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COMPLETION REPORT

U. S. ATOMIC ENERGY COMMISSION
CONTRACT NO. AT-(29-1)-507

ENIWETOK
PROVING GROUND FACILITIES

VOL. VI
RECONNAISSANCE REPORT SUPPLEMENT

HOLMES & NARVER, INC.
LOS ANGELES, CALIFORNIA

1 September 1951

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SECTION I

INTRODUCTION

HISTORICAL:

At the completion of Operation Sandstone the Los Alamos Scientific Laboratory established within its organization a permanent division for the testing of atomic weapons. This is known as J-Division. Soon after the establishment of J-Division recommendations were made to the Manager, Santa Fe Operations Office for the AEC to establish somewhat permanent testing and operational facilities at Eniwetok in order to greatly minimize the effort and cost involved in conducting repeated tests of this nature. J-Division also recommended at this time that a civilian engineering-construction firm be utilized for the principal construction program involved in the establishment of the proving ground facilities.

Accordingly, a contract was entered into between the AEC and the engineering firm of Holmes and Narver, Los Angeles, California to conduct an engineering survey of the requirements for the semi-permanent facilities at Eniwetok. The report of this study, entitled "Report on Reconnaissance, Planning, Utilities and Structures at Proving Grounds, Eniwetok Atoll for Atomic Energy Commission" and submitted 7 January 1949, served as a basis for a comprehensive study and planning program on the part of J-Division. This Report will be referred to herein as the "Reconnaissance Report". From this study the division recommended to the AEC an operational plan with detailed construction requirements which were believed to represent the most satisfactory and economical means for conducting repeated tests at the South Pacific site.

It should be pointed out that the subject of a continental site for atomic weapon testing was thoroughly considered at this time and the decision was made by the Commission that no satisfactory site was currently available,

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and that the Eniwetok Atoll should continue to be used.

On 20 April 1949 the Commission approved the recommendations submitted for an operation plan and construction program, and it thus became possible to define the scope of the work to be carried out by the contractor. The plan approved by the Commission provides for tests to be conducted in 1951 as well as one additional test operation.

The definitive contract between the AEC and Holmes and Narver was formally approved by the middle of June 1949.

OPERATIONAL PLAN:

In a general way, it is planned that the scientific tests shall be conducted as a shore based operation. This implies that all persons involved in the operation, in so far as is practical, shall be quartered either on the shot islands or the headquarter islands of Eniwetok and Parry. One exception to the above arrangement is currently seen to be the bomb assembly operation, and this will be carried out aboard a ship of the USS Curtis, AV-4, type.

Specifically, the scientific requirements for the tests are enumerated below, and it is from these requirements and the recommendations contained in the 7 January 1949 Holmes and Narver Survey Report that the construction program has been formulated.

(a) Detonation Sites.

It is planned to detonate three weapons on 300-foot Towers in the spring of 1951, on a 15 day schedule. The sites chosen, in order of detonation, are Engebi, Aoman and Runit.

(b) Photographic Station Sites.

Two photographic sites, one approximately 2 miles north and one approximately 2 miles south of each of the shot towers will be required. In addition to the land photography, certain aerial

photography will be required.

(c) Control Station.

A common firing control center, located at a safe distance from the shot islands is required. This site must be manned during the detonation.

(d) Animal Colony.

A requirement of the Medical-Biological group is for the establishment of an animal colony and associated laboratories at Eniwetok Atoll. Part of these installations must be available 1 December 1949 and the remainder 1 September 1950. It is expected that the animals shall become accustomed to the South Pacific climate by the time the shots are made.

(e) Living and Headquarter Sites.

In order to expedite the scientific work program living quarters are considered necessary on the shot island sites and at the site of the scientific operations headquarters. Each shot island camp must house an estimated two hundred people and should be temporary in nature since it will be destroyed by the blast. In addition it was decided to use Parry Island for the headquarters for all AEC operations, and semi-permanent living quarters for 600 personnel and temporary quarters for 200 personnel at peak load periods is required. All utilities on Parry should be semi-permanent in construction, requiring only a minimum of maintenance during the interim periods between tests. Likewise, wherever practical it was specified that utilities for the shot island work camps be made semi-permanent in nature, installed in bomb-proof shelters where practical.

