

## SECTION FOUR: BASIC DESIGN

### 4.1 Design Guidelines

(1) Building the Plan facilities will require that the construction work be completed and the equipment installed within a specified period on outer islands that are isolated from South Tarawa, with poor transportation access. Considering the lack of skilled technicians in the target area, the Plan will be based on the simplest and easiest possible construction methods, with careful attention to be paid to convenience of equipment transport and shortening construction time.

(2) While the facilities will naturally be expected to function as support facilities for the outer island fisheries, consideration will also be given to their contribution to the infrastructure of the 3 Plan islands, where agricultural development potential is small and fisheries represent a vital part of the islanders' livelihood.

(3) The ice-making facilities included in this Plan are already being used on South Tarawa and certain islands on which similar programs have been carried out, but this equipment is being introduced on the Plan islands for the very first time. While support can be enlisted from the Fisheries Division for maintenance and repairs, technical specifications have been drawn up so as to enable Council staff to carry out as many of the daily operations and maintenance requirements as possible. Equipment manuals, therefore, will be distributed to all Plan sites to facilitate maintenance and repairs.

(4) In order to achieve a smooth takeoff in facility operations and maintenance programs, the Kiribati government will be asked to provide technical support to the 3 Councils, particularly in connection with facility and equipment care. Similar assistance is expected in preparing the outboard motors which are to be used on various islands. These motors are beginning to make inroads in outer island fishing operations and daily life in general, and so there is a great need for repair and maintenance facilities to increase the rate of vessel motorization still further. This requirement can be met by utilizing the Plan workshop and developing a system for dispatching repair mechanics, as needed, to the Plan islands.

## 4.2 Design Conditions

### 4.2.1 Design Accuracy

Based on the results of the Basic Design for the Plan facilities, construction plans have been prepared on a scale of 1/100 to 1/150, and layout plans on a scale of 1/300 to 1/400. Facility construction costs have been estimated on the basis of these plans, subject to a variance of not over  $\pm 10\%$ .

### 4.2.2 Applicable Standards

Kiribati has no particular structural design standards. While the Public Works Division is guided mainly by British standards, these are not necessarily uniformly applied. Judging by the natural conditions, there is no need for particularly stringent standards, but we will apply the following standards for wind pressure. As no earthquakes have ever been reported in the area, seismic strength has not been taken into consideration.

Wind pressure  $q = 60 \sqrt{h}$   
q : velocity pressure  
h : height ( m ) from foundation

Although no materials were available to shed light on foundation conditions in the Plan area, since the soil quality is coral sand, we have determined that there is a no danger of uneven subsidence or related problems.

## 4.3 Basic Plan

### 4.3.1 Facility Placement Plan

All of the Plan sites are quite narrow, compressed between the road and lagoon on Aranuka and Maiana, and, on Kuria, which has no lagoon, between the road and the outer reef. On all three plots, the road is, by and large, located on the eastern side and the sea on the western. The areas of the sites are : 55 m x 75 m on Kuria, 40 m x 48 m on Aranuka, and 45 m x 25 m on Maiana. In Kuria, a public inn and tennis court are found on the Plan site, while, in Aranuka, the site contains a telephone office, agricultural office, and dwellings for Council families.

No structures are found on the Maiana site. All of the sites are located near Council facilities, that is to say, in the heart of the main village, and so effective site utilization is a major priority.

The Plan facilities, broadly speaking, are to comprise space for ice production, ice packing of catches, and handling operations ; repair work on outboard motors and other items ; storage and sale of gear and materials ; and rental operations for small fishing bouts. The facilities, accordingly, will be multi-faceted in nature, oriented mainly to then activities. The layout plan has been designed as follows, with due regard to the above conditions.

1) The facilities are to be multi-functional, reflecting the limited size of the sites and the relatively small size of the installations. They will, therefore be placed in one-story buildings in a concentrated complex. While it would also be possible to locate the Plan facilities in a 2-story structure so as reduce the building areas, we have decided to keep all structures one-story, considering the absence of construction equipment and the difficulty of raising and assembling steel-frame components on these logistically remote islands. The drum storage area has been located in a separate building out of safety considerations.

2) While existing buildings on the sites will, in principle, be retained, for the convenience of facility layout, it will be necessary to remove the public lodgings standing in the center of the site at Kuria along with the Council residences on the Aranuka property .

The layout Plan has been prepared with due allowance for distances between facilities and shore, the nature of the buildings surrounding the Plan sites, and access to the road and sea.

3) The drum cans are to be transported from Tarawa by small carrier vessels and landed by canoes on the various islands. On occasion, the drums may be dropped in the water from the vessels and recovered manually by the canoes. Light oil will be distributed to the generators and vehicles at the Plan facilities. As the drum storage areas must, therefore, have access to both the shore and road sides of the sites, they have been planned based on an appropriate assessment of site conditions on each island.

The facility layouts on the various Plan islands are shown below.

### 4.3.2 Surface Plan

Fishing patterns are almost identical on the 3 Plan islands and, while differences do occur in the scale of operations, as may be seen in the ice-making facility, these variations are not sufficient to warrant reflection in the scale or floor area of the Plan facilities. In addition, considering the common logistical conditions among the Plan sites (as discussed above), the fact these sites are located on islands posing serious transport problems, and the need to make the construction periods as short as possible so as to prevent needless increases in construction costs, we have elected to make the surface plans identical for all 3 islands. The room areas derived from this plan, after due allowance for span widths and multiple usage, are shown in Table 4 - 1.

Table 4 - 1 Room Areas

Room Designation	Required Area (m2)
Main Building	
Ice-making room & Handling area	75.00
Workshop	25.00
Materials storage	33.50
Conference room	37.50
Office	25.00
Machinery room	12.50
Toilets/ showers	12.50
Indoor corridor	75.00
Utility room	4.00
	300.00
Sub-total	
Drum storage area	16.00
Total	316.00

### 4.3.3 Sectional Plan

Since the natural conditions in the Plan area are characterized by high head and humidity and, for reasons to be discussed below, ventilation equipment will not be installed, it is essential that ample openings be provided to create natural ventilation. Although ceilings are not always provided in comparable structures in the area, when used, they are generally given a height of 2.5 - 3.5 m. The ceiling heights for the subject facilities have been set as follows.

<u>Room</u>	<u>Ceiling Height</u>	<u>Comment</u>
Office, storage area	2.7 m	
Other	Open ceilings	ceiling will not be hung

### 4.3.4 Structural Plan

#### (1) Structural Method:

The structures will use steel frame construction for posts and beams, with the walls and roofs to be made of PVC steel plates. Steel frame construction will most advantageous, since uniform quality is assured by factory production, while accuracy is easy to obtain during construction. However, since the Plan buildings are to be built in a location receiving constant breezes from the sea, extreme care must be given to rust-proofing. All of the steel frame components will, therefore, be finished with paint covered by galvanized zinc plating. For the same reason, the walls and roofs will use ribbed and corrugated PVC steel sheets, which are available in long lengths and have outstanding anti-corrosive properties.

#### (2) Foundations:

The soil on all 3 islands is coral sand, which shows no evidence of uneven subsistence or instability in the foundations. The Plan facilities, being steel frame, are relatively light-weight, and we have determined that there is no danger that the existing foundation will subside as a support base for the buildings. Accordingly, the foundation structure will be of the direct foundation type. We have set the allowable stress for sustained loading at 7.5 t / m<sup>2</sup>.

#### 4.3.5 Equipment Plan

##### (1) Electrical facilities

###### a) Generators

Since no commercial power source exists in the Plan area, standby generators will be installed. To provide sufficient start-up power to operate one ice-making unit, a 10 KVA generator will be required. While one 20 KVA generator could operate two ice-making units, to avoid unnecessary fuel waste and to cope with breakdowns, we plan to use twin 10 KVA generators at each location. Voltages differ between the commercial power systems on South Tarawa and the Line Islands but, in this Plan, we shall follow the South Tarawa specifications, as follows :

AC	50 Hz
Single-phase	240 V
3-phase	415 V

###### b) Lighting and Outlets

Once the ice-making equipment is started up, there will be reserve generating power even during the ice-making operations. This reserve can be expected to provide minimal power for lighting fixtures and wall outlets in the offices and other locations.

##### (2) Water Supply and Drainage, Sanitary Facilities

Water will be provided from rainwater collected in a 10 m<sup>3</sup> in tank on the roofs of the facilities. This rainwater is intended to furnish the required supply of raw water for the ice-maker as well as other uses, but during periods of low rainfall, when rainwater supplies cannot be obtained, wells will be used to make up the deficiency. On Kuria and Maiana Islands, new wells will have to be dug but, on Aranuka Island, we plan to use an existing water pipe, which was laid with UNDP assistance and extends up to the front of the Plan site. For water distribution, an

overhead tank of about 2 m<sup>3</sup> capacity will be installed, with water raised by pump and then gravity-fed to the consuming facilities.

With respect to drainage, given the need for careful consideration to protect the marine environment, particularly inside the lagoon, apart from rainwater drainage based on the natural slope within the Plan sites, all drainage will, in principle, be accomplished by permeation after appropriate treatment. Dirty and miscellaneous water from the toilet area will be fed to a treatment tank and permeated after joint treatment. Drainage pipes will be laid underground and will be of PVC construction.

In the drum storage area, the entrance will be slightly raised, creating a slope toward the interior, as a means of preventing any oil discharges resulting from accidental overturning of drums. This arrangement will facilitate drum movements while preventing any direct oil spill [leakage] from the storage area to the outside.

### (3) Other Facilities :

Judging from the public-service nature of the Plan facilities, air conditioning equipment will not be provided ; reliance will be on natural ventilation. A corridor will be built inside each building, with careful consideration given to ventilation. The only communication equipment to be provided will be SSB wireless sets, telephone equipment is not included in the Plan.

## **4.3.6 Finishing Plan**

### (1) Assumptions

The following natural and social condition's were taken account in preparing the finishing plan :

- Since the facilities are on the sea, they will be subject to salt damage.
- The climate is hot and humid throughout the year.
- The heavy rainfall in the area may be concentrated during a very short period.

- The only materials that can be sourced locally are gravel and sand. Even on South Tarawa, the bulk of the main building materials are imported, while the transportation infrastructure is undeveloped. Thus, a considerable safety margin will have to be built into the procurement timetable.
- The Plan areas are located on islands that are quite remote from South Tarawa. Though of small scale, the Plan facilities will nevertheless be pioneering projects on these islands.
- The construction period will be limited.

The finishing plan has been developed on the basis of the above conditions.

## (2) Exterior Finishes:

### a) Roofs:

In South Tarawa, many traditional homes are seen with thatched roofs made of palm leaves. In the case of public buildings, however, the roofs are almost entirely hip, hip-gable, or gable types, resembling those in a Maneaba (an assembly hall in a traditional building style). The principal material used in these roofs is steel plate. Virtually all buildings on the outer islands use traditional building methods. The roofs in some new buildings use corrugated steel sheets and have an area of 50~100 m<sup>2</sup>. In the subject Plan, the roof style will be gable and the roofing material ribbed, for ease of maintenance and construction.

### b) Exterior Walls

The wall material used in local public buildings is H.C. (hollow concrete) blocks, with the finish applied either directly or with an extra coat of mortar paint.

Around water facilities, we will use H.C. blocks, finished with mortar paint, but, for the majority of wall surfaces, steel plate spans will be specified, particularly in view of the limited construction period.

### c) Exterior Openings



Looking at public buildings in the area, the doors are generally wooden, and the windows almost all jalousie. In this Plan, the doors in offices and comparable areas will be aluminum and, in the machinery room, steel, while jalousie windows will be used throughout because of their excellent ventilating properties.

In designing these openings, ample eaves space has been provided to block out direct sunlight, while special consideration has been given to water tightness so as to prevent rain from blowing in from the sides.

## 2) Interior Finishes :

### a) Floors

In all rooms, we will, in principle, use concrete slab with mortar finish, as the standard flooring material. In the toilet-area, the floors will be given a tile finish for sanitary reasons.

### b) Ceiling and Wall Finishes:

Ceilings will be hung in the office and conference room, but elsewhere only open ceilings are planned.

