shore once every few years, and to take the facility to Guam, Japan or elsewhere for repairs and repainting would make maintenance difficult indeed.

Based on the above considerations, we have elected to use the steel sheet pile type as the mooring wharf for the 30 GT and 5 GT fishing vessels and the step type for the outboard powered boats.

4.5 Plan for the Shore Facilities

4.5.1 Basic Construction Plan

The shore facilities are intended to supplement the functions of the fishing port facilities outlined in the previous section. The fishing complex will support the mooring facilities while the workshop will support the shiprepair facilities.
We have examined the functions and scale of these shore facilities and have prepared a construction plan covering such aspects as planal surface and structure. The basic plans for the various facilities have been designed from the following standpoints:

(1) With respect to the determination of planal scope, to the extent that reliable data, standards, or local precedents were available, we based the determination on these benchmarks. In the absence of such data, we established the scope on the basis of specific trial equipment layouts, taking account of the equipment to be incorporated in the plan facilities, the materials to be fabricated using this equipment, personnel movements, material flow, and equipment maintenance space.

(2) The determination of sectional scope (roof height and ceilings) was made on the basis of the requirements imposed by the operations to be performed in the plan facilities and the size of the equipment along with a consideration of the tropical environment, particularly the prevailing height of ceilings in Micronesia.

4.5.2 Planal Plan for the Fishery Complex

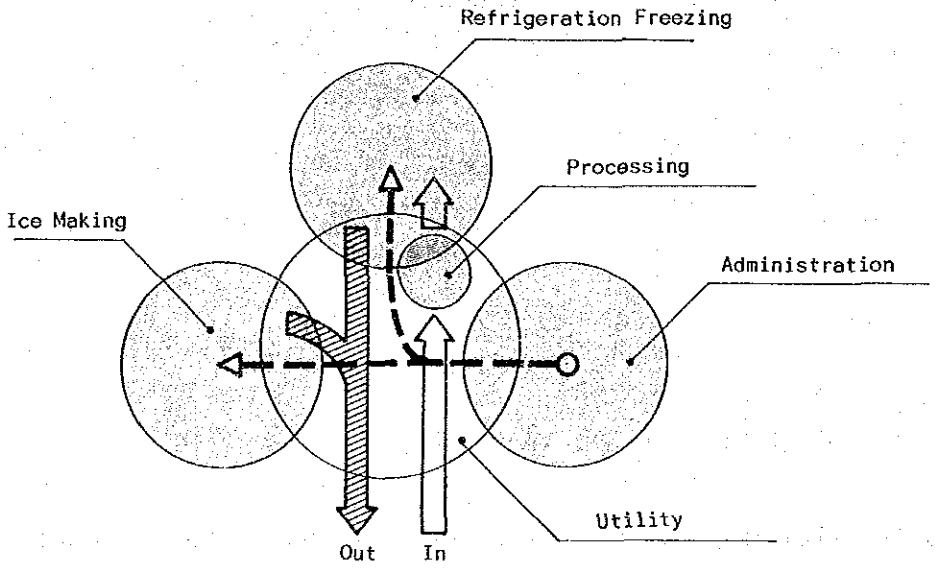
This facility is to be composed of a storage area, including processing and quick-freeze operations, an ice-making area, and an administrative area.

With respect to the storage area, we have arranged the various items of equipment so as to expedite the inward and outward movement of fish.

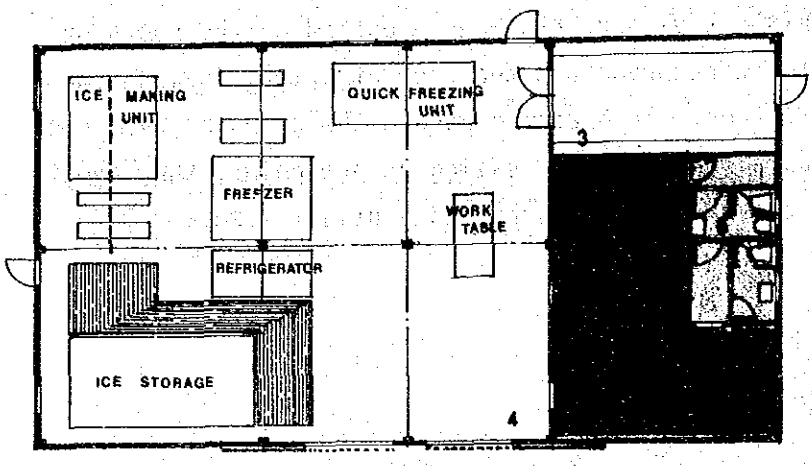
Catches are to be moved from the landing wharf to the processing room and then from the latter to either the refrigerator or the quick-freezer and, after freezing, to the freezer storage area, from which the fish will be sent to market as required.

In the ice-making and storage areas, it is planned to produce 2.5 tons of block ice in 12-hour cycles and then store this ice in the ice storage facility for release to market as required.

The layout of the administrative area has been prepared on the basis of movements to and from the work areas and the flow of materials into and out of the storage facilities. In order to handle the complex movements from these various areas without their crossing at any point, the layout provides core space in the facility to serve as a utility area.



By consolidating, in this manner, the major flow for catches, ice, and personnel in one line, we have sought to achieve optimum effective use of the area as well as efficiency in material flow. Following is the planal scheme for the plan developed on the basis of these findings. The plan floor area is 364 m^2.



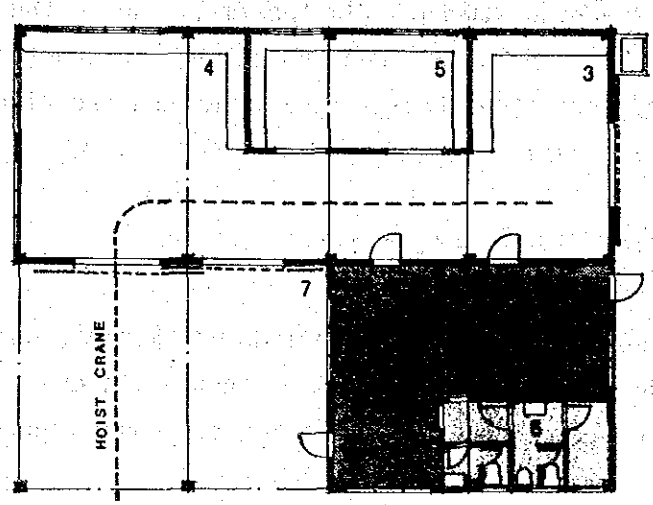
1 ADMI. OFFICE
2 STAFF R M
3 STORAGE R M
4 PROCESSING R M
5 LAVATORY & SHOWER R M

4.5.3 Planal Plan for the Workshop

This facility is composed of a repair area for outboard engines, a workshop area, and an administrative area.

The repair area for outboard engines and the workshop area may be considered to be fairly independent functions, with only minor linkage between them. The dominant element in the layout has been user convenience. That is to say, in the outboard repair space, we have assigned top priority to the access paths for visitors -- vis., the fishermen-

owners of the engines. In the workshop area, we have simplified the paths for the movement of materials from the slipway and have organically linked the various facilities, such as the work area and slipway, so as to centralize the repair function. The planal scheme is shown below. The plan floor area is 336 m^2.



1 MANAGEMENT OFFICE
2 STAFF R M
3 ENGINE REPAIR RM
4 WORK AREA
5 STORAGE R M
6 LAVATORY & SHOWER RM
7 EXTERIOR WORK SPACE

4.5.4 Construction Plan

This section will discuss the structure and components for the various facilities covered in the previous section.

(1) Structural Styles:

The most prevalent types of construction in Yap, the target plan area, are block and wood. Reinforced concrete is seen in some government buildings and steel construction is also seen in the customs warehouse in the Commercial Port and in large private wharehouses. However, as previously noted, since it is most

difficult to obtain good materials locally for concrete use, most of the factories, warehouses, and other large buildings in the plan area vicinity requiring high roof and wide span use steel-frame construction. Thus, one of the major characteristics of this area is the low incidence of reinforced concrete construction in large buildings.