Since the assistance of the military services is required in all such test operations as these, it was decided that the AEC should

provide semi-permanent quarters and utilities for 660 military personnel on Eniwetok Island. In addition to this semi-permanent group of buildings provision should be made on Eniwetok Island for a tent camp to house drone plane personnel and other groups involved in the operation for short times only.

(f) Communications.

1. Eniwetok to Oahu

The services are requested to furnish, install, maintain and operate the radio equipment required for the operation. Semi-permanent buildings and the required utilities for this communication link will be provided by the AEC.

2. Inter-Island

All inter-island communication, except that required to be radio type during shot periods, will be by means of submarine cable, and these cables shall interconnect the headquarters islands and all islands of the atoll on which any scientific installations occur. In addition, telephone buoys shall be installed off shore from the headquarters islands.

(g) Movement of Personnel and Cargo.

1. ZI to Forward Area

It is considered necessary for the operation that personnel time be conserved and that personnel be transported by airlift. All cargo, except that urgently required, will be transported by ships.

2. Inter-Island

The scientific operation requires inter-island transportation by boats between all of the islands of the atoll involved in the operation, and by liaison aircraft between the islands of Eniwetok, Parry, Runit, Bijiiri and Engebi.

(h) Dependable Shot Island Electrical Power.

Consideration has been given to the problem of suitable power sources for the shot island installations. The scientific requirement is that this power be made as dependable as is economically feasible, and that a system be provided for monitoring the shot island power during shot periods.

OUTLINE:

The above items constitute the principal scientific requirements. The construction program which is currently in progress is designed to fulfill these requirements, details of the construction program are furnished in the following sections of this Supplementary Report.

SECTION II

CRITERIA

GENERAL:

Pursuant to authorization contained in a letter from Mr. Carroll L. Tyler, Manager, Santa Fe Operations Office, U. S. Atomic Energy Commission, to Holmes & Narver, dated 16 September 1948 and in accordance with the general plan set forth in Section I of the Reconnaissance Report, representatives of Holmes & Narver and J Division visited the Eniwetok Atoll from 4 October to 17 October 1948 for the purpose of making a survey of existing conditions at the project site and prepared the Reconnaissance Report dated 7 January 1949, which Report formed the basis of the design and construction program set up. To avoid unnecessary duplication references are made throughout this Supplemental Report to the Reconnaissance Report of 7 January 1949.

Since the preparation of the Reconnaissance Report circumstances have caused some changes in procedure as well as basic changes in criteria. Therefore, those changes which have been made will be the principal subject of this Report.

A detailed report of the findings of the field survey trip will be found in Section II of the Reconnaissance Report.

The statement of criteria as set forth in Section III has been changed to some extent and amplified due to developments in planning for the scientific aspects of the operation since January 1949.

EXPERIMENTAL ISLANDS:

It is now contemplated that only three islands will be used for tests, these islands being those which were used during the Operation Sandstone and are Engebi Island, Aomon Island and Runit Island. The fourth test location referred to in the Reconnaissance Report located on Bogallua Island has been

eliminated from consideration other than the possibility of laying submarine cable to this island at the same time other cable laying operations are going on.

In addition to the use of these islands for tests, Aomom Island and Runit Island will be used for Photo Tower locations as well as Aniyaanii and the Coral Head location in the lagoon. There will be additional Photo Tower locations for stereoscopic photography. These are planned to be located as follows: Two towers on Teiteiripucchi; one tower on Bokonaarappu; two towers on Piiraai; and one tower on the sand spit south of Runit Island approximately two miles distant from Runit zero.

An animal colony and associated laboratories will be located on Japtan Island with living quarters for personnel necessary to maintain the animal colony and participate in the Medical-Biological test program.