The following finishes will be used, as appropriate, for the floors, ceilings, and interior wall surfaces.

Ceilings : Paint finish on a veneer base.

Walls : Paint finish on a mortar base and paint finish on a veneer base.

## 4.4 Equipment Plan

### 4.4.1 Small Carrier Vessel

#### (1) Hull

Following are the principal particulars for the small carrier vessel.

( All figures are approximate. )

Total length	15.50 m
Length between perpendiculars (LPP)	13.20 m
Mold width	4.80 m
Mold depth	1.90 m
Planned draft under full load	1.10 m
Gross tonnage	39.0 tons
Fuel tank capacity	9.6 m <sup>3</sup>
Water tank capacity	5.4 m <sup>3</sup>
Fish hold capacity	1.9 m <sup>3</sup>
Cruising speed	8.0 Kts
Regular crew size	7 persons

(with deck passengers of 15)

Applicable regulations	Ship Safety Rules of the Government of Japan (3rd class fishing vessel)
Vessel class	None

#### (2) Deck machinery

Windlass	1.0 ton x 10 m / min. 3.7 Kw, electric-powered	1 unit
Cargo winch	0.25 ton x 30 m / min. 1.4 Kw, electric-powered, with Davit	1 unit
Ventilator	0.75 Kw (for use in machinery room)	1 unit
Steering gear	1.5 Kw, electric-powered- hydraulic type	1 unit
Air conditioning	for steering house and crew quarters	1 set

#### (3) Engine Room Equipment

Main engine	300 HP x 2,000 rpm, continuous rated	1 unit
Auxiliary engine	38 HP x 1,800 rpm	1 unit
Dynamo	24 Kw x 225 VAC, 50 Hz	1 unit
Refrigeration equipment for fish hold	0.75 Kw, electric-powered	1 set
Pumps		1 set

#### (4) Navigation and Electronic Equipment

Magnetic compass	Card diameter 165 mm	1 unit
Searchlight	1 Kw	1 unit
Radar	10 Kw, 12" CRT, 48 nautical miles	1 unit
Depth sounder	1 Kw, 11", color CRT	1 unit
SSB transceiver	150W	1 unit
GPS plotter		1 unit
Weather facsimile		1 unit

#### 4.4.2 Equipment

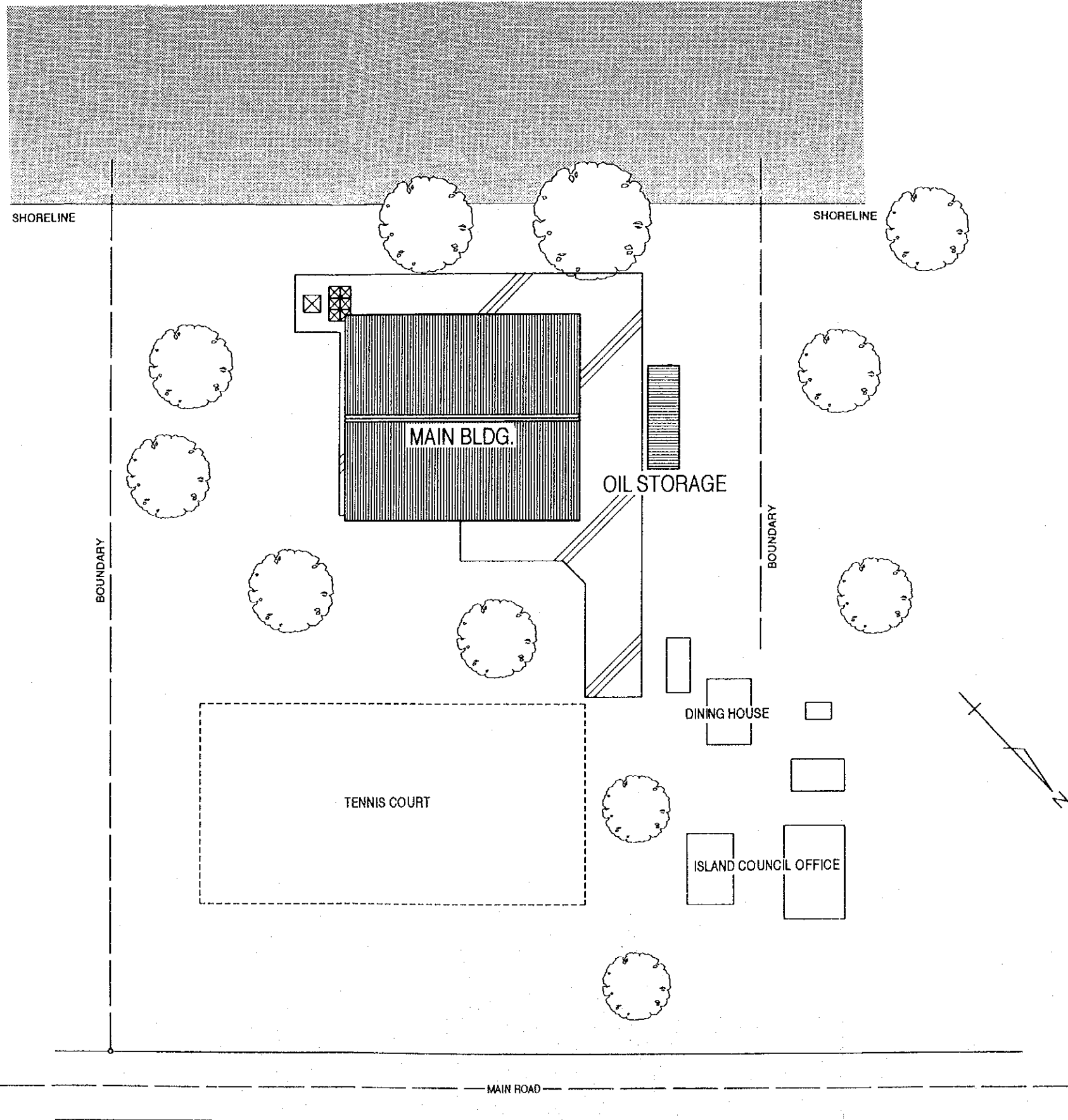
The main types and specifications of the items in the equipment plan, as well as the quantities of them for the 3 plan islands, are as shown in Annex-V.



## 4.5 Basic Design Plan





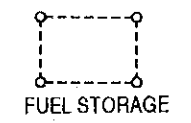
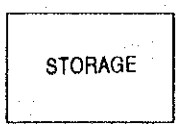
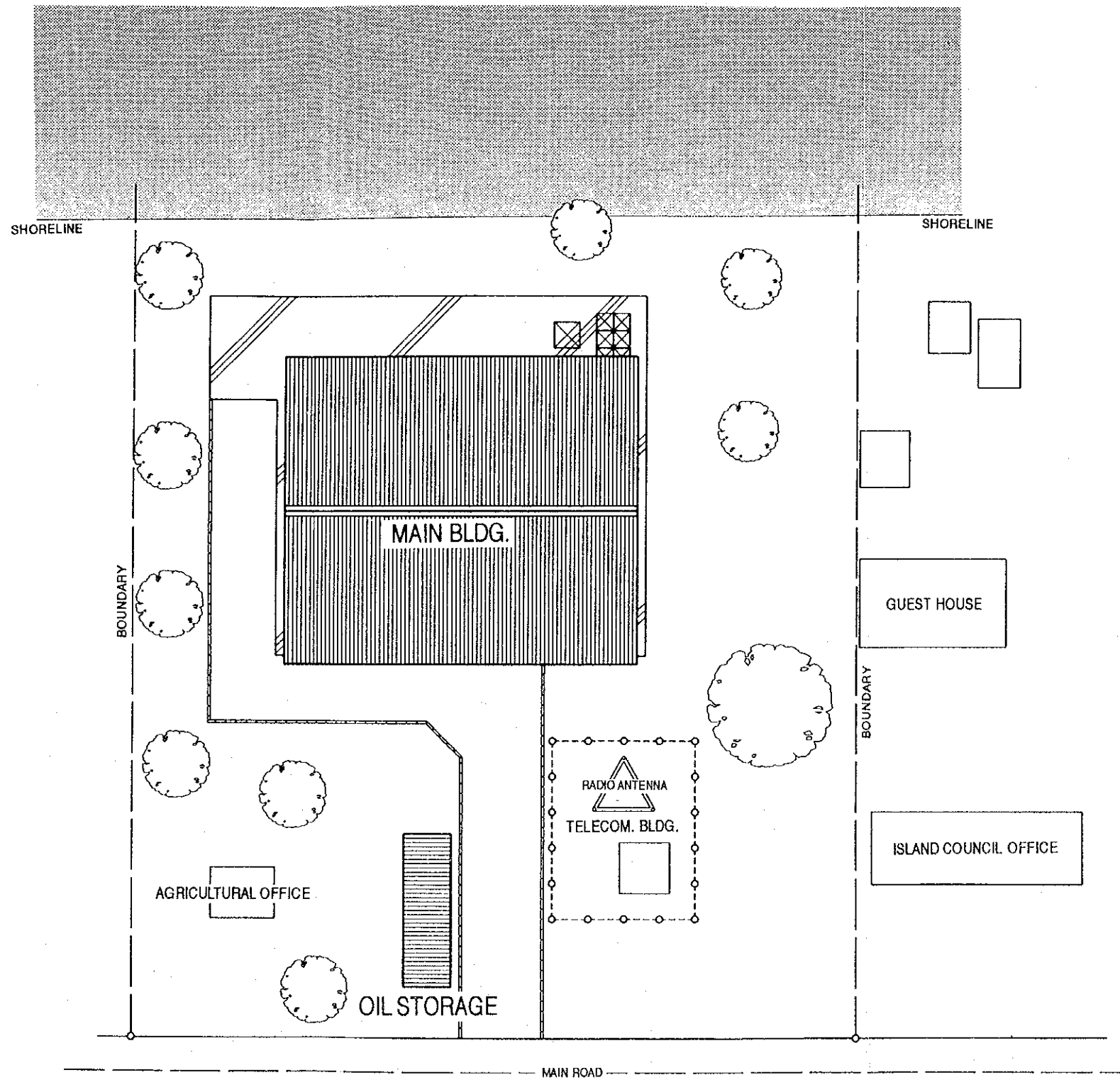