The plan facilities -- both the Workshop and the Fishery Complex -- all have functions requiring both high roofs and wide span. From the standpoint of soil-bearing strength (10 tons/m^2), and in the interest of lightening building weight and shortening construction time, we have concluded that steel-frame rigid frame construction would be most appropriate here.

(2) Structural Component Plan:

In considering the component plan for the various facilities, our thinking has been essentially on the following lines, with due consideration being given to natural and sociological conditions:

... The facilities are to be located on the seaside, which makes them vulnerable to salt damage.

... This is an area of high temperature and humidity.

... The large rainfall is concentrated in an extremely short period.

... The key building materials must all be improted.

... The construction period is limited.

We have developed a plan for the various construction components based on the above conditions.

1) Roofing:

The most prevalent styles of roofing in the vicinity of the plan are pitched gable, hip, and flat roofs. For small homes, roofing materials are mostly thatch or corrugated iron sheets,

with concrete used on a portion of the flat roofs.

In medium-sized or larger buildings, the bulk of the roofs are long corrugated sheets.

For the subject facilities, we have specified the use of iron-sheet roofing on the grounds that this is the most common type in the area and is easy to build and maintain. With a view toward providing heat-resistant properties, it will be necessary to consider in the design the use of ventilation and insulation under the roof along with rust-proof treatment.

2) Exterior Walls:

The wall materials generally used in the area are wood, galvanized iron, and concrete block. But, considering that the wood and galvanized sheets must be imported, concrete block, which is produced locally, is relatively more frequent.

In this project, we have specified block structure for the lower portions of the walls up to about 3 m above ground level, since this material has good shock-resistance, and iron sheeting materials, the same as used in the roof, for the upper wall sections.

3) Interior Finish:

The floor finish will, in the interest of ease of operations, be standardized as mortar steel trowel, finish upon blind concrete. We are thinking of using tile in certain areas, such as the lavatory and shower room.

With regard to wall finish, paint on mortar will be used in the general wall areas for the base block sections; elsewhere, we will, in principle, apply no finish.

In the office and staff room, painted plywood will be used,

with tile used in the lavatory and shower room.

With respect to the ceiling finish, in general, no finish will be done in general work areas so as to improve ventilation. However, in the office and lavatory/shower room, painted plywood and perforated panels will be selectively used in accordance with the intended room use.

4.6 Structural Plan

4.6.1 Applicable Standards

The applicable standards in the FSM for construction design conform to those of the U.S. However, we will employ many items of Japanese equipment, while the construction is to be carried out by a Japanese contractor. As a result, the Yap State authorities have consented to the use of Japanese standards, and these will, therefore, be used in the following designs. The finishing port plan will be based on the Standards for Structure and Design for Fishing Ports (Japan Fishing Port Association, 1984 Revised Edition).

4.6.2 Soil Conditions

Figures 1 and 2 in the Appendix show boring locations and drilling logs in the construction area. The following conclusions can be drawn from these findings.

The basic foundation is green schist, which has metamorphized from the sedimentary rock. The gradient from the center of the reclaimed land is 1/4 - 1/5 toward the beach line and 1/7 - 1/10 toward the ocean side. The basic foundation has a natural accumulation of sand mixed with coral, with an N value of 15 - 40, and, in a portion of the site, are found soft silt layer. (BH-4).

The reclaimed land above this foundation is hard, composed of coral rocks or sandy soil mixed with basalt.

4.6.3 Seismic Design Intensity

Although seismic observations are not made in Yap, since the islands are of volcanic origin and neighboring Guam is known to be prone to earthquakes, and considering the reports of a major earthquake in Yap in 1911 and the fact that earthquakes, albeit minor, have been experienced in recent years, we shall employ a maximum seismic design intensity of 0.15, as used in the design of fishing ports in Japan.

4.6.4 Selection Criteria for the Works Facilities

The following selection criteria were used for the fishing port and shiprepair facilities:

(1) Design Criteria for the Fishing Port

1) Assumptions:

a) Target Facilities:

Mooring wharf for 30 GT and 5 GT fishing vessels	For the landing of catches	1 berth
	For fishing preparations and supply	1 berth
Outboard-powered boats	For the landing of catches and finishing preparations	(10 vessels lag vertically)

b) Facility Scope:

Length 80 m	30 GT / 5 GT	55 m
	Outboard-powered boats	25 m
Height	30 GT / 5 GT	C.D.L. +2.5 m
	Outboard-powered boats	C.D.L. +1.1 m ~ +2.5 m
Front-water depth	Plan depth	C.D.L. -3.0 m
	Design depth	C.D.L. -3.5 m

c) Structural Conditions:

30 GT / 5 GT	Steel sheet pile type
Outboard boats	Lower sections: Steel sheet pile type Upper sections: Step type

2) Natural Conditions:

a) Tides:

H.W.L.	C.D.L. +1.5 m
M.S.L.	C.D.L. +1.0 m
L.W.L.	C.D.L. +0.0 m

b) Seismic Design Strength:

KH = 0.15
KV = 0.0

c) Foundation Conditions:

The bearing layer exists at depth of C.D.L. -12 m. The sand layer, which has N value 15 - 30, exists between the ground surface and bearing layer.

Bearing Layer:

Internal friction angle	40°
Bulk density	1.8 t/m^3 (Moist) 1.0 t/m^3 (Boyed)
N value	50

Sand Layer:

Internal friction angle	35°
Bulk density	1.8 t/m^3 (Moist) 1.0 t/m^3 (Boyed)
N value	25

3) Material Conditions:

a) Unit Weight:

Concrete	2.3 t/m^3
Reinforced concrete	2.45 t/m^3
Ballast; filled land	1.8 t/m^3 (in air) 1.0 t/m^3 (in water)
Seawater	1.03 t/m^3

b) Allowable Stress of Concrete:

Design strength	σ ck = 180 kg/cm^2
Allowing bending compressive stress	σ ca = 60 kg/cm^2

c) Friction Coefficient:

Concrete and ballast	0.6
Concrete and concrete	0.5

4) Land Strength:

US = 1.0 t/m^2

(2) Shiprepair Facilities:

1) Assumptions:

a) Target Facilities:

Slipway for 30 GT use

Ramp for 5 GT fishing vessels and outboard-powered boats

b) Facility Size:

Slipway	Rail length	70 m
	Rail width	4 m
	Gradient	1/10, 1/13, 1/16
Ramp	Length	45 m
	Width	13 m
	Gradient	1/10, 1/30

2) Natural Conditions:

(Same as for the fishing port)

4.6.5 Design Conditions for the Shore Facilities

(1) Target Facilities and Scope:

1. Workshop -- a one-story steel-frame building of 336 m^2
2. Fishery Complex -- a one-story steel-frame building of 364 m^2

(2) Natural Conditions:

These are the same as for the fishing port. However, with respect to wind pressure strength, based on records of the Yap Meteorological Bureau, the maximum wind velocity was recorded in 1960 at 72 miles/hour (37 m/sec.). (No observations have been made of maximum instantaneous velocity.) In this plan, therefore, we have applied Japanese standards.

Speed pressure = $q = 60\sqrt{h}$ kg/m^2h (height from ground)

Wind pressure is derived from the following formula

$W = q \times C$ kg/m^2C ... wind-force coefficient

4.7 Facility Plan

4.7.1 Power Facilities

Power supply in the area is distributed over high-voltage trunk lines from the generating station under the jurisdiction of the Department of Planning and Statistics, Utilities and Contracts Section. The power line crosses the plan site in an east-west direction.

Power is carried overhead to the Sewage Treatment Plant on the eastern side of the site. It will be distributed from 3 high-voltage lines of 4000 V, 60 Hz and will be brought into receiving power boards at the plan facilities via a transformer on the pole.