Living facilities will be provided in several locations in the Atoll. The principal AEC facilities will be located on the headquarters islands of Parry and Eniwetok. It is now contemplated that there will be approximately 440 scientists and 220 operating personnel housed in semi-permanent living quarters on Parry Island with temporary quarters for 200 additional personnel at peak load periods. Semi-permanent quarters and utilities will be provided on Eniwetok Island for 660 military personnel. In addition a tent camp will house personnel involved in the operation for short times only. There will also be complete semi-permanent facilities for approximately 150 personnel on Japtan Island, and on or adjacent to each of the experiment islands there will be a tent camp to house approximately 320 personnel, 100 quartered two to a tent, and 220 men quartered four to a tent. These camps will be located on Engebi Island , Rojoa Island and Runit Island. The camps on these islands will also be used by construction personnel during the period of construction of facilities.

CONSTRUCTION CAMP:

In consideration of available funds during Phase I, the required design period and the fabrication and delivery of aluminum structures for the permanent camp, it was determined to be orderly and economic planning to rehabilitate certain structures on Eniwetok Island for an interim construction camp for 230 men during the transition period between Phase I and Phase II. Such rehabilitated structures on Eniwetok will be of subsequent value to the ultimate augmentation of the garrison.

SPECIAL STRUCTURES:

On the experimental islands certain special structures will be required. Among these are 300-foot Towers to contain the weapon for each test and several structures for housing instrumentation and other test structures for the several services participating in the tests. All Photo Towers will be 75 feet high. Seventy-five-foot towers of the Navy Radar type are now located on Aniyaaii Island and on the Coral Head. These will be rehabilitated by replacing the manually operated skip hoists by electric driven hoists of superior design. Two additional towers of the same type are now crated in storage at the Atoll and will be erected on Aomon and Runit Islands. The six new Photo Towers will be of triangular guyed structures of a design similar to the 300-foot Towers and will be located approximately two miles from the zero towers.

COMMUNICATIONS:

An adequate, reliable communication system consisting of submarine cables between manual switchboards will form the principal communication system and this will be backed up by radio for emergencies. To provide reliability and to increase capacity of the system during peak loads, all cables will be laid in duplicate. The existing signal and control cables which are now in place

between Parry Island, Aniyaanii, Coral Head, Runit, Biijiri, and Engebi have been tested and found to still be serviceable and it is contemplated these will be reused, and any additional signal and control cable which will be laid will be taken from the surplus stock now at the Atoll. This additional cable which is stored in reels has been tested and found to be in satisfactory condition.

TRANSPORTATION:

For inter-island transportation the air strips on Parry Island, Aniyaanii, Runit, Biijiri and Engebi will be reconditioned; first, by laying Marsten metal mats for immediate use, and later by asphalt paving over this matting. Piers of wood pile construction will be provided for the operation of boats on the lagoon between islands.

UTILITIES:

The electric power requirements are extremely important and detailed economic studies have been made and the decision reached to provide a power plant to serve each island or group of islands. The power plants and their locations are discussed later in this Report.

For water supply, a dual system is provided at all locations where personnel will be housed. A salt water system will be used for toilet flushing and fire protection and a fresh water system will be used for washing, showers, and drinking purposes. The fresh water will be obtained by the use of compression type distillation units which are further described hereinafter.

An adequate sewage collection system with outfall sewers to the lagoon will be provided on all islands which are inhabited. Trash and garbage will be incinerated.

Neither Aomom Island or Biijiri Island contain sufficient area to provide

for a living camp in addition to the scientific space requirements. The water distance between Biijiri Island and Rojoa Island is relatively short and it is planned to construct pier-type trestle connection between these two islands and thus make one continuous unit out of the three islands, Aomon, Biijiri and Rojoa, there already being a causeway between Aomon and Biijiri.

More detailed discussion of the design and construction problems involved and the method of handling these is covered in the following sections.