**PLOT PLAN** s=1:400  
 Location : Buariki, Kuria Is.





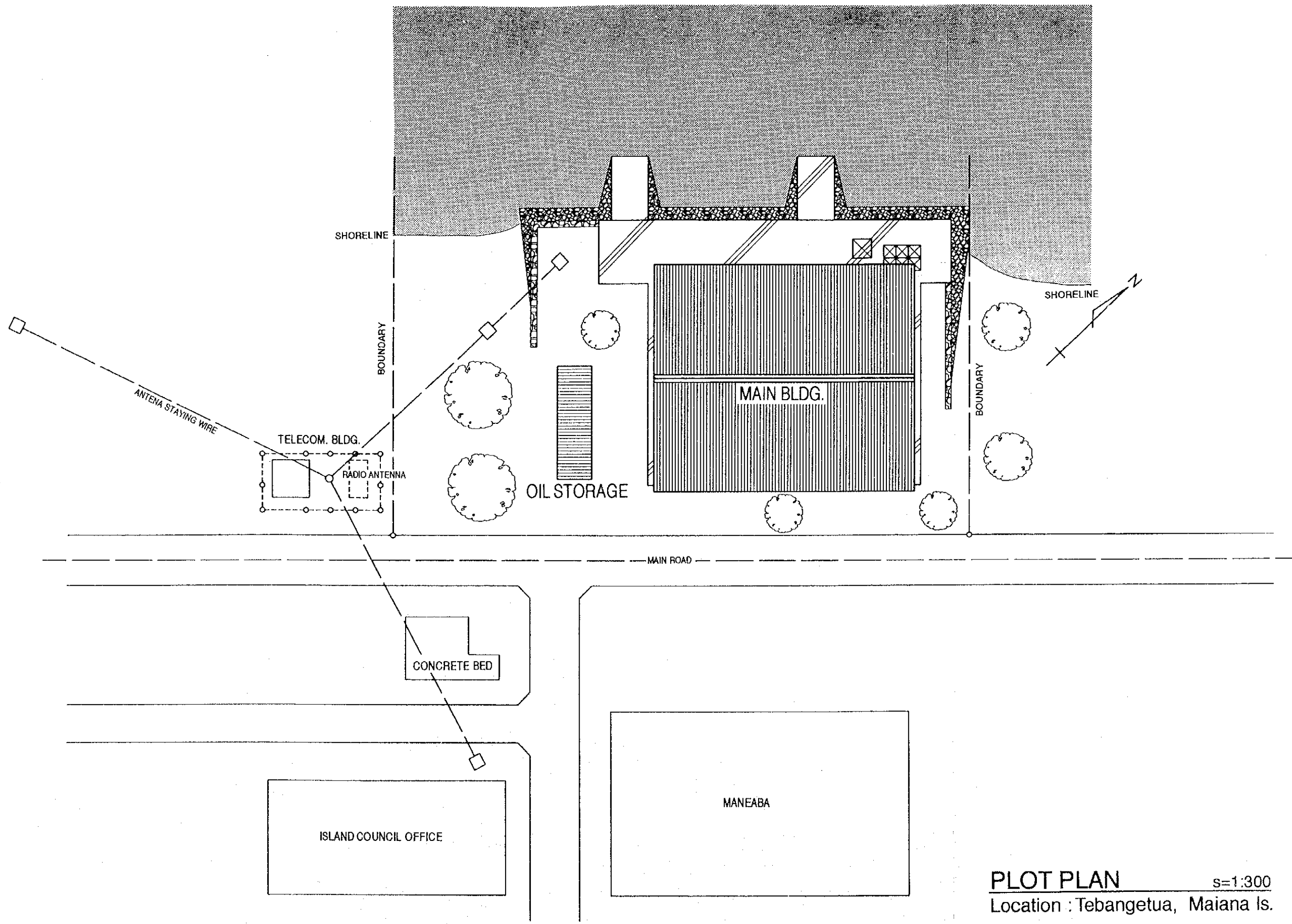




**PLOT PLAN** s=1:300  
 Location : Buariki, Aranuka Is.





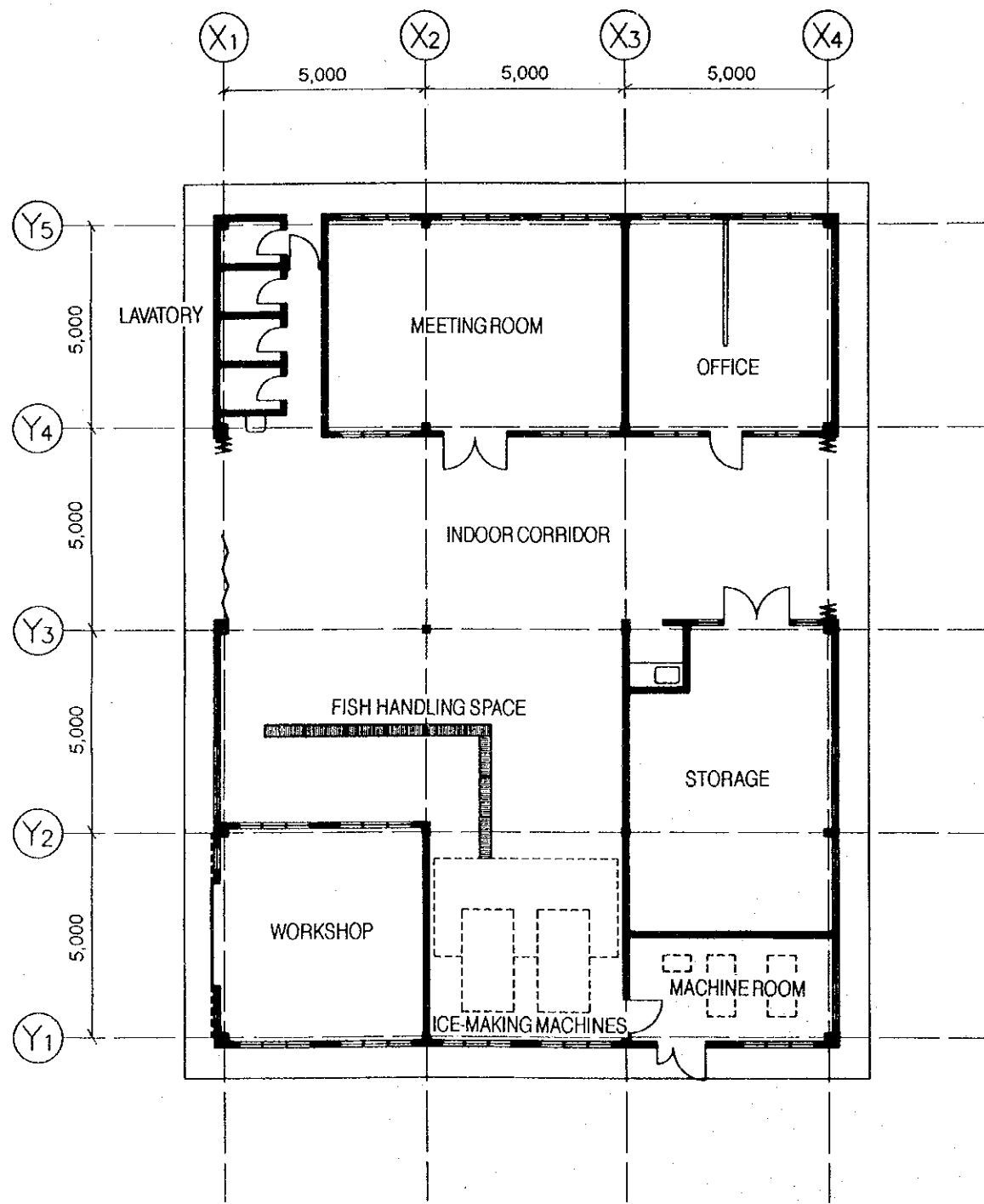


**PLOT PLAN** s=1:300  
 Location : Tebangetua, Maiana Is.

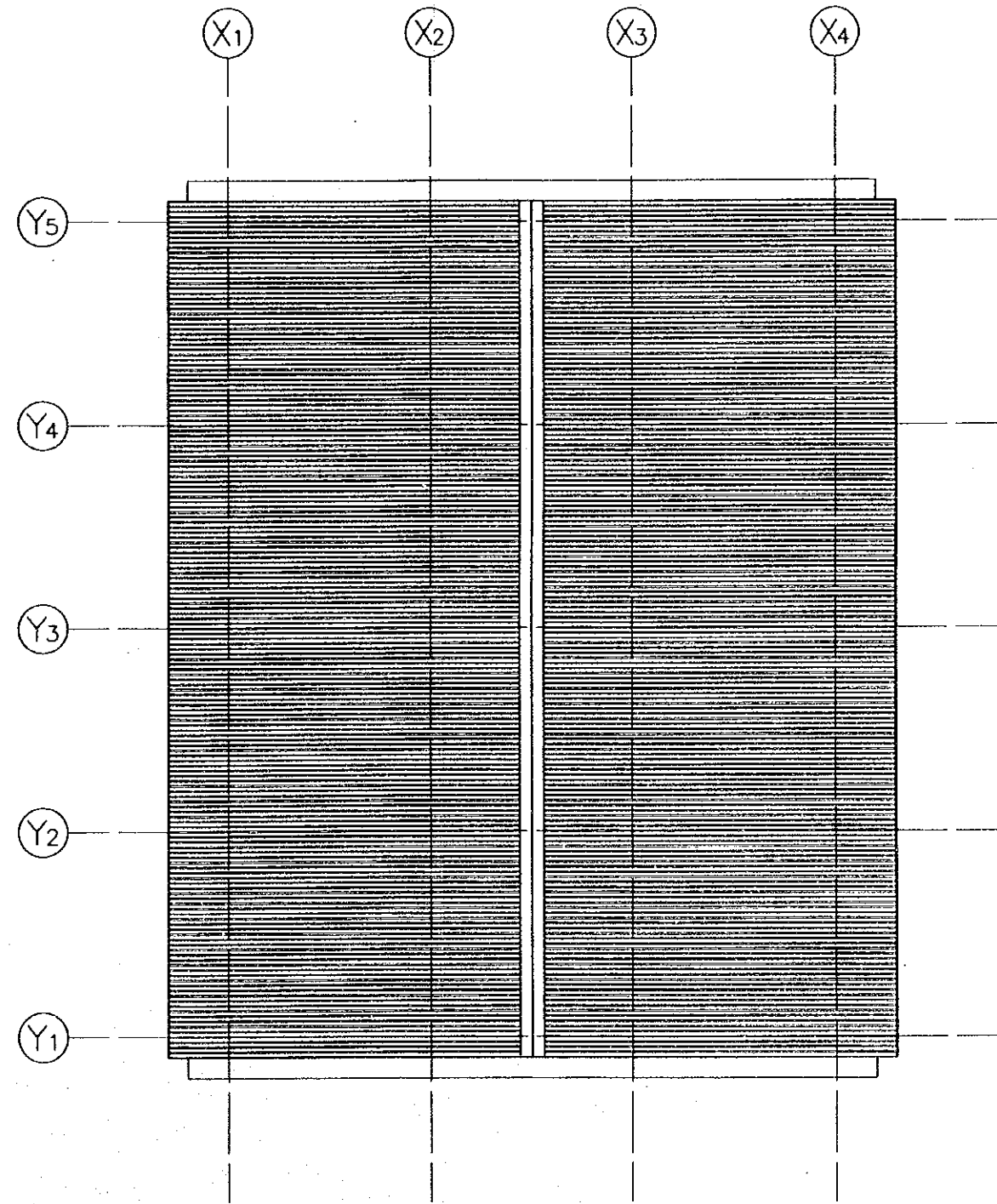








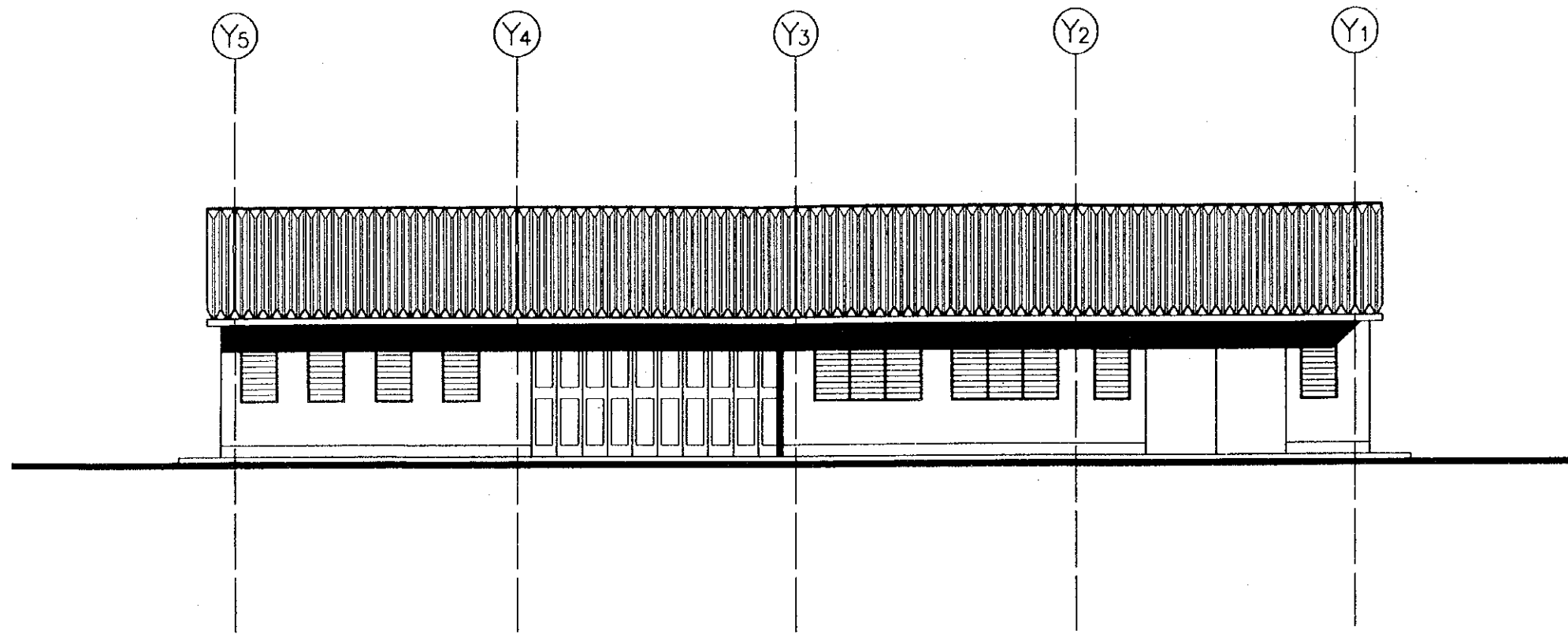
FLOOR PLAN s=1:150



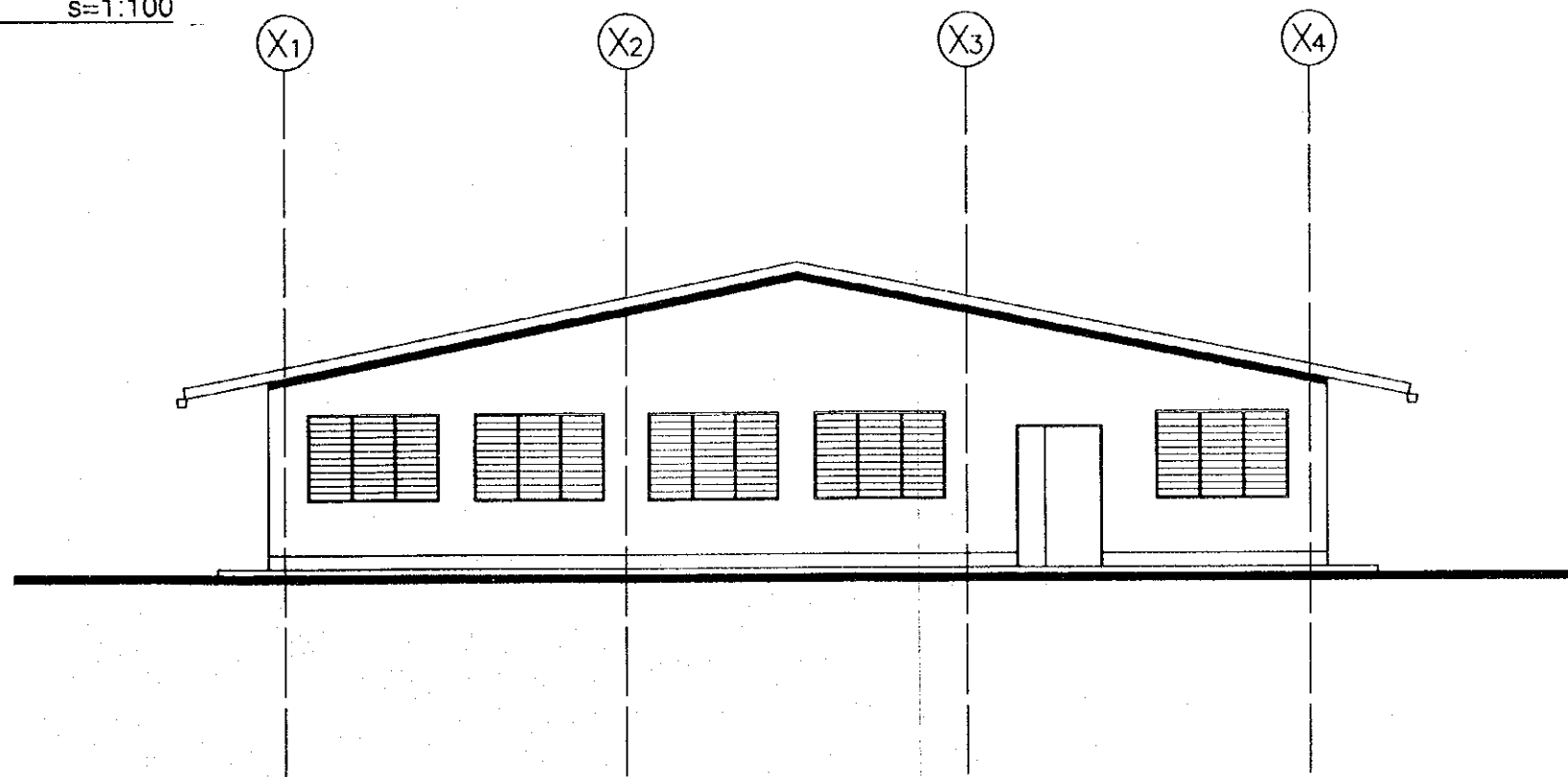
ROOF PLAN s=1:150 (all dimensions in mm)







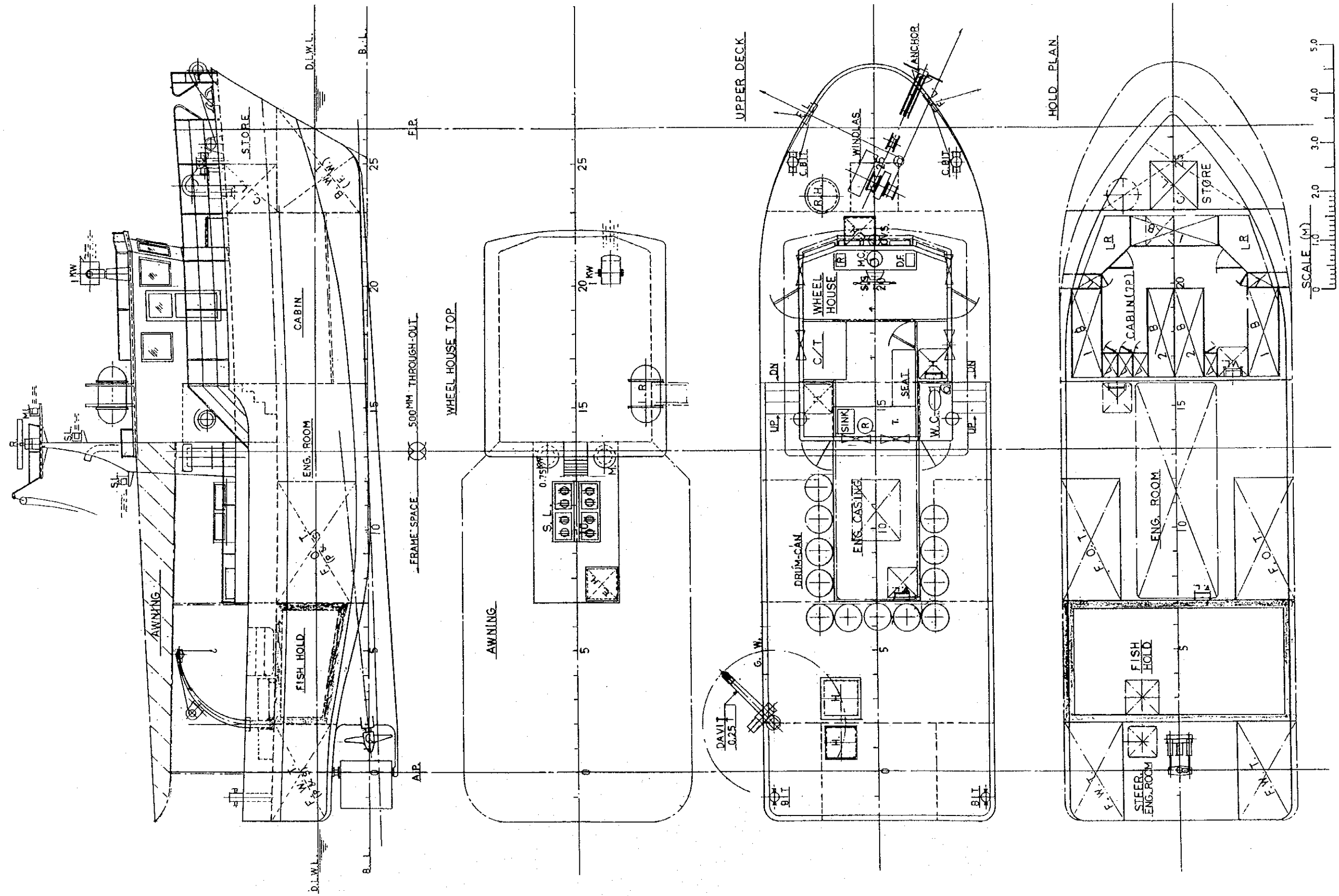
ELEVATION s=1:100



ELEVATION s=1:100







General Arrangement Plan for Small Carrier Vessel









## 4.6 Construction Plan

### 4.6.1 Guide Lines

The Plan facilities comprise a one-story steel-frame building with a total area of 300 m<sup>2</sup> and a concrete block structure of 16 m<sup>2</sup>. Since the main building will be of steel frame, the construction period should be relatively short. Nevertheless, there are certain constraints associated with projects implemented under grant-aid cooperation from the Government of Japan. Since there is only one regular sailing every other month from Japan to Tarawa, careful consideration will have to be given to work schedules. The following measures will, therefore, be taken to insure completion of the Plan facilities without disruption to project flow.

- 1) Even in South Tarawa, which is characterized by a concentrated population and an active consumer economy, block construction, based on local building methods, is occasionally seen in small structures, such as residences and stores, though the number of such building is still limited. Public buildings, such as hospitals, hotels, and libraries, are almost all built by foreign contractors. Thus, given the shortage of skilled technicians even on South Tarawa, not to mention the outer islands, there is a clear need to dispatch technical guidance personnel ( supervisors ) from Japan to improve construction efficiency.
- 2) The only construction materials that are locally available are gravel, sand and other primary products plus a few secondary items, such as cement and wood. The other finishing materials and components would be quite difficult to procure in Kiribati within a short period of time, in view of their limited usage. Accordingly, the plan is to source steel frames and other key materials from Japan.
- 3) The Plan sites are spread over 3 islands, all of which suffer from highly inconvenient transportation access from South Tarawa. Thus, in order to complete the construction work within the prescribed period, careful attention must be given to the problem of moving personnel and materials to the Plan area.