The load voltage for the facilities will be on the following standard:

Lighting and wall outlets	Single-phase 110 V, 60 Hz
Power	3 phase 220 V, 60 Hz

The power system may be sub-divided into power for lights and wall outlets and powered facilities.

(1) Lighting and Wall Outlets:

From the standpoint of maintenance and ease of handling, it would be desirable to procure bulbs whenever possible in Yap. In this area, fluorescent and incandescent lighting fixtures are most generally used. In the subject facility, we shall use mainly fluorescent fixtures, with incandescent type used as necessary. The illuminance of the various rooms will, in line with local conditions, be as follows:

Office	400 LUX
Staff room	300 LUX
Processing and repair areas	300 LUX
Ice, refrigerator, freezer	300 LUX
Lavatory and shower room	100 LUX

We will also provide lighting fixtures for night work at the mooring and shiprepair facilities as well as inside the fishing port facilities.

The circuits for the wall outlets will be standardized at single-phase 110 V.

(2) Powered-Facilities:

Powered equipment at the fishery complex will include a freezer, refrigerator, and ice plant and, at the workshop, compressors, machine tools, and welding equipment. Power will also be required at the slipway for the lifting winch.

4.7.2 Water Supply and Drainage Facilities

(1) Water Supply:

Water will be brought into the site from municipal water mains (3 inch) laid along the road leading to the site. The facilities requiring water supply at the fishery complex include the ice plant, water to clean the catch, and water for general use, such as in the washrooms and showers. In the workshop, a small amount of water will be required for the cleaning of work areas and for general use in the office and lavatory. We have also provided water supply facilities at the preparation wharf.

With respect to the municipal water mains, there will be no problems with water pressure or water volume. Water will be brought in to each facility with direct connection from the water mains and then distributed to the various taps.

(2) Drainage:

A portion of the sewage and general-use water in the vicinity of the site area is drained via sewage pipes at both private and governmental facilities. Otherwise, drainage is generally

discharged directly into the water or disposed of via evaporation and seepage.

The drainage system for the subject facilities may be sub-divided into sewage, miscellaneous water, water from work areas, and rainwater. Sewage and miscellaneous water will be drained together, via direct drainage through sewage pipes laid along the adjacent road. Drainage of oily water from the work areas will be processed by the trap method, whereby the oil is first separated and the water then evaporated and seeped. Rainwater drainage will be directly into the sea in front of the site through drainage pipes.

(3) Fuel Supply:

Fuel supply facilities will be provided for the 30 GT and 5 GT fishing vessels and to outboard-powered boats belonging to YFA.

The capacity of the fuel storage tanks will be 10 Kℓ for diesel fuel and 5 Kℓ for gasoline. The tanks will be located near the yard entrance; diesel fuel will be fed via underground pipes to the supply wharf and loaded on vessels by means of hoses.

In the case of gasoline, a supply nozzle will be provided near the tank for filling portable tanks brought by users. Designs for dangerous substances, such as the fuel tanks, will follow Japanese standards.

4.8 Equipment Plan

This plan covers the various items of equipment for repair use that are to be installed in the workshop repair facilities. The functions of this equipment are designated as follows:

1. Inspection and repair work on 30 GT and 5 GT fishing vessels.
2. Inspection and repair work on outboard engines.
3. Repair work on the freezer and other items.

Selection of this equipment was based on the following conditions:

... Equipment was selected of a type and in such quantities as to fully meet the conditions inherent in the basic functions and repair scope of the workshop.

... In principle, we avoided equipment whose use would require a high level of skills.

... The selected equipment must be easy to maintain and service.

... We have avoided, insofar as possible, equipment requiring replacement parts or expendables that would normally be difficult to obtain locally.

Following is a description of and specifications for the equipment that has been selected on the basis of the above conditions:

(1) Outboard Engine Repairs:

The equipment required for purpose may be classified into machinery for repair use, tools, equipment, and receptacles.

Japan has considerable background and experience in operating this type of facility. The required equipment has been choosen, based on this experience, with due allowance for local conditions. A summary of the equipment for this function is as follows:

Equipment for repair use:
- Hydraulic press
- Drill machine
- Vice
- Grinder
- Parts cleaning stand

Facilities:

Test equipment for outboard engines	(test tank)
Air supply equipment	(compressor)
Work bench	(work table)
Work stand	(work rack)
Charger unit	(battery charger)
Materials handling facilities	(chain blocks)

Receptacles:

- Cabinets
- Parts shelf

Tools:

- Set of repair tools

(2) FRP Repairs:

Equipment required for FRP repairs may be classified into tools and other equipment.

The most important elements affecting FRP repair work are: 1) the environment in which the repairs are made; 2) the level of repair skills; and 3) the selection of glass fiber and resin materials. With proper knowledge of these areas and facilities geared to these considrations, FRP repairs are not all that difficult to perform.

Following is an outline of the equipment and materials used in FRP repairs:

Tools:

- Sandpaper
- Disc sander
- Hacksaw
- Drill
- Scale

Material:

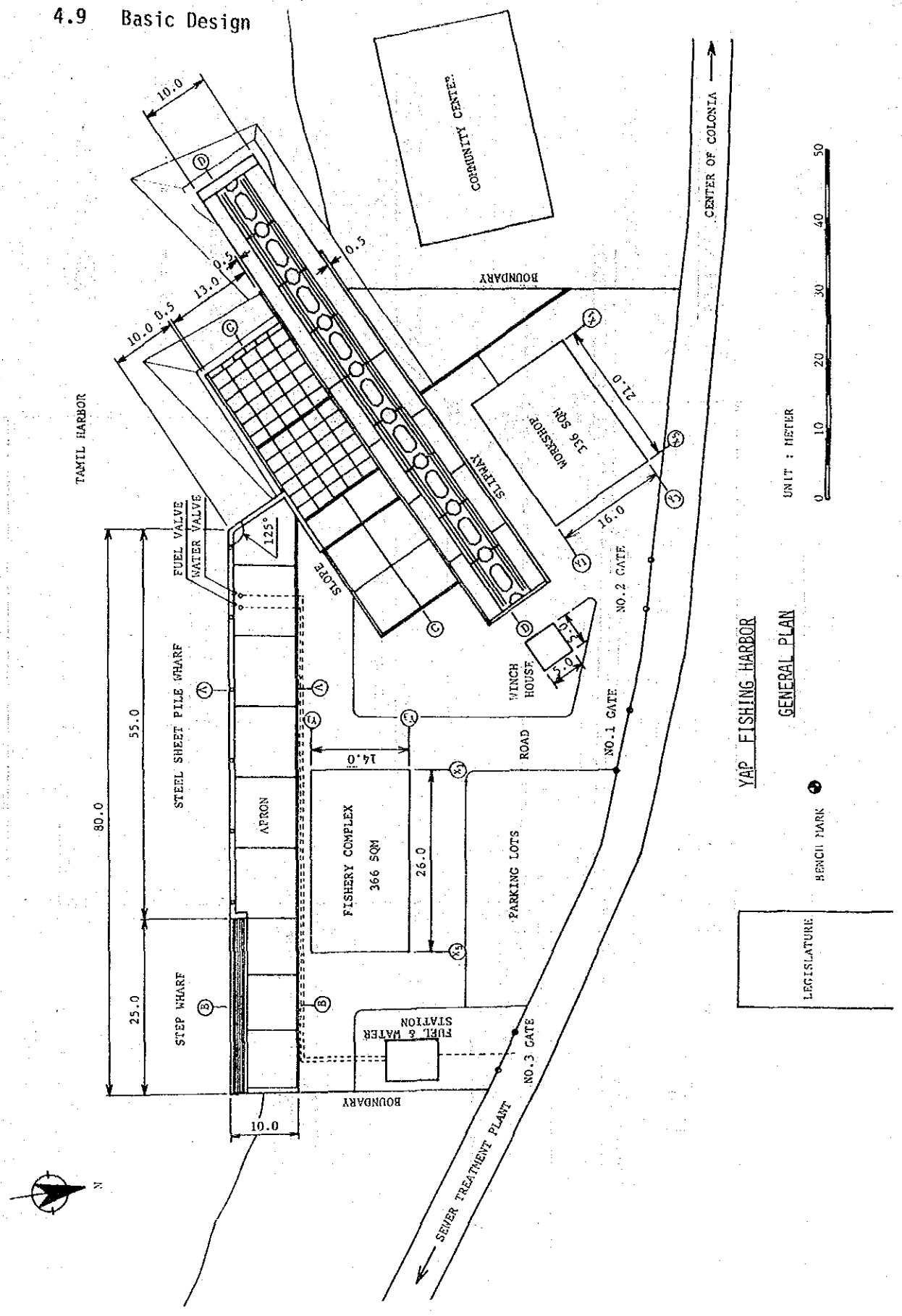
Polyester resin
Gelcoat
Acetone
Glass cloth
Glass rubbing cloth
Glass mat