SECTION III

DESIGN

GENERAL:

The design of facilities for the proving ground is based on information relative to experimental operations furnished by J Division and which has been outlined in Section I of this Supplemental Report, information obtained by the reconnaissance party when the Atoll was visited in October, 1948, and on economic considerations consistent with good engineering practice.

It was noted when the party visited the site that there was rapid deterioration of many materials due to the extremely corrosive action of the combination of high humidity and salt spray. However it was noted that certain alloys of aluminum seemed to resist this corrosive action extremely well whereas most other materials showed evidence of extreme deterioration.

It was therefore determined that all buildings and structures which are to remain for a period of five years should be constructed of those alloys of aluminum which have been found to resist the corrosive action referred to above. As a result of studies made it was determined to use structure in which the principal members are stamped from sheet aluminum of proper gauge and thickness. The alloy used for these sheets is 4S Alclad and the extrusions used for door frames, girts, panel frames, etc., will be of the alloy known as 63-ST. These particular aluminum alloys are highly resistant to salt spray and high humidity as well as having the desired tensile strength. Detailed description of the building construction is included hereinafter.

SURVEYS:

Section II of the Reconnaissance Report, Pages 10 to 15 inclusive, describes the survey work that had been done at the Atoll prior to

1 February 1949. The program for horizontal and vertical control and scope of field work to be performed by our survey forces in connection with the design of facilities as proposed and described in the Reconnaissance Report on Pages IV-2 to IV-10 inclusive, have been and are being followed. This work is proceeding according to schedule.

PERSONNEL BUILDINGS:

Aluminum Building Construction. As a result of the study and cost analysis, referred to in the Reconnaissance Report of 7 January 1949, it was determined that in so far as possible aluminum alloy would be used for building construction due to structural stability, durability, cost, prefabrication possibilities, and the adaptability of a simple basic design to all required uses, and the ease and speed of erection. The standard building will be 24'0" clear width inside entirely free of columns, trusses, and tie rods, and may be built in any length on 4'0" modules. The original design of aluminum buildings called for a 3'0" module but as a result of a more detailed study this was increased to 4'0" to take advantage of economies in material and erection cost. The standard height of side walls will be 8'0" from cement floor to base line but can be increased up to 16'0" if required. None of the buildings planned except the power plant for Parry Island and Eniwetok Island will have a plate line in excess of 8'0". Details have been completed to allow various plan combinations of the 24' buildings placed side by side or in T or L shaped plans.

The walls are so designed that two-thirds of the wall area may be opened for ventilation by means of awning type aluminum panels arranged in pairs one over the other from floor to door height. Swing doors 2'10" by 7'0" and sliding doors 6'10" by 7'7" may be placed at any modular distance on side or end walls to fit plan requirements. All swing door openings will

be provided with projecting rain hood above the opening. Sliding door jambs will be provided with neoprene rain stops, door head and sill will include proper flashings or rain drips. When in closed position, window covers and doors will be well flashed to provide dry storage.

Standard aluminum screen frames with plastic "Lumite" or similar screen "wire" will be provided on any awning openings where screens are desired. Screens are easily mounted or detached by means of metal clips. Plastic filament is not affected by corrosion, is non-absorbent, non-inflammable, of high tensile strength and stronger in impact than conventional screen wire.

The structural roof is separated by means of wood purlins from an upper aluminum roof to give a clear separation 9" wide for passage of air. A continuous ridge vent is placed above the upper roof.

All interior partitions will be built of standard corrugated aluminum sheets set in oxtruded aluminum frames bolted to floor and roof purlins. Except toilet rooms, or other necessarily enclosed areas, all interior partitions will be 15" up from the floor and 6'9" high to allow free passage of air. Corridor doors to rooms will be provided only where required for privacy.

Other Building Construction. All buildings except small shelters such as an air and water dispatch building near the air strip on Parry Island which will be of wood construction, and the power plants on the experimental islands, will be aluminum alloy construction. The power plants on the experimental islands will be concrete as described under Electric Power Supply Systems.