#### **4.6.2 Unique Aspects of the Construction Program**

Structures are presently standing on the Plan sites at Kuria and Aranuka, a portion of which will have to be removed. It will be necessary to discuss and confirm the scope and method of removal with the respective Island Councils, which administer these existing facilities and have also been designated the implementing organizations for the subject Plan. Based on the size and construction methods specified for the Plan buildings, we anticipate no unusual constraints in the construction program. However, an effort will be required during construction to minimize any adverse impact on the lagoon environment. This will entail particular care, during the foundation phase, to prevent any careless efflux of muddy water into the lagoon during periods of heavy rainfall.

#### **4.6.3 Supervisory Plan**

The Plan will proceed in the following sequence. After the exchange of official documents between the Government of Japan and the Kiribati Government, an Implementing Design Agreement will be concluded between a Consultant of Japanese nationality and the Ministry of the Environment and Natural Resource Development in the Kiribati government. The Consultant will prepare detailed design drawings, specification sheets, cost estimates, tender and contract documents, as required for plan implementation; and, subject to the approval of the above Ministry, will then validate tender qualifications, evaluate tenders and tender documents, and select the contractors.

After conclusion of the construction contracts, the Consultant will approve the construction drawings and make periodic inspections during equipment manufacture in Japan, while also exercising construction supervision in Kiribati so as to insure proper flow and accuracy in the construction phase. Since the construction plan is small in scope and involves no special construction techniques, we have determined that there is no need to station a resident supervisor in the Plan area. It will be sufficient for the Consultant to validate project progress through preliminary discussions in Kiribati, interim inspections, inspections upon completion of the work, and a final check at the stage of equipment turnover.

#### 4.6.4 Procurement Sources for Equipment and Materials

##### (1) Construction Materials:

Among the construction materials to be used in the Plan, sand, gravel, concrete block, wood, and cement are available in Kiribati and so will, in principle, be sourced locally. However, with respect to steel frames, roofing and wall materials, and finishing materials, as well as the materials for the water supply/drainage and electrical facilities, considering the obvious difficulties in attempting to obtain these items locally within a limited period of time, it is presumed that they will all be procured from Japan.