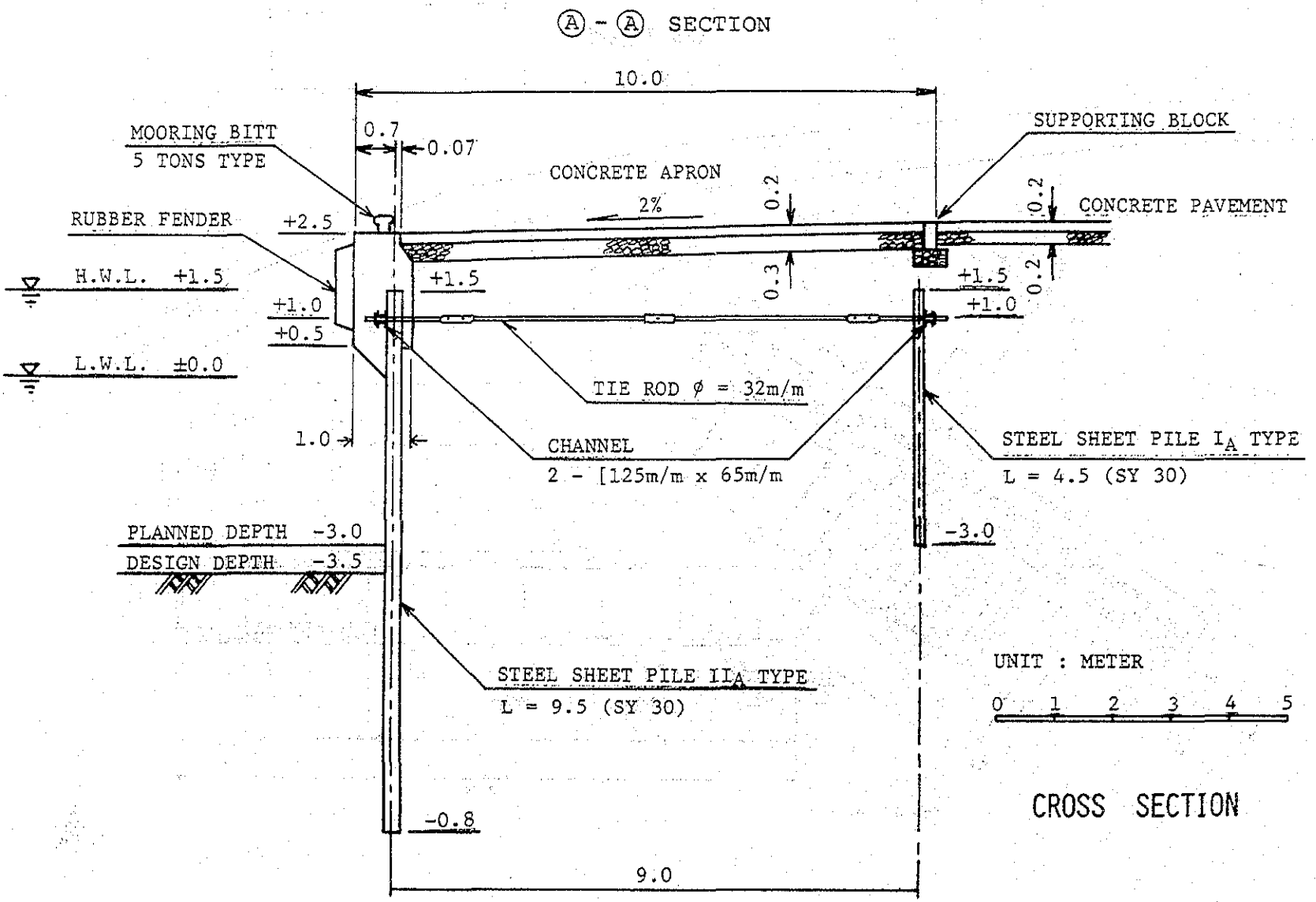
(3) Other Equipment:

We have selected certain other tools and equipment, as shown below, for use in repair work on fishing vessels and fishing gear. This equipment covers a wide range of applications, including refrigeration and freezing equipment, piping work, hull repairs, and rigging.

Welding and cutting machines
Pipe-bender
Surface measuring gauge with magnet
Diesel nozzle tester
High-speed cutter
Other tools