There will be certain areas where tent quarters will be provided to take care of temporary requirements, as for example the quarters for 220 personnel on the experimental islands, the space for a possible 200 additional personnel

on Parry Island and the possibility of a considerable increase in the number of Military personnel on Eniwetok Island during times of experiments. The tents will be erected on concrete floor slabs with latrine and shower facilities in more permanent structures.

Site Planning. The Site Plan shown on Plate 4 has been approved for Parry Island. The grouping of buildings has been planned to take full advantage of existing roads and usable buildings wherever possible. Existing pier locations for freight and personnel are being reused but will require considerable rebuilding and enlarging. The present Marine Ramp and Marine Railway are to be reused in their present locations. Housing is being provided for 220 scientific personnel and 440 operating and maintanance personnel along the ocean shore of the island to obtain the maximum exposure to prevailing breezes. In addition, provision is included for a 200-Man tent camp with latrine and shower buildings for possible peak requirements.

The Administrative Area on Parry Island, including AEC Administration Building, Contractor's Adminsitration Building, Photo Laboratory, Instrument Laboratory and Repair Shops, and Counting and Sample Laboratories, is located centrally and entirely enclosed by an 8 foot high chain link fence with entrance gates under Security Guard control. Also centrally located on Parry Island is the Firing Control Center. The air strip is located south of all quarters adjacent to the personnel pier. P.O.L. facilities are located on the lagoon side on the north end of the island adjacent to deep water.

For Eniwetok Island the facilities to be provided are not firm as of the date of preparation of this Report. Current planning provides for the construction of a 660-Man camp of semi-permanent type quarters and utilities. Since the number of personnel to be housed on Eniwetok Island may possibly be increased over the number of 660, it is planned that the increase will be

taken care of by a tent camp. The exact location of the permanent camp as well as the tent camp is a matter now under discussion and therefore a site plan for this island will not be further discussed in this Report. At the present time the garrison, as well as the construction forces, are housed in rehabilitated structures on Eniwetok Island and it is contemplated that the garrison can be quartered there for a sufficient period of time to permit a decision to be made and facilities to be provided in more permanent construction. There is no basic change in the general site planning for the camps on the experiment islands. Minor changes in the number of personnel to be accommodated on these islands have caused some slight rearrangements.

The site plan for Engebi Island is included in this Report as Plate 5. The site plans for the other experiment islands will be similar with slight variations made necessary by camp area available on each island.

Living Quarters. Two sizes of buildings will be used for living quarters: (a) A building to house nine men in individual rooms, or eighteen men, two men to a room. These buildings are identical and their occupancy may be shifted. (b) Building to house thirty-six men, four men to a room. This building is so arranged that each room for four men may be subdivided to provide two rooms for two men each, thus providing extreme flexibility of arrangement. Floor plans of these buildings are shown in Plates 6 and 7.

The design of the partitions is such that they can readily be moved although being of aluminum construction throughout. Each quarters building is provided with toilet facilities to accommodate the number of men to be housed therein, and a small space for refrigerator to hold chilled drinks, a storage closet for bottled goods and a chilled water drinking fountain. Each man will be provided with an aluminum wardrobe closet equipped with a protected heating element to keep clothing dry. This wardrobe closet is

shown in Plate 14.

Administration and Laboratory Buildings. Floor plans of the following administrative buildings are appended: Scientists' Administration Building, Plate 16, Holmes & Narver Administration Building, Plate 15, Photo Laboratory, Plate 18, Instrument Laboratory and Repair Shop, Plate 17, Counting and Sample Laboratories, Plate 19, Radsafe Building plan has not been finally approved as of this date but this will provide for the handling of instruments used in checking radiological safety and clothing worn by the monitors. All laboratory buildings will be air conditioned to the extent of reducing relative humidity only except the Photo Laboratory where temperature of 70° with 50% relative humidity is required.