The planned procurement sources for the principal construction materials are shown below :

<u>Item</u>	<u>Source</u>
Construction Phase :	
Sand	Kiribati
Gravel	Kiribati
Cement	Kiribati
Concrete blocks (reinforced)	Kiribati
Woods and veneers	Kiribati
Steel frames	Japan
Roofing materials	Japan
Wall materials	Japan
Fittings	Japan
Paint	Japan

##### Facility Phase :

Electrical wiring	Japan
Lighting fixtures	Japan
Switches and sockets	Japan
Switchboards	Japan
Pipes for water supply and drainage	Japan
Sanitary fixtures	Japan

## (2) Equipment

The main items of equipment are the ice-making facilities, generators, water intake tanks, small carrier vessel, canoes and skiffs, outboard motors, fishing gear, fish boxes, and small vehicles. The small fishing boats will be sourced in Kiribati, in view of the many existing vessels of this type that have been built at the Betio Shipyard in South Tarawa as well as their successful performance in prior projects of a similar nature.

Outboard motors were formerly imported also from the U.S., but presently virtually all come from Japan, with some Japanese manufacturer maintaining sales agency in South Tarawa. By specifying inventories of replacement parts and after-service as one of procurement conditions, the option can be widened of sourcing these motors in both of Kiribati and Japan. As to fishing gear, while netting is available from South Korea and Taiwan, fishing lure heads, lead lines, and other gear are mainly of Japanese origin. But, in view of the difficulty of obtaining the prescribed standards and sizes on the local market within the tight project schedule, we plan to procure all fishing gear and materials from Japan. The other main pieces of equipment, such as the ice-makers, generators, and vehicles, are all manufactured products and so, in principle, will be sourced in Japan.

### **4.6.5 Implementation Schedule**

The responsibilities to be assumed by Japan and Kiribati in connection with project implementation may be summarized as follows :

#### (1) Responsibilities to be undertaken by the Government of Japan :

Assuming that the subject Plan is implemented under a grant-aid from Japan, the following responsibilities will be undertaken by the Japanese government :

##### 1) Construction of the Plan facilities.

2) Procurement of the ice-making facilities, outboard motors, and other equipment.

3) Consulting services in support of the Implementation Design and tender process, construction supervision, and other aspects of the projects.

(2) Responsibilities to be Undertaken by the Kiribati Government :

Assuming that this Plan is implemented under a grant-aid from Japan, the following responsibilities will be undertaken by the Kiribati government :

- 1) Securing the Plan sites and confirming the extent, method, and time of removing existing structures from the properties.
- 2) Obtaining all permits and approvals for the construction phase as well as any other permits or approvals that may be required for Plan implementation.
- 3) Formalities and costs connected with bringing power lines into the Plan area.
- 4) Obtaining prompt customs clearance and duty exemptions on all imported equipment and materials related to this Plan.
- 5) Obtaining exemptions from taxes and surcharges on Japanese nationals providing project services in Kiribati.
- 6) Any other responsibilities in connection with Plan implementation that are not specifically included among those to be assumed by the Government of Japan.

Assuming activation of the subject Plan, the project implementation schedule, pursuant to the above division of responsibilities between the two governments, may be divided between the construction phase for the facilities contained in the Implementation Design, including tenders; and the provision of equipment and materials. The construction and supply programs include the following stages :

1) Construction work--

-- ice-making and handling building; drum storage area.

2) Power, water supply/drainage, and sanitary facilities--

-- wiring, piping, and installation work

3) Equipment supply--

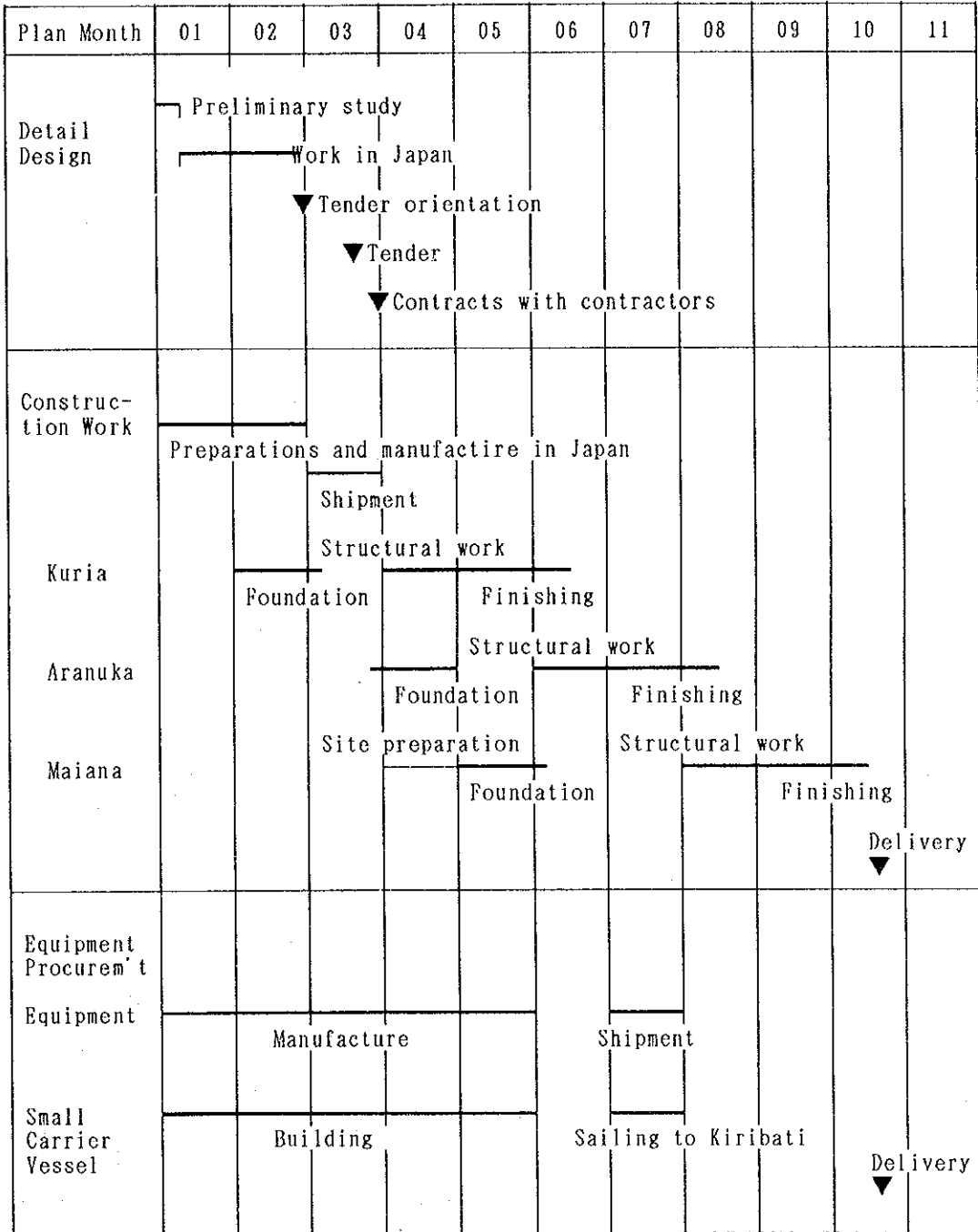
-- supply, installation, adjustment, and test operation of the ice-making units, generators, small carrier vessel, fishing gear and materials, small fishing boats, and other items.

It is anticipated that the construction phase of the project, including both preparatory work in Japan and construction work in Kiribati, will require about 10 months. In the case of the equipment and materials, the items requiring the longest procurement lead times will be the newly constructed small carrier vessel and fishing boats and the ice-making equipment, which is to be procured in Japan; procurement time for these items may be estimated at approximately 4 ~ 5 months each. More than a month will be required to install and adjust the ice-makers and a portion of the workshop equipment on the 3 islands.

An optimum Implementation Plan has been developed, with due regard for these conditions as well as construction costs, as shown in the following Implementation Progress Chart.



### Implementation Progress Chart



## SECTION FIVE: PROJECT EVALUATION AND CONCLUSIONS

### 5.1 Project Evaluation

#### (1) Evaluation Criteria:

The subject Plan, which is to be carried out on 3 islands in the Gilbert group : Kuria, Aranuka, and Maiana-- , is composed of the following phases : establishment of ice-making and related incidental facilities on these islands : donation of small fishing vessels and fishing gear ; and the construction of a new vessel to replace the Nei Tewenei, which is presently operated by the Fisheries Division to develop outer island fisheries. The purpose of the ice-making facilities is to maintain the freshness of fish catches, while the small fishing boats and gear are intended to strengthen the fish production structure on the Plan islands. The small carrier vessel, which is to be supplied as a replacement for the Nei Tewenei, will have the dual role of continuing the fishery extension work of its predecessor while providing logistical support for the Plan facilities, particularly in transporting fuel.

An artisanal fishery already exists in the Plan area, conducted primarily with traditional canoes, and this activity plays a major role in supplying foodstuffs for the 3 islands, based principally on hand-line, trolling, and drift gillnet operations.

Among the facilities and equipment to be introduced to the Plan areas under this project, the ice-making plants, in particular, will represent an entirely new facility on the Plan islands. High expectations are held for these facilities not only because they will permit chilled storage of fresh fish for the very first time, but also in terms of meeting general demand for ice beyond the fishing industry. In addition, while a considerable number of traditional canoes already exist on these islands, very few are motorized. Since the low level of island incomes makes it difficult for the residents to secure improved canoe models or outboard motors, the role that will be played by the small fishing vessels incorporated in this Plan may be seen as going far beyond one of simply supplementing the existing vessel population.

## (2) Freshness Control:

In our field survey, we interviewed a panel of managers in the 3 Island Councils to obtain their opinions on the reasons why the ice-making facilities were needed, and the views expressed were almost identical on all 3 islands. In addition to the needs related to fishing operations, such as temporary storage of surplus catches, fish storage during inclement weather, and extending the time spent in fishing grounds, various general uses were emphasized, such as maintaining the freshness of meat, vegetables, and other fresh foods as well as storing perishable beverages, medicines, and vaccines. Given the inability to use refrigerators, owing to a lack of commercial power, the opinions of these respondents made us keenly aware of the compelling need for ice on the outer islands.

### 1) Adjusting fish supplies

Demand for fresh fish is generally high in Kiribati, with most fish distributed in fresh form. While some salt-dried products are seen, there are apparently produced not so much to increase market value but rather as a means of fish preservation.

By packing the donated fish boxes with ice, surplus catches during good fishing periods can be kept in various degrees of freshness for 2 ~ 3 days after landing, while, during bad weather periods, when fishing is not possible, the decision can be made to ice-pack already landed catches to extend their market life. Thus, by using ice to retain freshness, fish supply on the islands can be stabilized. The number of beneficiaries on the 3 islands combined may be estimated at 244 full-time and part-time fishing households.

### 2) Extension of operating periods

In our field survey, it was found that canoe fishing is generally a one-day operation, with fishing time thus limited to a maximum of 12 hours. While this constraint is partly a reflection of the limited seaworthiness of the canoe, the main reason for rushing back to port is to avoid a loss of freshness in the catch. Depending on fishing conditions, fishermen are sometimes obliged to salt-dry their catches on board their boats. But if catches can be ice-packed on board instead, operating time can be extended, in accordance with fishing conditions, thereby gaining access to more distant grounds. The estimated number of

beneficiaries will be the same as that shown in the preceding section for full- and part-time fishing households.

### 3) General demand:

While the volume of ice output envisaged in this Plan is not large, a general demand, beyond that from the fishing industry, can be anticipated from the 4,172 inhabitants of the 3 Plan islands. Preserving the freshness of imported meats and medicines is a pressing problem on the outer islands. Small storage warehouses, based on solar power, are being developed for vaccines and other pharmaceuticals that require chilled storage, but these are not yet in general use. Accordingly, the ice-making operations on the Plan islands can be expected to meet a general demand of this nature, in addition to that for fishing use.