4.9 Basic Design

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5 TONS TYPE
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0.07
CONCRETE APRON
2%
SUPPORTING BLOCK
0.2
0.2
CONCRETE PAVEMENT
RUBBER FENDER
+2.5
H.W.L. +1.5
+1.5
0.3
+1.5
0.2
+1.0
+1.0
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L.W.L. ±0.0
TIE ROD ϕ = 32m/m
1.0
CHANNEL
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STEEL SHEET PILE IA TYPE
L = 4.5 (SY 30)
PLANNED DEPTH -3.0
DESIGN DEPTH -3.5
-3.0
STEEL SHEET PILE IIA TYPE
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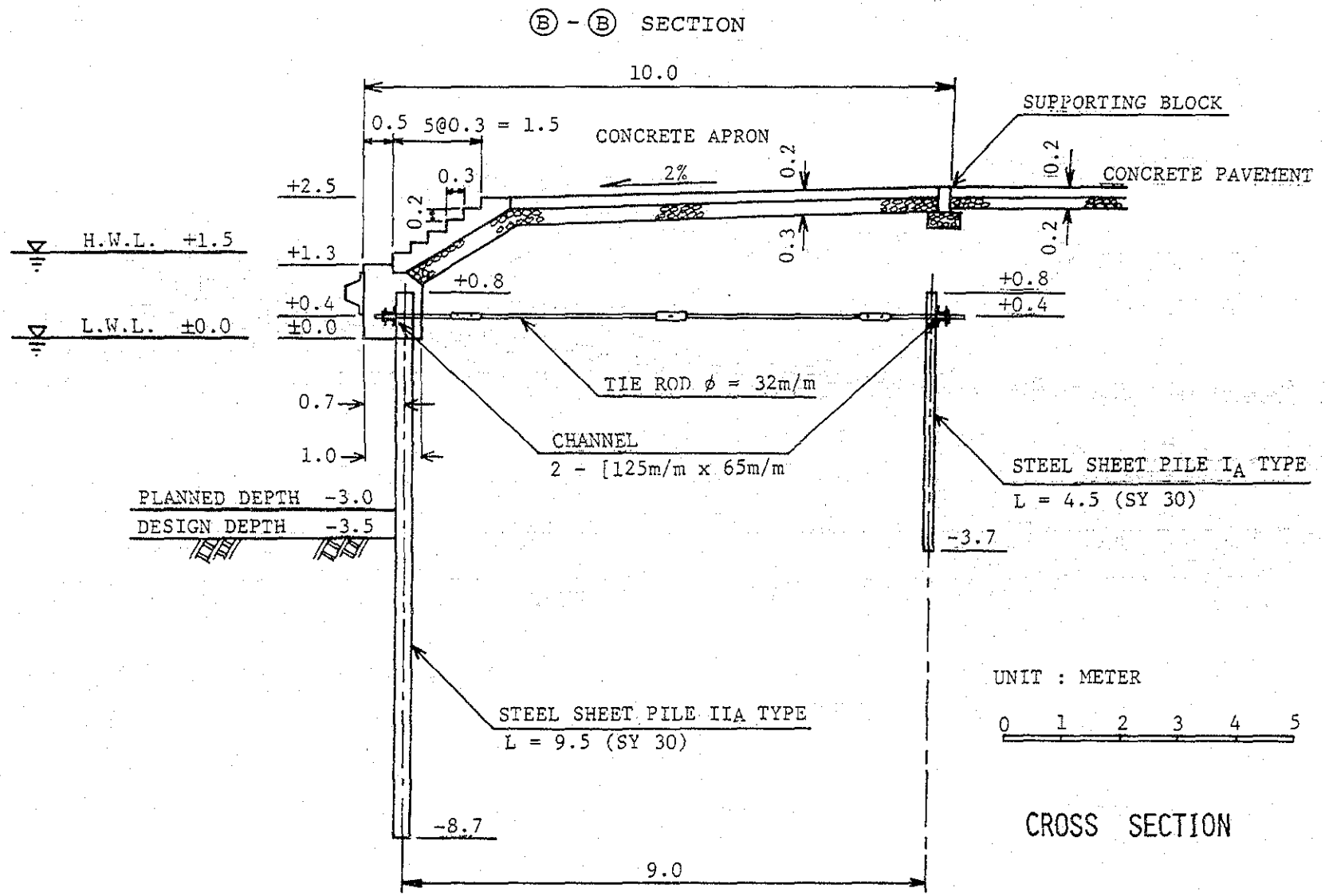
Ⓑ - Ⓑ SECTION
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CONCRETE APRON
2%
SUPPORTING BLOCK
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±0.0
TIE ROD ϕ = 32m/m
CHANNEL
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PLANNED DEPTH -3.0
DESIGN DEPTH -3.5
STEEL SHEET PILE IA TYPE
L = 4.5 (SY 30)
-3.7
STEEL SHEET PILE IIA TYPE
L = 9.5 (SY 30)
-8.7
9.0
UNIT : METER
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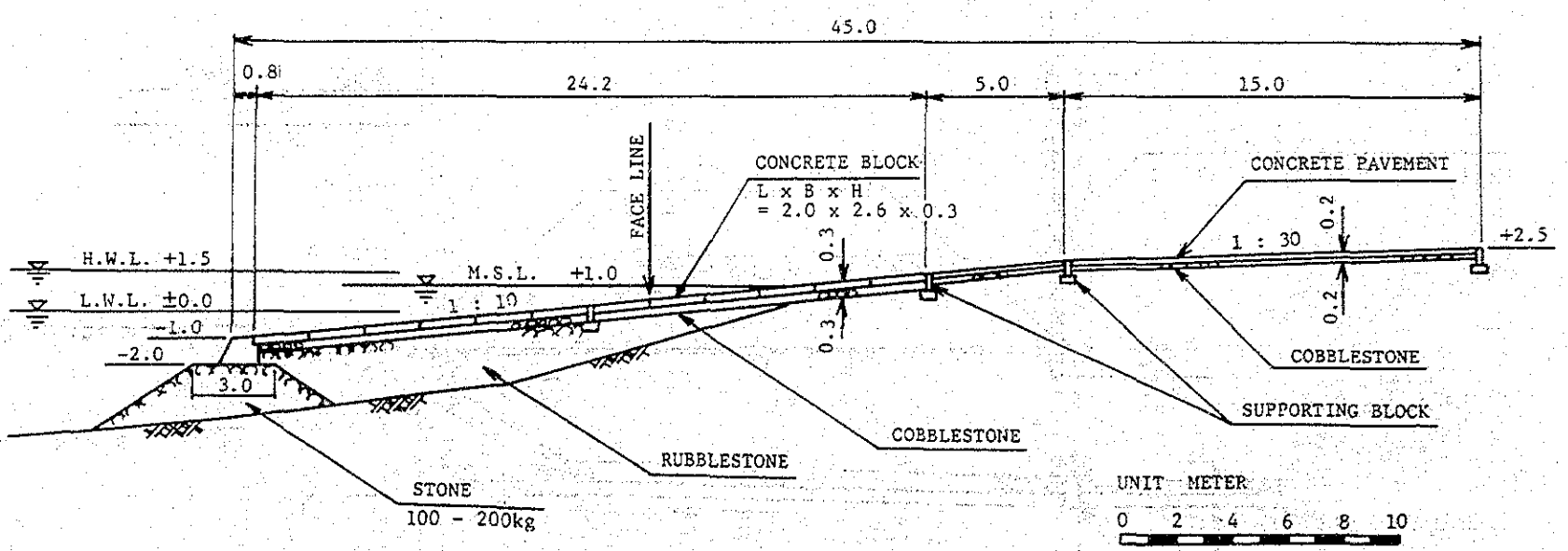
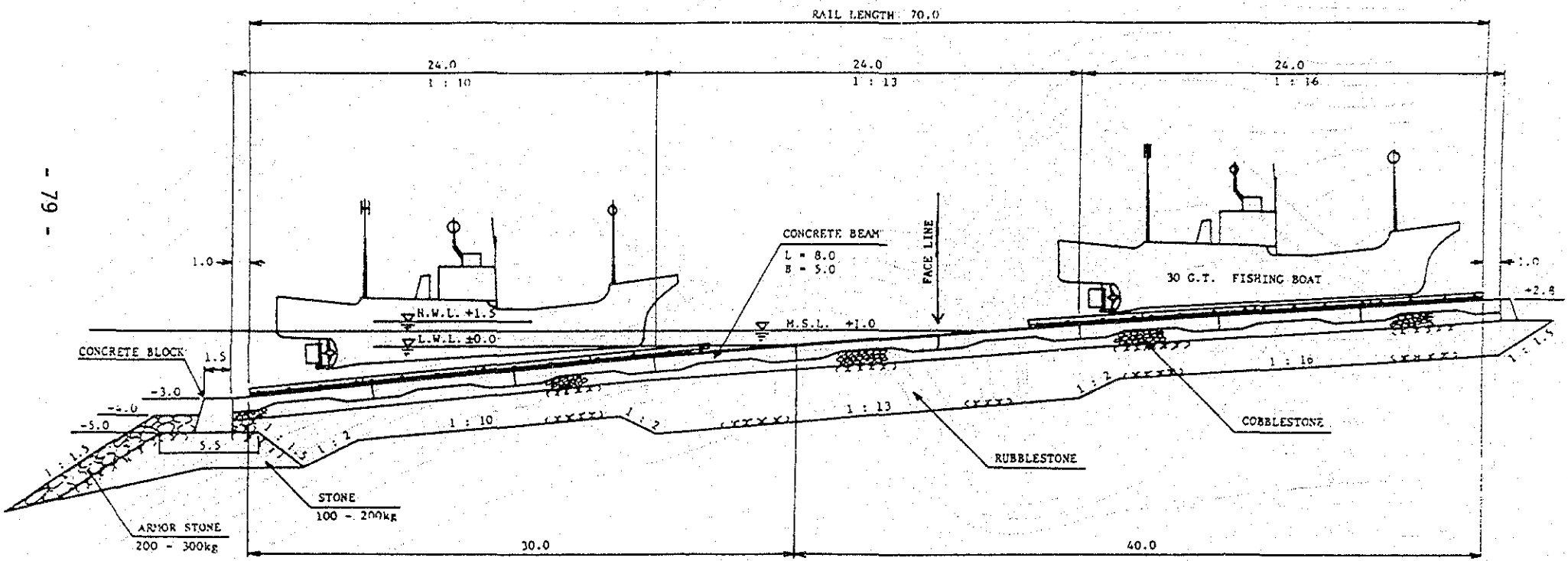
CROSS SECTION