Other Buildings. The Infirmary, Plate 9, is planned to handle emergency surgical or accident cases. Included in this facility are the following:

(a) Six bed ward

(b) Small laboratory for usual blood tests, and biochemistry

(c) Surgery with portable X-Ray and dark room

(d) Small diet kitchen

(e) Dental office for emergency work

(f) Nurses' living quarters

Mess Hall, Plate 8, and Post Exchange, Plate 11, are placed between Scientists' and Holmes & Narver quarters to reduce cross traffic but sufficiently isolated to avoid Mess Hall noises and odors in the quarters.

In the first stage of construction one dining wing of the Mess Hall will be omitted and the end of dining wing temporarily closed in such manner that the missing wing can be built during the second stage of construction without interruption of Mess Hall service and without changes in first stage construction. The Mess Hall is planned for "family style" service at the

tables. Waiters will return dirty dishes to dish washing room in roller carts. Mess tables will be designed with integral benches to seat eight people. Table tops will be tempered Masonite finished with waterproof clear lacquer. Kitchen facilities will include adequate store room for bulk storage of staples. Vegetable and meat preparation rooms. Three large walk-in refrigerators. Pastry and rolls baking unit, oil fired ranges, steam kettles, vegetable cooker, deep fat fryers, griddles, adequate scullery equipment, etc. Mechanically ventilated range hood will be included.

The Bakery, Plate 8, will be in a separate building adjacent to the kitchen and will include rotary bread baking over, proofing cabinet, doughnut fryer, ice cream maker and hardening cabinet. A separate pantry for preparation and distribution of box lunches is included in the bakery plan.

The Laundry, Plate 12, with facilities for taking care of sheets, towels and other flat work, as well as personal laundry, will be located near the power plant and will provide weekly laundry service.

The Power Plant Building, Plate 23, will house the diesel-generator sets and electrical switching equipment as well as water distillation units and necessary auxiliary pumps. The salt water pumps will be located in a separate structure near the waters edge. All of these facilities are described in greater detail hereinafter.

In addition to the buildings which have thus far been described, an outdoor theatre having a seating capacity of approximately five hundred, as well as a Post Exchange, Plate 11, a Recreation Building, Plate 10, Fire Station, Security Office, Security Quarters and Shop Buildings are included in the general plan for Parry Island.

EXPERIMENTAL STRUCTURES:

The Reconnaissance Report discussed at considerable length the condition

of existing structures, recommended repairs, realignment of Gamma Stations and additional structures. The thinking along this line has not changed.

Zero Towers. The experimental towers are designed as triangular structures 300 feet high with guys at the 250 foot level. The head house is of aluminum as described in the Reconnaissance Report. The general appearance of the towers is shown in Plate 18, Page IV-38 of the Reconnaissance Report.

One of the 300-foot Towers is to be built of aluminum throughout above the 25 foot level excepting for the cables and elevator guide rails which remain steel.

It is planned at this time to completely erect one tower at the fabricator's yard in Los Angeles so that all mechanical and electrical features can be tested as well as structural connections checked for good alignment and ease of erection.

Photo Towers. The two 75-foot Navy type Radar Towers now located on the Coral Head and Aniyaanii will be remodeled to the extent of providing new electrically operated hoists. The float and ladder recommended in the Reconnaissance Report will be provided at the Coral Head. The two spare towers now packaged and stored in Eniwetok will be erected on Aomon and Runit Islands.

Six new Photo Towers will be erected at the locations previously described. These towers will be triangular in shape with sides twelve feet eight inches in dimension and guyed at the 62 foot 6 inch level. The tower height is 75 feet to the floor of the head house and this house is to be laid out to suit the photographic requirements. An electric motor driven hoist with guide rails is provided for handling of equipment to be used in the house. Stairs are designed on exterior face of tower for personnel use.

WATER SYSTEMS:

As recommended in the Reconnaissance Report distillation units are used in the design of the fresh water supply.