### (3) Improvement in Fish Production Efficiency:

In comparison with the 4 m length of traditional canoes, the improved 7 m canoes and skiffs to be donated under this Plan will have a far greater capacity for both fishing gear and crews. These new small fishing boats will have distinct advantages over conventional canoes when loading the bulky gear used for trap fishing or in terms of increasing production efficiency of the hand-line fishery, which requires larger crews. And, when fishing in the ocean or on the outer edge of the reef, the Plan boats, equipped with outboard motors and considerably more seaworthy than ordinary canoes, will afford better access to fishing grounds, while economizing on round-trip sailing times. The introduction of the Plan boats, therefore, can be expected to lead to higher and more efficient fish production in the 3 islands.

Ownership of traditional canoes on the 3 Plan islands is larger than the number of households engaged in fishing on either a full-time or part-time basis.

Considering also the present state of the subsistence and commercial markets for fish on the islands, it is unlikely that many households with no past record of fishing incomes will newly enter the fishing industry merely on the basis of the introduction of the Plan fishing boats. The demand for these boats then will presumably be concentrated among existing fishermen ( full- and part-time ) switching over from traditional canoes to the larger, higher-quality Plan boats. In that event, given the advantageous lease rates and fuel costs, the new boats are likely to be leased collectively by groups of fishermen, rather than singly.

Such group leases are, in fact, already evident with the upgraded canoes presently owned by the Island Councils on Kuria and Maiana. While the difference in catch volume per vessel between traditional canoes and the Plan boats cannot yet be precisely measured, a rise in production efficiency and net fishing incomes (after direct costs) can certainly be expected to result from a more intensive production structure.

#### (4) Maintaining the Transport Structure :

The donation of the small carrier vessel, seen from its direct impact on the public finances of Kiribati, will be significant in terms of reducing the maintenance costs associated with a superannuated vessel as well as in eliminating the entire cost of building a new vessel, which would become necessary in due course. With regard to maintenance expenses, there should be an immediate saving of about A\$ 6,000, which was the amount appropriated for this purpose in the fiscal 1994 budget. However, in view of the fact that the new vessel will be completely financed by a grant-aid, the saving in construction expenditures has been eliminated from the project evaluation.

The building of a replacement vessel takes on considerably greater significance from the standpoint of fisheries development on the outer islands. The new vessel will continue to play the same role as the present Nei Tewenei, yet will also add the transport services required by the Plan islands, in the same form and with the same frequency as those rendered to other outer islands.

As was shown in the flooding accident to the current vessel in September, 1994, the Nei Tewenei is felt to be considerably superannuated and so will eventually reach the stage at which sailing frequencies will have to be curtailed or operations even totally discontinued.

If, for sake of argument, this vessel was no longer able to furnish transport services, light oil for operating the ice-plant or other plan facilities would then have to be procured through existing channels, in which case the price premium, based on transport costs alone, can be estimated at no less than 12 cents / ltr., which would translate into an increased fuel burden of A\$ 3,800 per year for the 3 Plan islands combined. Moreover, if forced to rely on private carriers for fuel

supplies, this would also entail major inconvenience in terms of erratic delivery schedules, but the more serious impact on Plan operations would certainly result from the higher fuel costs.

Apart from the resulting pressure on ice prices, which would in turn reduce ice sales revenues, it might then become impossible to maintain a balance between income and outgo. Considering this danger, maintaining the transport structure by constructing a replacement vessel for the Nei Tewenei can be considered indispensable to the smooth continuity of Plan operations.

## **5.2 Conclusions**

Since independence in 1979, economic development on the outer islands has been consistently positioned by the Kiribati government as one of its highest priority development policies, to which a concentrated effort has been devoted. In the fisheries sector, projects have been carried out, principally in the Gilbert Islands, based on aid from the U.K. and Japan, focusing on the development of shore support facilities and procurement of fishery materials. In tandem with these projects, the Kiribati government has also been involved in a fisheries extension program oriented mainly to the distribution of fishing gear and supplies, dissemination of fishing and aquaculture technology, and support for fish shipments.

In the three Plan islands - Kuria, Aranuka, and Maiana -, the resident population is small, while the low level of fishermen's incomes has impeded the penetration of a consumer society. Since copra and agriculture evidence little room for development, the fishing industry is intended to play a crucial role in economic development on these islands. However, with fishery support facilities still undeveloped, major constraints exist at the present time on fishery development. The subject Plan, then, by establishing ice-making and other shore-based facilities and supplying fishery equipment and materials, is intended to improve freshness control and distribution conditions for catches and thereby strengthen the fisheries production structure on the outer islands. Accordingly, this Plan is positioned as a key element in the government's Outer Island Fisheries Development Program.

The direct beneficiaries of this Plan will be artisanal fishermen living in this sparsely populated area. With fish a precious food product on all three islands,

life there cannot be divorced from fishing activity. Economic development on the outer islands is also a pressing need in terms of eliminating the disparities in living conditions between South Tarawa and these outer islands. It has, therefore, been determined that there is ample justification for carrying out the subject Plan under a grant aid from Japan.

The shore facilities under this project will be built on sites located in villages in the respective centers of the 3 target islands. All of the sites were confirmed to be owned or administered by the Island Councils, which are the centers of government on each island. All three sites face both a road and the shore, in very convenient locations adjacent to the Council offices, while the foundation conditions present no construction problems for the Plan facilities. In the case of the Maiana site, however, since the beach line at high tide threatens to encroach on a portion of the property, some simple leveling and embankment work will be required to deal with this situation within the parameters of the foundation work for the Plan facilities.

The responsible body for this Plan is the Ministry of Environment and Natural Resource Development, while the Island Councils on the 3 Plan islands will administer and operate the shore facilities and fishery equipment. The Fisheries Division will operate the small carrier vessel which is to transport cargoes and move technical support personnel to the outer islands, including the Plan area. The 1994 operating budgets for the Councils on the 3 Plan islands range between A\$ 40,000 ~ 100,000. In drafting the technical specifications and planning the scope of the Plan facilities and materials, special consideration was given to budgetary constraints. It is projected that the income from operation of the Plan facilities will comprise 10 ~ 30 % of annual Council revenues. With respect to the balance between income and outgo from project operations, during the first few years, interest income from the revolving fund for fishing gear and materials will be quite modest, which will give rise to a temporary deficit of some A\$ 200 ~ 300 per annum. Thereafter, however, income and outgo are expected to be in balance.

Based on implementation of the subject Plan, it will become possible to maintain freshness in island catches. In addition, while stabilizing fish supplies on each island, the project will enable fishing vessels to extend their operating periods, which are presently limited by the inability to chill catches on board. It is further anticipated, that, thanks to the development of a more intensive system of fishery

production, there will be a marked improvement as well in production efficiency. It may thus be expected the Plan will provide effective support, on both the production and distribution levels, for the local fisheries, which occupy such a strategic position in the economy of the outer islands. It has been concluded, therefore, that there would be considerable significance in implementing the subject Plan under a grant-aid from Japan.



## **Annex**

- I. Members of the Basic Design Study Team
- II. Survey Itinerary
- III. Discussants
- IV. Minutes of Discussions
- V. Others
  - 1. List of the Plan Equipment
  - 2. Breakdown of Operation Costs and Revenues
  - 3. Meteorological Data in South Tarawa



I. **Members of the Basic Design Study Team**

Assignment	Name	Organization
Leader	Akihiro Mae	Assistant Director, Office of Overseas Fisheries Cooperation, Fisheries Agency
Project Coordinator	Tadashi Ikeshiro	Deputy Director, Training Affairs Division, Okinawa International Center, JICA
Fishing Boat and Fishing Gear Planner	Toyomitsu Terao	Fisheries Engineering Co., Ltd.
Fishery Facilities Planner	Yoshiharu Matsumoto	Fisheries Engineering Co., Ltd.
Ice Making Facilities and Market Planner	Takahumi Toshihara	Fisheries Engineering Co., Ltd.

## II. Survey Itinerary

Day	Date	Itinerary	
	Sept. 1994		
01	14 Wed	Lv. Tokyo (20:45)	
02	15 Thr	Ar. Nadi (08:20), Lv. Nadi (12:00) → Ar. Suva (12:45)	
03	16 Fri	Lv. Suva (18:45) → Ar. Nadi (19:30)	
04	17 Sat	Lv. Nadi (08:00) → Ar. Tarawa (15:30)	
05	18 Sun	Survey at South Tarawa	
06	19 Mon	Courtesy visit to Ministry of Environment and Natural Resources Development, Ministry of Foreign Affairs and International Trade and Ministry of Home Affairs and Rural Development	
		Mae, Ikeshiro, Terao	Matsumoto, Toshihara
07	20 Tue	Tarawa → Maiana (*)	Preliminary discussion with PWD
08	21 Wed	Maiana → Kuria (*)	Tarawa → Aranuka (*)
09	22 Thr	Kuria → Aranuka (*)	Survey on the plan site and fishery study
10	23 Fri	Aranuka → Kuria → Tarawa (*) Draft minutes was submitted to MENRD.	Aranuka → Kuria (*) Survey on the plan sites
11	24 Sat	Team meeting, data analysis	Site survey, fishery study
12	25 Sun	Study on living conditions	Study on construction works
13	26 Mon	Discussion with MENRD	Kuria (10:00) → Tarawa (10:30)
		Signing of the Minutes of Discussions	
		Mae, Ikeshiro	Terao, Matsumoto, Toshihara
14	27 Tue	Tarawa (08:45) → Suva (16:30)	Survey on construction works
15	28 Wed	Suva (18:45) → Nadi (19:30)	Study on fish distribution
16	29 Thr	Nadi (01:45) → Tokyo (07:25)	Interview with MHARD on the 3 plan islands.
17	30 Fri	Tarawa (11:00) → Maiana (11:10), Survey on the plan sites	
	October		
18	1 Sat	Fishery study, Maiana (18:00) → Tarawa (18:10)	
19	2 Sun	Data analysis	
20	3 Mon	Study on fish distribution, study on equipment and materials for construction works, along with construction skills	
21	4 Tue	Discussion on the project components with MENRD and Fisheries Division	
22	5 Wed	Supplementary study on construction works, fish distribution, and internal transport	
23	6 Thr	Meeting with MENRD	
24	7 Fri	Lv. Tarawa (07:45) → Ar. Nadi (15:25) Lv. Nadi (17:00) → Ar. Suva (17:35) Reporting to Embassy of Japan and Suva Office of JICA	
25	8 Sat	Lv. Suva → Ar. Nadi	
26	9 Sun	Data analysis	
27	10 Mon	Lv. Nadi (13:45) → Ar. Tokyo (19:25)	

Remarks: (\*) Chartered flight

### III. Discussants

Name	Title and Organization
(South Tarawa)	
Elliot Alli	Assistant Secretary, Ministry of Foreign Affairs and International Trade
Baraniko Baaro	Secretary, Ministry of Home Affairs and Rural Development (MHARD)
Iamti Rakautu	Assistant Secretary (MHARD)
Pablito Briz	Rural Development Officer (MHARD)
Nakibae Teuatabo	Secretary, Ministry of Environment and Natural Resource Development (MENRD)
Peter Tong	Senior Resource Economist (MENRD)
Ioataake Timeon	Project Economist (MENRD)
Craig Wilson	Environment Unit (MENRD)
Tukabu Teroroko	Chief Fisheries Officer, Fisheries Division (MENRD)
Maruia Kamatie	Senior Fisheries Officer, Fisheries Div. (MENRD)
Kitoba Tearo	Fisheries Officer, Fisheries Div. (MENRD)
Tooti Tekinaiti	Fisheries Officer, Fisheries Div. (MENRD)
Baraniko Raobati	Fisheries Officer, Fisheries Div. (MENRD)
Teboko Tarau	Captain of Nei Tewenei, Fisheries Div. (MENRD)
Varai Koneteti	Officer in Charge, Meteorological Div. (MENRD)
Matereta B. Raiman	Inspector of Taxes, Taxiation Division, Ministry of Finance and Economic Planning (MFEP)
Kautuna Kaitara	Chief Customs Officer, Customs Division (MFEP)
Tapetulu Merang	Acting Civil Engineer, Public Works Division (PWD) Ministry of Works and Energy (MWE)
Teitia Nikuata	PWD Officer (MWE)
Tiaon Kabaua	PWD Officer (MWE)
Tabea Riwata	General Manager, Kiribati Shipping Service Ltd.
Ioakim Tooma	General Manager, Betio Shipyard Ltd.
Itaea A. Riteri	Senior Accountant, Development Bank of Kiribati