Ⓒ—Ⓒ SECTION SLOPE



CROSS SECTION

Ⓓ—Ⓓ SECTION SLIPWAY



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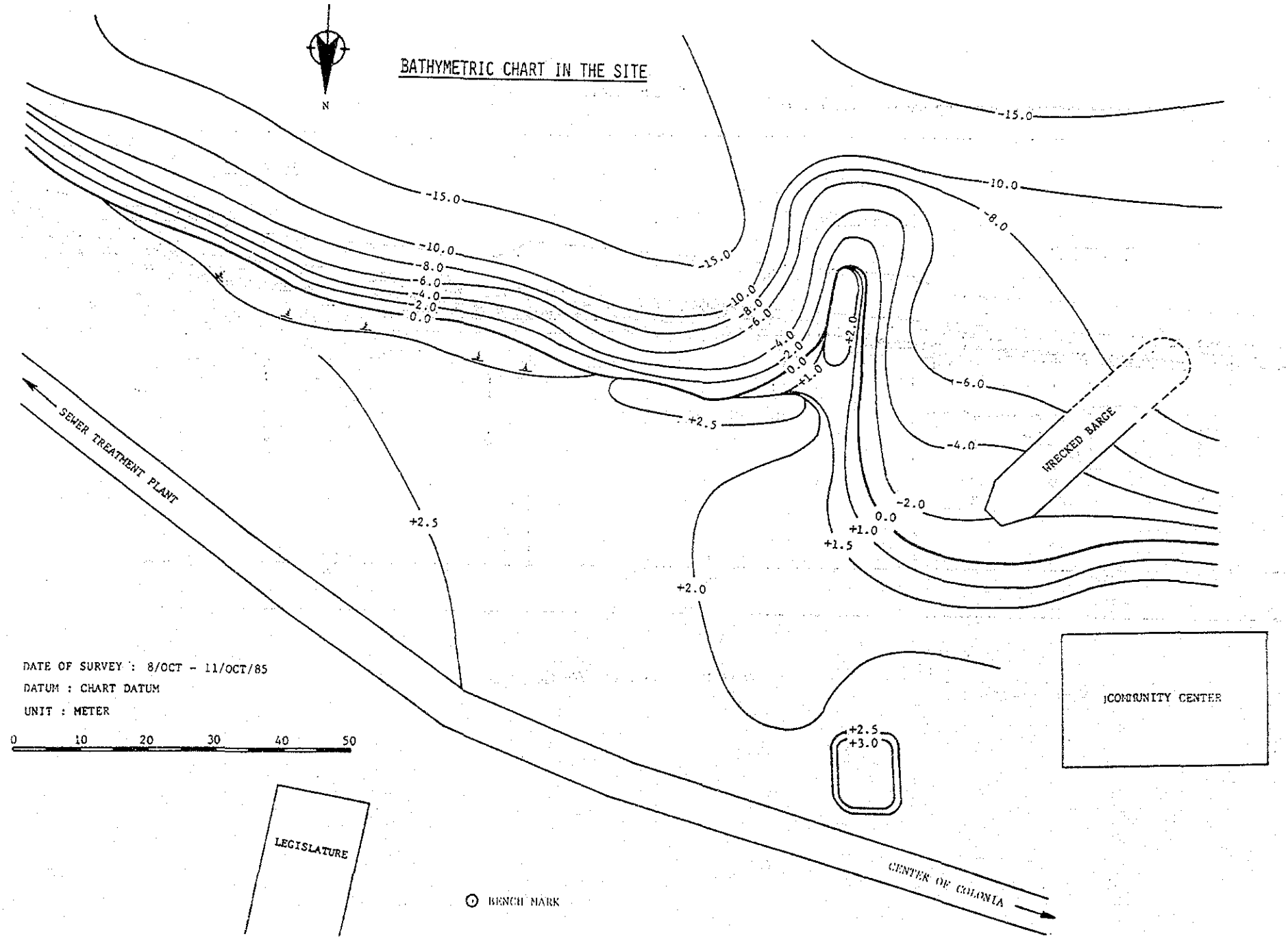
BATHYMETRIC CHART IN THE SITE
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-15.0
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WRECKED BARGE
SEWER TREATMENT PLANT
COMMUNITY CENTER
LEGISLATURE
CENTER OF COLONIA
BENCH MARK
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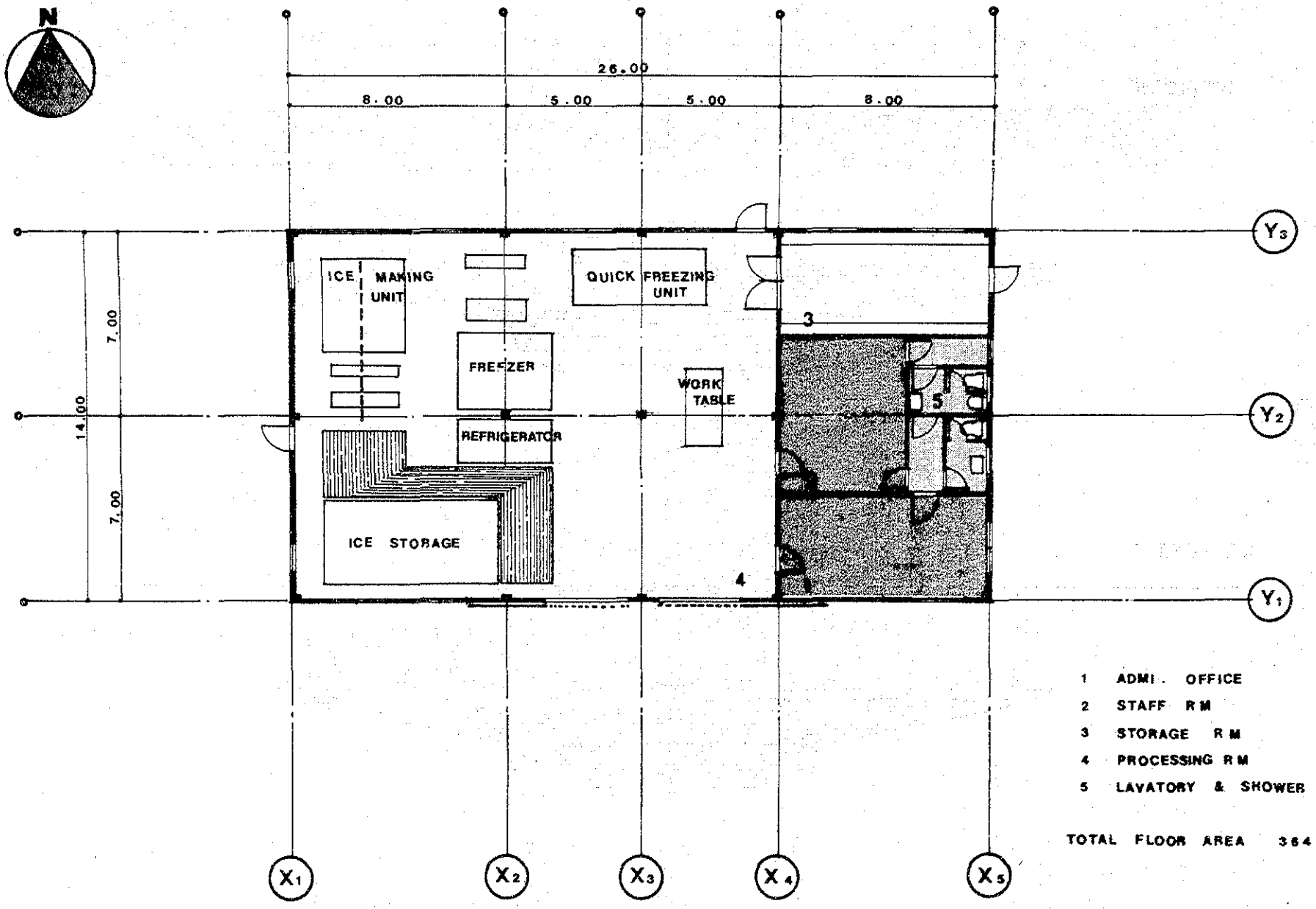
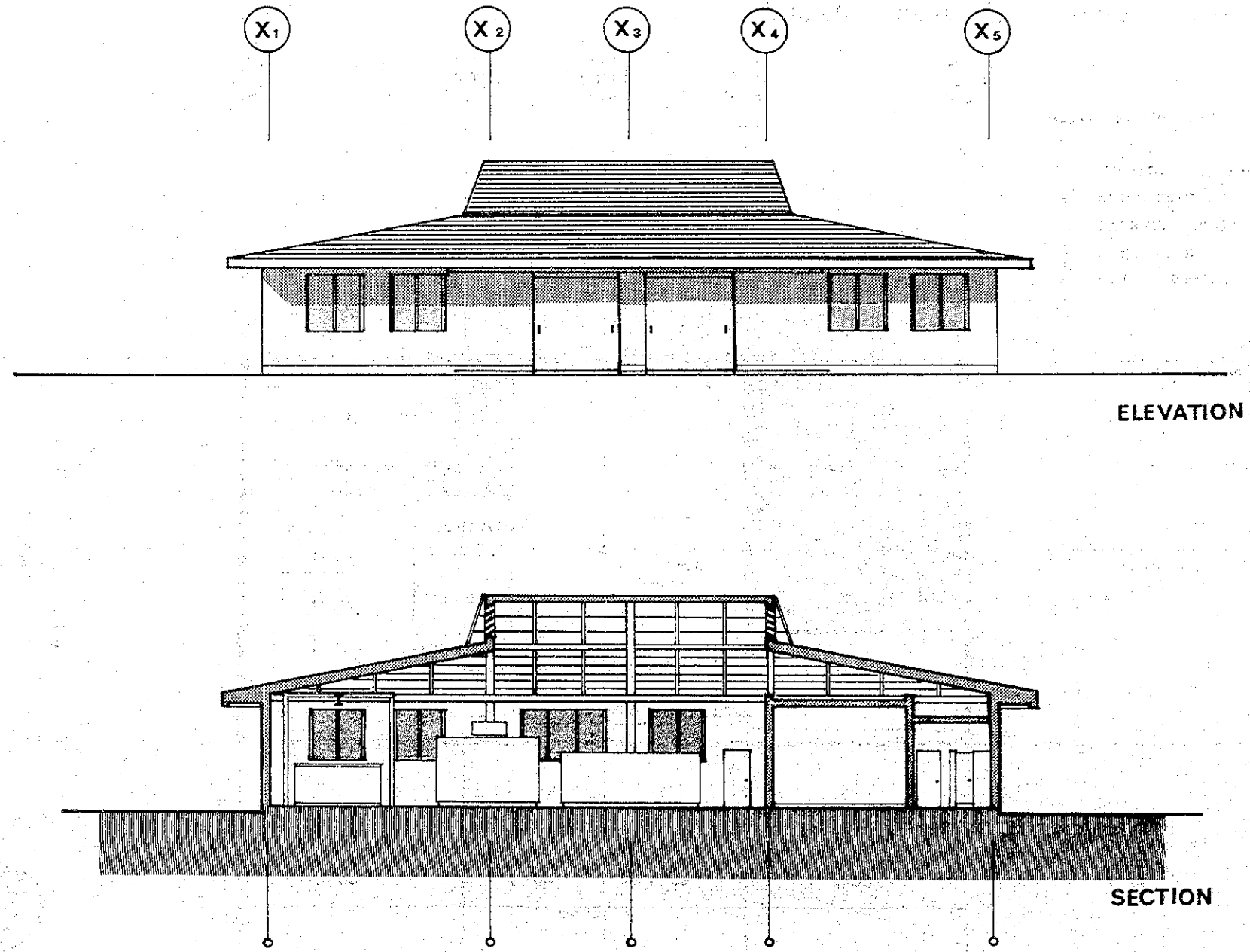