After careful analysis of operating procedures it was determined that electric motor driven compression type distillation units using the exhaust heat from the diesel engines driving the generators of the electrical power system, would give the most economical operation.

Two surface storage tanks of 500 barrel capacity each are provided to give an adequate reserve of fresh water with a similar size elevated tank to maintain constant pressure on the system.

Maintaining an allowance of 50 gallons per man per day of fresh water, as used in the Reconnaissance Report, it is necessary to supply salt water for all purposes where it can be advantageously used.

A complete system of salt water supply lines, providing fire fighting, equipment washing, toilet flushing and similar uses, has been designed and will in many cases parallel the distilled water lines.

Elevated storage tanks totaling 1000 barrels capacity are connected to the salt water distribution lines and give a good workable line pressure with a reserve capacity for fire use.

When the Reconnaissance Report was prepared the method of cooling the Diesel engines had not been determined. It has since been decided that salt water will be used, and the size of salt water pumps has therefore been increased from 100 g.p.m. each to 300 g.p.m. each. This permits the reduction of the fire pump from 500 to 300 g.p.m., thus making all salt water pumps identical.

Asbestos cement pipe is used for distribution lines of both salt and fresh water systems with a minimum coverage of two and one half feet of earth over the lines.

The above descriptions are applicable to Eniwetok and Parry Islands varying only as to capacities required due to population and use differences. Experiment island water installations are similar but greatly reduced in size due to small population anticipated and the fewer uses of water required.

Intake lines on Eniwetok and the experiment islands are planned for the seaward side of the islands but the Parry intake is to be located on the lagoon side as described in the Reconnaissance Report.

SANITARY SEWER SYSTEMS:

The layout and design of the Sanitary Sewer Systems follow the description as given in Section IV of the Reconnaissance Report with the following exceptions:

Clay pipe was found to be so much cheaper than other suitable types that, even including a crating cost of approximately 25% it is more economical. The reuse of crating lumber for construction on the site will reduce the net cost of crating somewhat.

Due to the relatively level topography of Parry Island a study is being made to determine the relative advantages of sewage pumping versus gravity flow. The relative costs of constructing sewers below ground water as compared to the cost of the pumping plant; and the relative cost of pumping versus maintenance of sewers on a flat grade are factors entering into this comparison.

Eniwetok Island layout has not been firmed up at present but the same conditions are anticipated for this location as were found on Parry.

ELECTRICAL POWER SUPPLY SYSTEMS:

General Requirements. Electrical power will be required on a number of islands of the Atoll for construction of facilities and during the operations for experimental purposes. These islands are: Eniwetok and Parry,

where personnel will be housed, Engebi, Aomon, Biijiri, Rojoa and Runit (the experimental islands) and Aniyaanii, Coral Head in the lagoon, Teiteirpuchi, Bokonaarappu, Piiraai and a sand spit south of Runit Island which are locations for Photo Towers. During the interim between experiments, referred to as the "roll-up period", power will be required on Eniwetok Island only as all personnel remaining on the Atoll will be housed here. This personnel will consist of a small garrison of troops for security and a maintenance force.

Maximum Demands. In the Reconnaissance Report, the maximum demands for all islands were estimated before preliminary designs were made. Since the preparation of the Reconnaissance Report of 7 January 1949, preliminary designs of electrical facilities for Parry Island have been made and the connected load determined to be approximately 1380 KW with a resultant estimated maximum demand of 405 KW.

As stated hereinbefore, the number of people to be served on Eniwetok Island is not firm at the present time. If the number remains at six hundred, it is believed the estimated demand will be approximately the same as in Reconnaissance Report, plus an additional 50 KW for expanded communications requirements or 475 KW. It is possible that an additional sixteen hundred men may be quartered on Eniwetok for a short period, mostly in tents. Under these conditions it is believed the maximum demand on Eniwetok will be approximately 650 KW. A more detailed engineering analysis will be made when the use of Eniwetok Island has been made firm.