Name	Title and Organization
Takaeang Reiti (Maiana Island)	Market Manager, Outer Islands Fishery Project (MENRD)
Katiua Taniern	Chief Councillor, Maiana Island Council
Kabwearuru Temoti	Clerk, Maiana Island Council
Toaea Beiateauea	Fisheries Assistant
(Kuria Island)	
Baewa Tabuanaba	Chief Councillor, Kuria Island Council
Tokoa Aromati	Clerk, Kuria Island Council
(Aranuka Island)	
Maninraka Tiare	Chief Councillor, Aranuka Island Council
Kiamair Berane	Deputy Chief Councillor, Aranuka Island Council
Teebete Baaringa	Clerk, Aranuka Island Council
(Fiji)	
Yoshiaki Kotaki	Counsellor, Embassy of Japan (EJ)
Hiroyuki Onishi	First Secretary (EJ)
Yasuhiro Tojo	Second Secretary (EJ)
Shiro Kinouchi	Resident Representative, JICA
Hiroshi Saito	Deputy Resident Representative (JICA)
Hajime Watanabe	Asst. Resident Representative (JICA)
Masataka Matsumi	Resident Representative, Overseas Fishery Cooperation Foundation (OFCF)
Masateru Anraku	Chief Fisheries Advisor (OFCF)

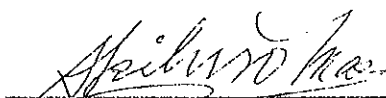
#### IV. Minutes of Discussions

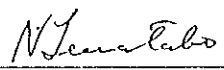
MINUTES OF DISCUSSIONS  
BASIC DESIGN STUDY  
ON  
THE PROJECT FOR OUTER ISLANDS ARTISANAL FISHERIES DEVELOPMENT  
IN  
THE REPUBLIC OF KIRIBATI

In response to a request from the Government of the Republic of Kiribati, the Government of Japan decided to conduct a basic design study on the Project for Outer Islands Artisanal Fisheries Development (Phase II) ( hereinafter referred to as "the Project" ), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Kiribati a study team, which is headed by Mr. Akihiro Mae, Assistant Director, Office of Overseas Fisheries Cooperation, Fisheries Agency, and is scheduled to stay in the country from September 17 to October 7, 1994. The team held discussions with the officials concerned of the Government of the Republic of Kiribati and conducted a field survey at the study area. In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the basic design study report.

September 26, 1994

  
-----  
Akihiro Mae  
Leader,  
Basic Design Study Team,  
JICA

  
-----  
Nakibae Teuatabo,  
Secretary,  
Ministry of Environment and  
Natural Resource Development,  
Republic of Kiribati

## ATTACHMENT

### 1. Objective

The objective of the Project is to enhance outer islands fisheries production and improve the handling and marketing of the resulted fish landings by providing fishery relevant equipment to and establishing shore-based fishery support facilities in the project sites.

### 2. Project site

The project sites are located in Kuria, Aranuka and Maiana Islands as shown in the location maps as attached in the Annex I.

All the three Project sites have been secured by the Government of the Republic of Kiribati.

### 3. Responsible agency

Ministry of Environment and Natural Resource Development has overall responsibility for the Project. The Island Councils in Kuria, Aranuka and Maiana Islands are also responsible for the implementation of the Project.

### 4. Items requested by the Government of the Republic of Kiribati

After discussions with the basic design study team, the items listed in Annex II were finally requested by the Kiribati side.

However, the details of the components of the Project i.e. scope, scales, specifications, numbers, and so forth will be examined and finalized after further studies.

### 5. Japan's Grant Aid system

- (1) The Government of the Republic of Kiribati has understood the system of Japanese Grant Aid explained by the team.
- (2) The Government of the Republic of Kiribati will take necessary measures, described in Annex III for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

### 6. Schedule of the study

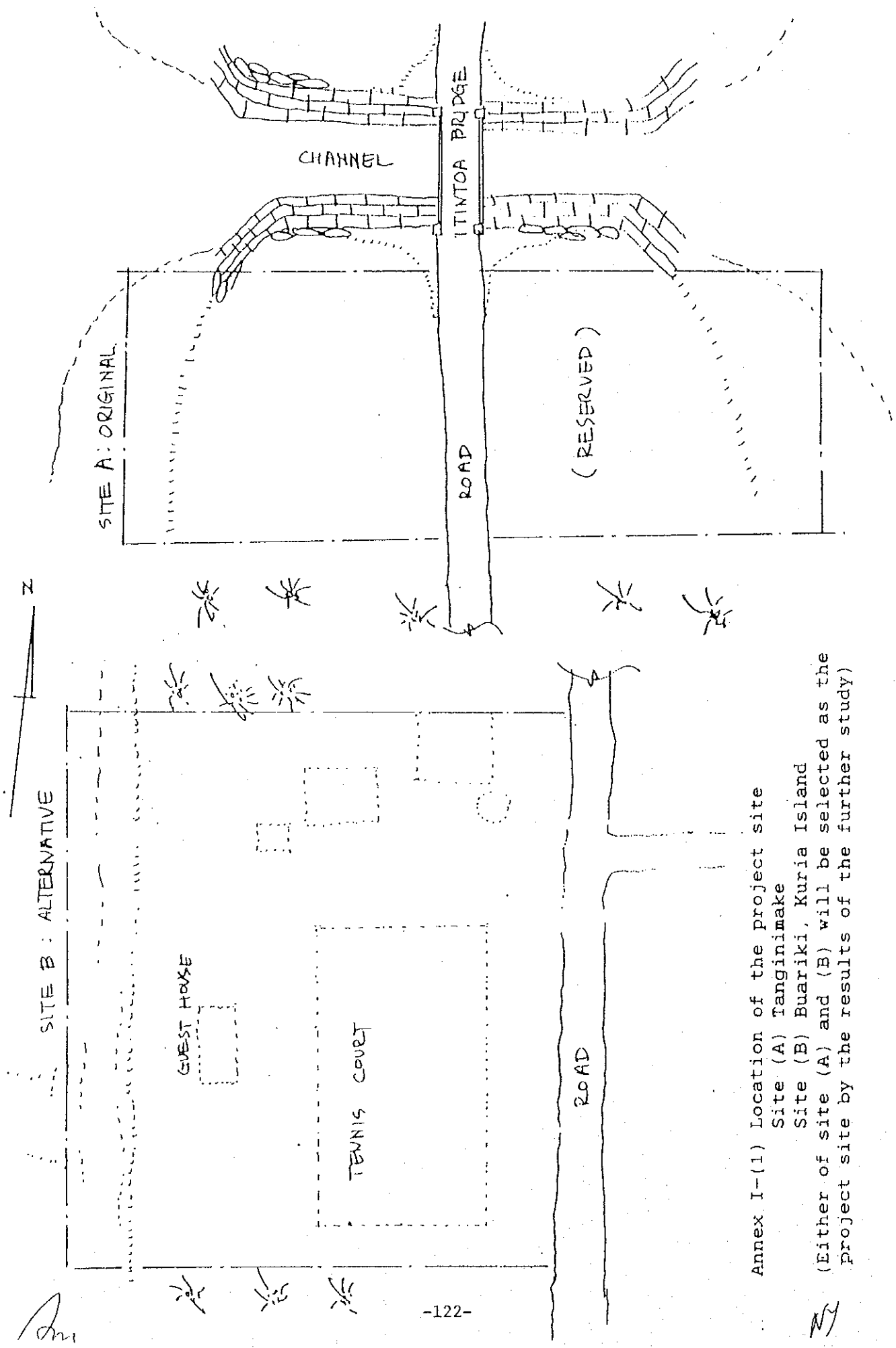
- (1) The consultants will proceed to further studies in Kiribati until October 7, 1994.
- (2) JICA will complete the final report and send it to the Government of the Republic of Kiribati by January in 1995.



## 7. Counterpart fund

If and when the products, purchased by the grant aid from the Government of Japan, are sold or leased to fishermen, the Government of the Republic of Kiribati shall take necessary measures to ensure the followings:

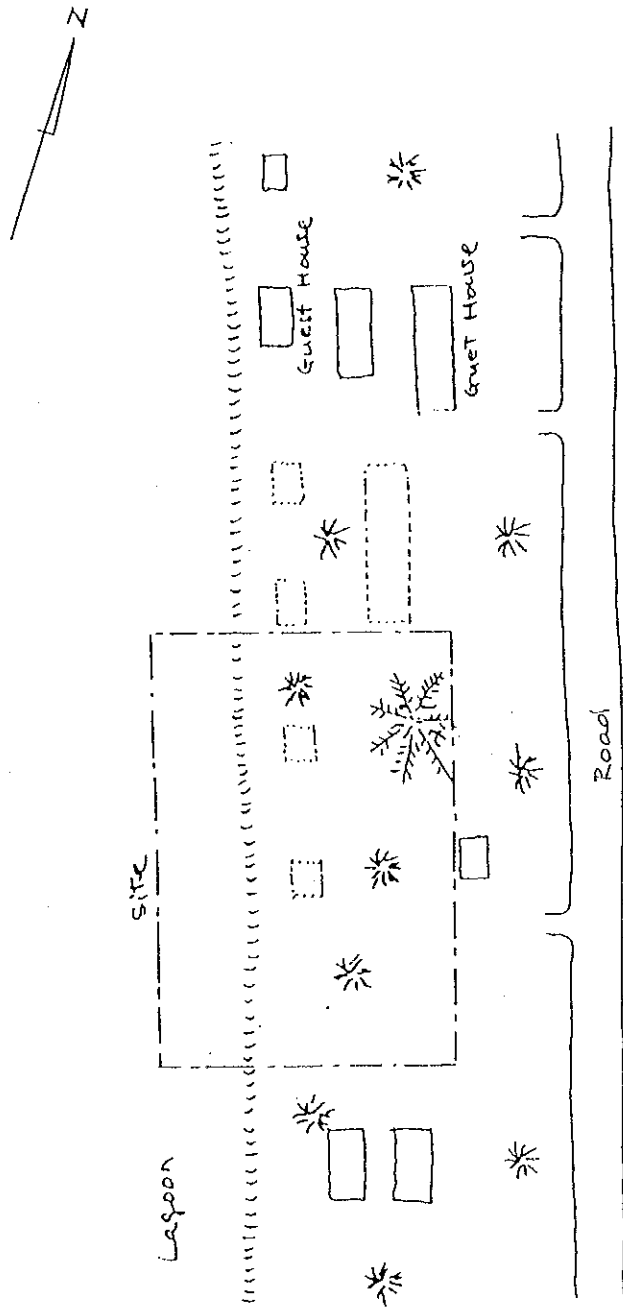
- (1) to deposit the funds generated from the sale or the lease into a separate account,
- (2) to utilize the funds for the purpose of promoting fishery in the Republic of Kiribati,
- (3) to consult with the Government of Japan on utilization of the funds, and
- (4) to provide, on the request of the Government of Japan, a report on the use of the funds and the balance in the account.