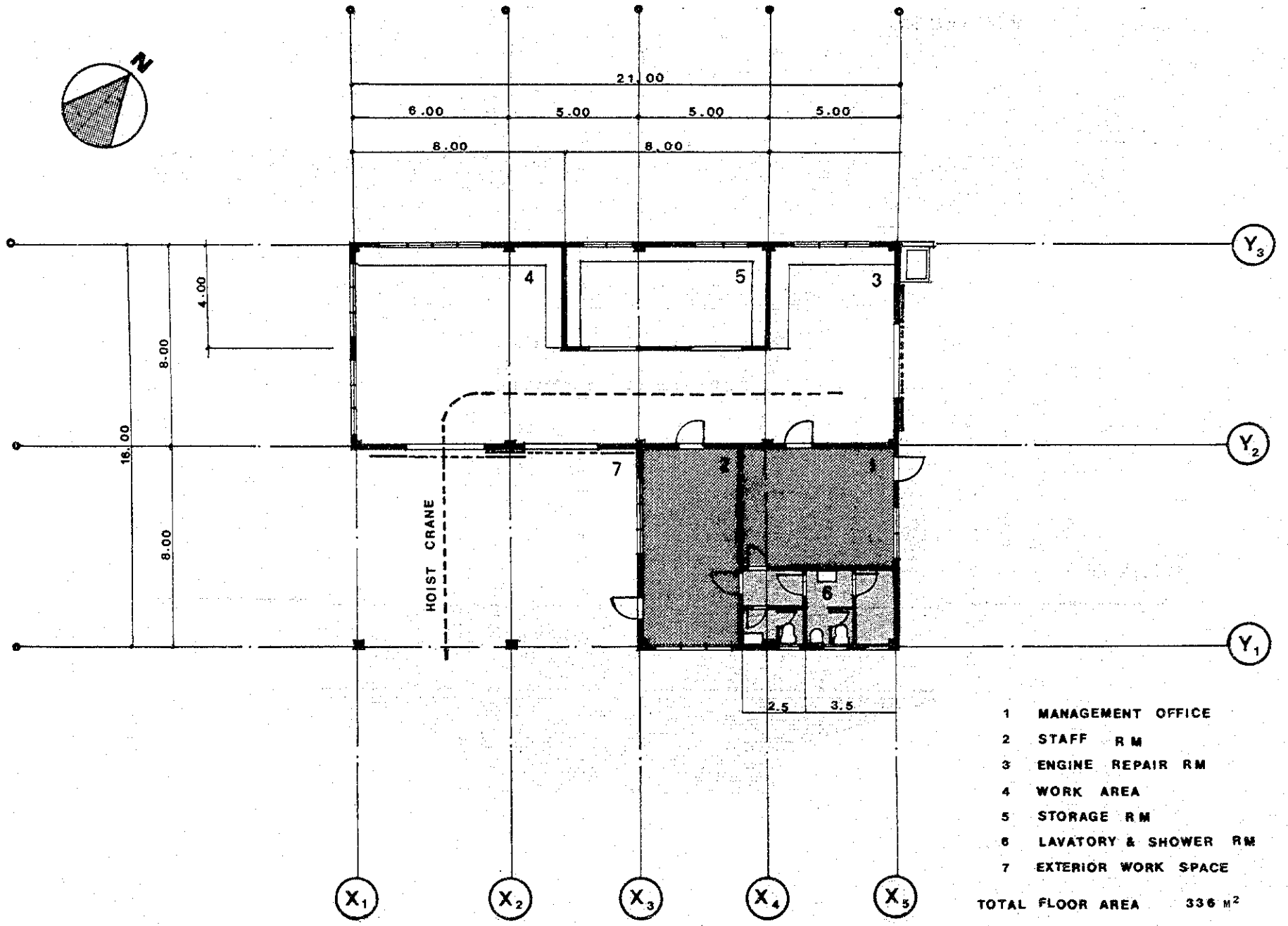
1 ADMI. OFFICE
2 STAFF R M
3 STORAGE R M
4 PROCESSING R M
5 LAVATORY & SHOWER R M.