Annex I-(1) Location of the project site  
 Site (A) Tanginimake  
 Site (B) Buariki, Kuria Island  
 (Either of site (A) and (B) will be selected as the project site by the results of the further study)

Am

Annex 1-(2) Location of the project site  
Buariki, Aranuka Island

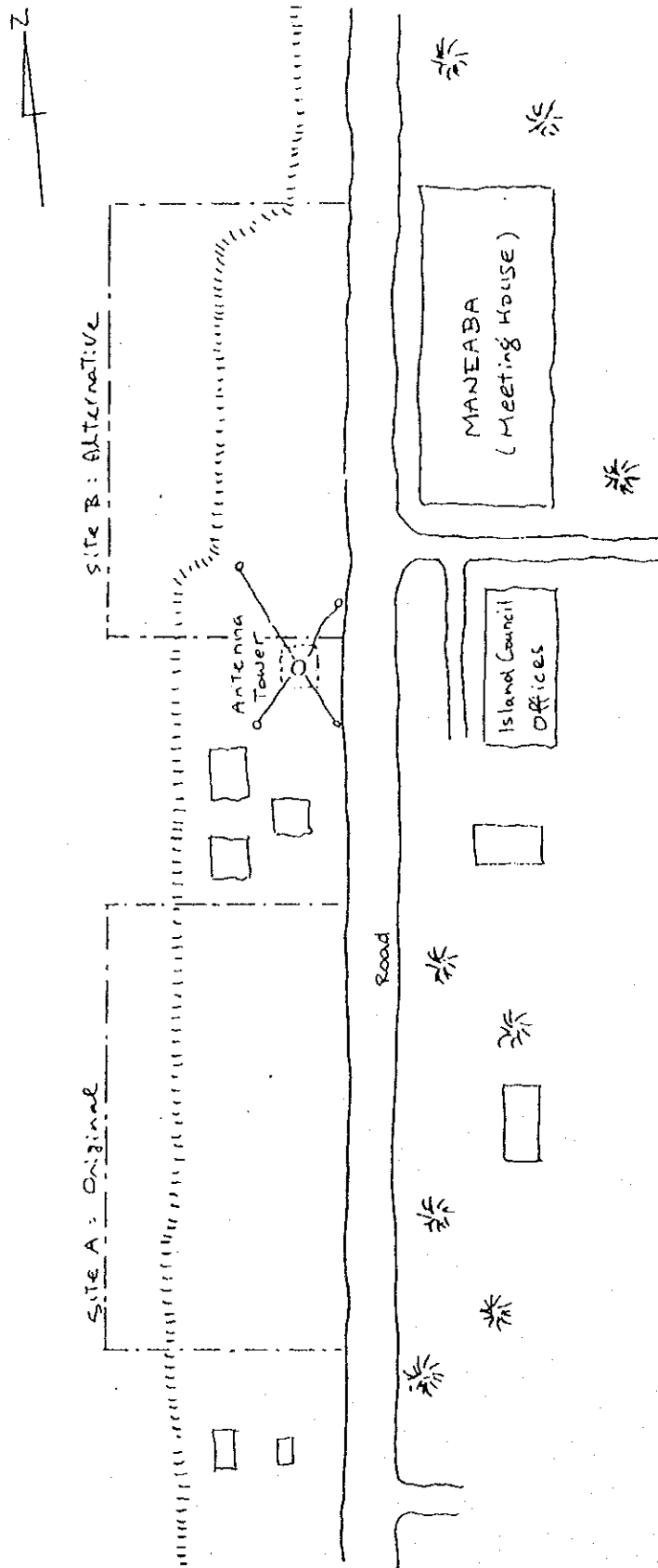


REMARK: Locations of the existing buildings are subject to the  
Topographic Survey by the team.

Ny

Annex I-(3) Location of the project site  
Tebangerua, Maiana Island  
(Either of site (A) and (B) will be selected as the  
project site by the results of the further study)

LAGOON



*Am*

*NJ*

Annex II

Items Requested by the Government of the Republic of Kiribati;

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- Ice making plant with ice storage bin and generator
- Building(s)
  - Office
  - Warehouse
  - Work space
  - Meeting room
  - Shed to stock fuel drums
  - Restroom and shower facilities
  - Related necessary facilities including insulated room and machinery room
- Freshwater tank
- Canoe and skiff boats
- Outboard motors with spare parts
- Fishing gears
- Insulated fish boxes
- Fish carrier boat
- Safety equipment
- SSB radio telephone
- Pick-up (4WD)
- Facilities to protect the fish carrier boat at the time of rough sea conditions, if necessary

Annex III

Necessary measures to be taken by the Government of the Republic of Kiribati in case Japan's Grant Aid is executed.

1. To secure the sites for the Project, clear and level the sites prior to commencement of the Project.
2. To secure yard for stocking material and constructing temporary facilities at the Project sites, if necessary.
3. To undertake incidental external works such as planting, fencing, making gates and exterior lightning in and around the sites, and construct the access road to the sites prior to commencement of the construction, if necessary.
4. To provide facilities for distribution of electricity, water supply, drainage, telephone line and other incidental facilities, when needed.
5. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
6. To ensure prompt unloading and customs clearance at ports of disembarkation in the Republic of Kiribati and internal transportation therein of the products purchased under the Grant.
7. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Kiribati with respect to the supply of the products and services under the verified contracts.
8. To accord Japanese Nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into Republic of Kiribati and stay therein for the performance of their work.
9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.
10. To bear all the expenses other than those to be borne by the Grant, necessary for construction of facilities as well as for the transportation and the installation of the equipment.
11. To coordinate and solve any matters which may arise with third party and inhabitants living in the Project area during implementation of the Project.

*Am*

*NJ*

## V-1. List of the Plan Equipment

### Outlines of Specifications and Quantities for the 3 Islands

Equipment	Specifications	Maiana	Kuria	Aranuka	Total
Ice maker	220Kg/1 cyl. block	2	2	2	6
Ice storage bin	1.8m x 1.8m	1	1	1	3
Generator	10KVA, diesel drv.	2	2	2	6
Water catch mn't	FRP tank, 10 m3	1	1	1	3
Small fishing boat	Canoe app. 7.1m	13	6	6	25
	Skiff app. 7.1m	2	3	2	7
Safety equipment	Lifejacket	45	27	24	96
	Signal mirror	15	9	8	32
	Buoyant smoke sgnl	15	9	8	32
	Hand light flares	15	9	8	32
	Whistle	15	9	8	32
	Parachute flares	15	9	8	32
	Water proof electric torch	15	9	8	32
	Bailer	15	9	8	32
	Magnet compass	15	9	8	32
Outboard motor	15 PS, gasoline	17	8	8	33
	40 PS, "	3	4	3	10
	Spare parts				1
Repair tools for outboard motors	Hydraulic press, 15 tons	1	1	1	3
	Drilling machine, 13 mm	1	1	1	3
	Grinder, 150mm	1	1	1	3
	Air compressor	1	1	1	3
	Work bench	2	2	2	6
	Parts shelf	3	3	3	9
	Others	1	1	1	1
Fishing gear Gill net	3.5" NL 100m/roll	50	50	50	150
	4.0" "	50	50	50	150
	5.0" "	50	50	50	150
	Float, sinker, etc	1	1	1	1
Hand line	Line 8 sizes, 100m	100 ech	100 ech	100 ech	300 ech
	Kirby 9 sizes	1800 "	1600 "	1600 "	5000 "
	Mutsu 8 sizes	400 "	300 "	300 "	1000 "
	Sinker	1800 "	1600 "	1600 "	5000 "
	Swivel 3 types	400 "	300 "	300 "	1000 "
	Hook wire 3 sizes, 400 m length	3 "	3 "	3 "	9 "

Equipment	Specifications	Maiana	Kuria	Aranuka	Total
Trolling gear	Lines( nylon), 100m	30	30	30	90
	Double hook 5 sizes	400 each	300 each	300 each	1000 ech
	Lure head 3 sizes	100 "	100 "	100 "	300 "
	Boards:				
Underwater gear	Splashing 2 sizes	30 "	30 "	30 "	90 "
	Diving 2 sizes	30 "	30 "	30 "	90 "
Fish handling equipment	Mask, snorkel, watertight flash-light, fins/set	10	10	10	30
	Insulated box, 90 liters	40	40	40	120
	Ditto (for the FD)		90		90
SSB transceiver	Platform scale	1	1	1	3
	150W, antenna mast, wiring materials	1	1	1	3
Pickup truck	equipped with crane (500kg)	1	1	1	3
Others	Shelves	1	1	1	1



## V-2. Breakdown of Operation Costs and Revenues

### V-2. Breakdown of Operation Costs and Revenues

#### (1) Shore Facilities

##### a) Ice sales

Ice price : 20 ¢ /kg

Kuria : 20 ¢ /kg × 44,000kg = A\$8,800  
Aranuka: 20 ¢ /kg × 44,000kg = A\$8,800  
Maiana : 20 ¢ /kg × 20,000kg = A\$4,000

##### b) Rents by fishing boats (KIR-8 and KIR-10)

Kuria : 4.20A\$ × 9 × 100day = A\$3,780  
Aranuka: 4.20A\$ × 8 × 100day = A\$3,360  
Maiana : 3.30A\$ × 15 × 100day = A\$4,950

##### c) Interest from the revolving fund

Sales of the fishing gear supplied by the Plan, totaling A\$43,000 for each of the 3 islands, is assumed to be completed by the end of the 5th year. 80% of the fund is operated after the 5th year with an annual interest of 2% (KDB, 1994).

Average interest in the first 5 years = A\$ 344  
After the 6th year = A\$ 688

##### d) Fuel costs

###### Generators

Kuria, Aranuka: 20ps × 200g/H × 12 hrs × 200day ÷ 0.84 × A\$0.55 = A\$6,300  
Maiana : 20ps × 200g/H × 12 hrs × 91day ÷ 0.84 × A\$0.55 = A\$2,860  
(fuel cost per weight of ice = 14.29 ¢ /kg)

###### Vehicles

Pickup : 6 ltrs/day × 200day × A\$0.55 = A\$ 700

##### e) Maintenance costs

###### Buildings

0.5% of direct construction cost : A\$1,900

###### Machinery

2% of EX-GO-DOWN prices for ice makers, generators, pickups and outboard motors.

Kuria : 175,400A\$ × 2% = A\$3,500  
Aranuka: 173,300A\$ × 2% = A\$3,500  
Maian : 185,300A\$ × 2% = A\$3,700

##### f) Personnel expense (Reference only)

Sales and lets 104US\$ × 12mths = A\$1,250  
Facilities 80US\$ × 12mths = 1,000

Total 2,250

(2) Small Carrier Vessel

a) Operation conditions estimated from 1993 records of M/V Nei Tevnei

Annual cruising range : 8,500 nautical miles  
Operation days : 187 days  
Driving hours (Main engine) : 1,200 hrs  
(Generator) : 4,500 hrs

b) Operation costs

Fuel : Main engine  $180\text{g} \times 300\text{PS} \times 0.85 \div 0.84 \times 1,200\text{hrs} \times \text{A\$}0.55 = \text{A\$}36,100$   
Generator  $200\text{g} \times 38\text{PS} \times 1.00 \div 0.84 \times 4,500\text{hrs} \times \text{A\$}0.55 = \text{A\$}22,700$

Foods : 1994 budget by the Fisheries Division A\$10,000

Maintenance: Building cost  $\times 2\%$  A\$20,000

Total : A\$88,800

### V-3. Meteorological Data in South Tarawa

(1) 1992

#### Precipitation (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Month	204	300	332	548	292	101	117	106	81	70	128	509	2,792
Max. Day	61	64	124	164	46	43	92	22	30	19	17	16	-

#### Average Temperature (°C)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Monthly	28.2	28.3	28.3	28.0	28.4	28.5	28.6	28.6	28.8	28.9	28.7	28.1	-
Day max.	33.1	32.7	32.4	32.2	32.5	32.7	34.0	33.0	33.3	32.7	33.3	32.7	-
Day min.	22.8	23.1	23.7	23.1	24.0	23.7	23.4	23.4	23.9	23.0	23.2	22.9	-

#### Average Relative Humidity (%)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	81	79	81	82	-	78	73	76	69	70	75	81	-

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#### Precipitation (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Month	391	308	617	472	578	344	272	271	205	432	100	368	4,362
Max. Day	71	67	149	103	139	67	57	40	71	102	33	60	-

#### Average Temperature (°C)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Monthly	28.0	27.9	27.7	-	27.9	28.2	28.0	28.1	28.2	28.0	28.7	28.4	-
Day max.	32.4	33.0	32.2	32.5	32.1	32.4	32.0	32.5	33.3	33.0	33.0	33.1	-
Day min.	22.4	23.1	22.7	23.2	23.2	23.9	23.2	23.5	23.0	23.0	23.7	23.0	-

#### Average Relative Humidity (%)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	78	83	83	-	84	80	80	78	80	81	75	79	-

Source: Betio Weather Station (1994)









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