TOTAL FLOOR AREA 364 m²

FISHERY COMPLEX FLOOR PLAN S = 1 : 200 m



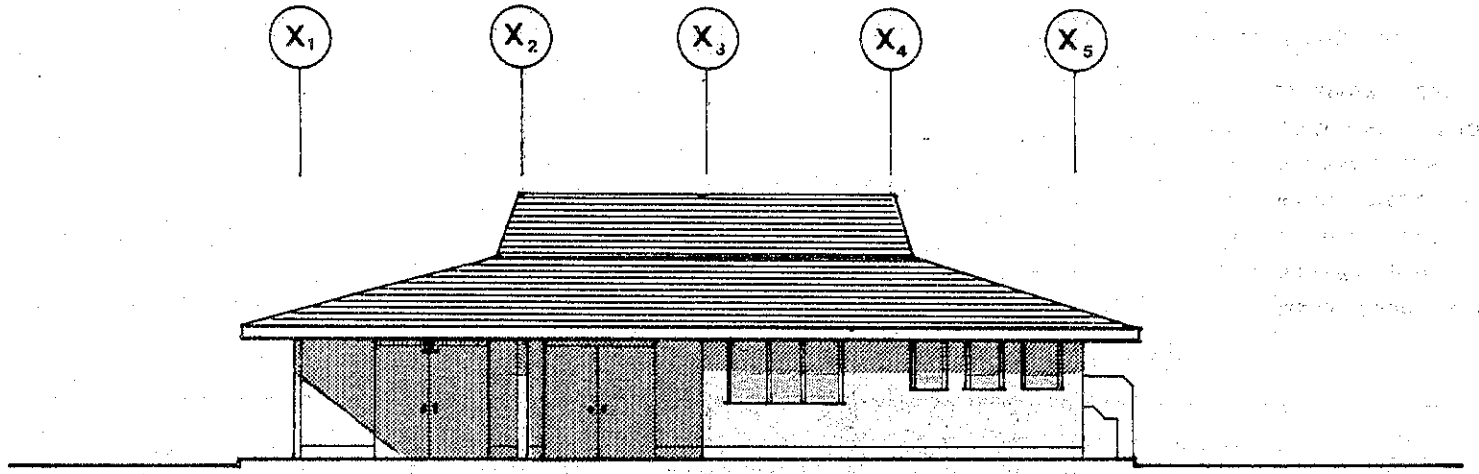
FISHERY COPLEX S = 1 : 200 M



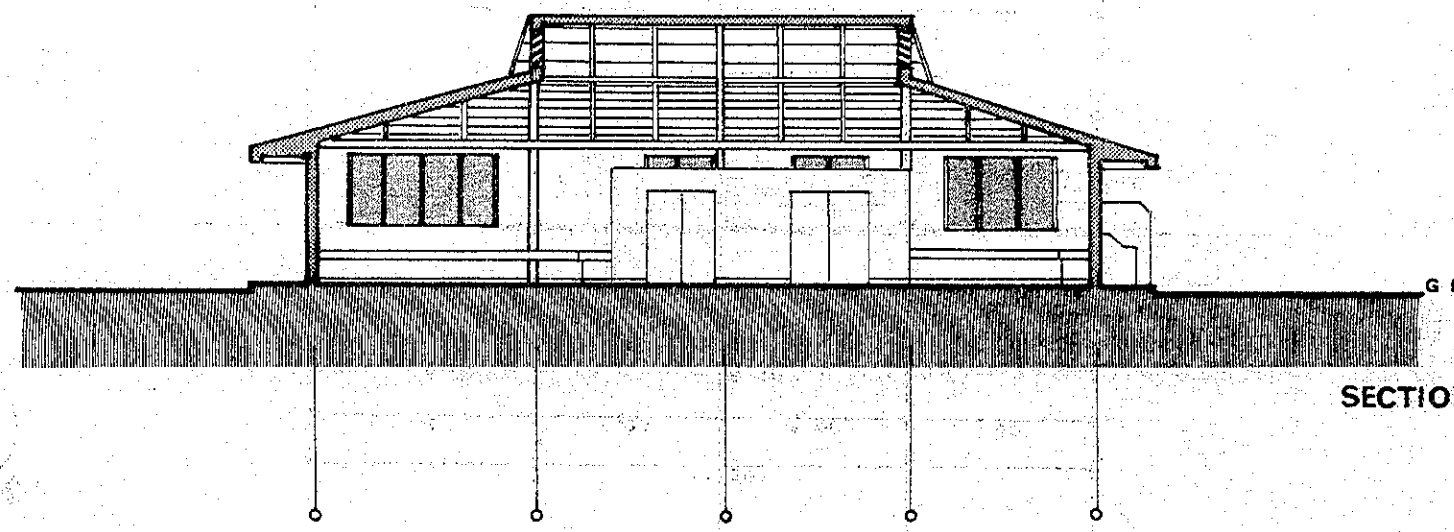
1 MANAGEMENT OFFICE
2 STAFF R M
3 ENGINE REPAIR RM
4 WORK AREA
5 STORAGE R M
6 LAVATORY & SHOWER RM
7 EXTERIOR WORK SPACE

TOTAL FLOOR AREA 336 M²

WORKSHOP FLOOR PLAN S = 1 : 200M



ELEVATION



SECTION

WORKSHOP

S = 1 : 200

4.10 Scope of Construction

4.10.1 Scope

The subject plan is targeted at 30 GT and 5 GT fishing vessels and small boats, equipped with outboard engines, owned by YFA. It is designed to provide, on the basis of a grant-in-aid from Japan, a fishing port infrastructure, including fish landing, storage, supply and repair facilities. The scope of the program is outlined below:

1) Securing a site for the fishing port.

2) Construction of fishing port facilities and fishery complex.

3) Procurement of supplies and equipment for the fishing complex.

4) Provision of services relating to implementation and supervision of the above.

5) Making all procedural arrangements and obtaining approvals in connection with project implementation.

4.10.2 Division of Responsibilities between the FSM and the Government of Japan

Assuming that this project is implemented on the basis of a grant-in-aid from Japan, the respective responsibilities of the two sides would be as follows:

1) FSM -- Areas of Responsibility and Courtesies:

   a) Securing a project site and making any necessary site preparations, including the sea area, to eliminate obstructions.

   b) Provision of electric power and incidental facilities and bringing power lines into the site.

   c) Securing the necessary water supply.

d) Customs clearance and payment of all charges, including duties and clearance charges, in connection with importing into the FSM the various materials and equipment.

e) Taking steps to exempt Japanese personnel, who come to the FSM in connection with the provision of construction equipment and services, from all taxes and other assessments.

f) Securing and granting to Japanese and related individuals such approvals, licenses, and other privileges as may be necessary for project implementation.

g) Securing the necessary budgets for effective maintenance and management of the facilities to be constructed under the project and the costs of preparing the necessary furniture and fixtures.

2) Responsibilities of the Japanese Side:

a) Procurement of all required materials, equipment, and labor for the construction work.

b) Arrange for ocean and inland shipping, including insurance, of the materials and equipment to be imported for the construction project.

c) Consulting services on detail design, assistance on bid tenders, and supervision of the construction work.

4.11 Estimate of Cost to be borne by the FSM Side

Cost for removing ship wreck from the proposed site is estimated at 39.6 Million Yen.