Although the utility requirements and designs for experimental islands have not been finally determined, more complete information and further consideration of demand factor has indicated a reduction from 200 KW estimated maximum during the experiment in the Reconnaissance Report to 130 KW. The

estimated demand for one experiment island at full activity is now determined as follows:

200-Man camp at 0.5 KW per man	100 KW
Instrumentation utility	30 KW
Current estimated maximum demand during experiment	130 KW

This requirement is also subject to additional engineering analysis as requirements are firmed up and designs prepared. The table in the Reconnaissance Report on estimated system demand is no longer of significance, since it has been decided to provide an individual power plant serving each of these loads rather than serving the entire system from one or two plants.

Plate No. 21 shows the present Power Demand Estimate and a portion of the Load Cycle for all islands.

Type of Sources. The Reconnaissance Report developed the fact that a Diesel plant or Diesel plants would be the most economical solution to the power source problem consistent with reliability (see Pages IV-82 to IV-84).

Number, Location, and Capacity of Diesel Plants. A modification of the many plant schemes recommended on Page IV-107 has been adopted. The present plan is shown on Plate 22. Both experiment island power and Photo Island power will be voltage monitored at the firing control center during shot periods.

One power plant will be provided on each of the three experiment islands to serve the living quarters, the Timing Building, the Zero Tower, and the Photo Tower. Each plant will be housed in a permanent reinforced concrete structure constructed partially below ground and protected on the side toward the Zero Tower by earth revetments. It will be located either at the camp or between the camp and the Timing Building. It is planned that each of these experiment island power plants will consist of two 118 KW Diesel

generator units with space in the plant for an additional similar unit. Each of these Diesel generator units consists of a medium speed (720 revolutions per minute with a corresponding piston speed of 1080 feet per minute), Diesel engine designed for operation on standard Navy fuel directly coupled to a moisture resistant, fungus proof 2400 volt alternator. An exhaust heat boiler will be provided with each unit to utilize the waste heat as a source of steam for the water distillation units mentioned elsewhere in this Report. In order to insure sufficient steam for these water distillation units at times when a Diesel generator unit is operating at light load, an auxiliary electric heater with automatic controls will be incorporated in each exhaust heat boiler.

The plant for Parry Island will be constructed above ground. Both the Diesel generator units and the water distillation units mentioned elsewhere in this Report will be housed in an aluminum building. This power plant will consist of four 142 KW units with space for a future fifth unit as shown on Plate No. 23. This will permit three units to carry the estimated maximum demand of 405 KW with one unit out of service. These units will also generate at 2400 volts and be similar to the units provided for the experiment islands and Eniwetok except for the number of cylinders and the generator capacity. This standardization will reduce to a minimum the spare parts stock requirement and the maintenance problem.

Until more information as to requirements is available and thoroughly analyzed, it is not certain whether one or two plants will be provided for Eniwetok. In either event, the plant or plants will be above ground. It is probable that one plant consisting of five 142 KW units or five 168 KW units similar to those for Parry and the experiment islands will be required.

Additional small plants consisting of two small low-voltage units will probably be required for the four new Photo Tower locations in addition to the one on Coral Head and on Aniyaanii. Exact power loads for these sites have not yet been firmed up.

Requirements During Construction. It was contemplated in the Reconnaissance Report (see Page IV-95) that construction forces initially housed at Eniwetok in small numbers and later based on Parry would require power for their operations prior to the completion of the final plants. To this end a survey was made and some low-voltage skid mounted Diesel generator units were located on Eniwetok. These units required repairs to put them in suitable condition. These repairs have been and are being made and these units are being used for this purpose. Several additional small units will be used to supplement the ones obtained on Eniwetok.

ELECTRICAL POWER DISTRIBUTION:

Since a modification of the Many Small Plant scheme of power supply is being adopted as the power supply system for the operations, no inter-island power distribution is required (see Pages IV-96 to IV-101 of the Report).

Power Distribution on Islands. Overhead distribution will be provided on Parry and Eniwetok and for the construction camp portion of experiment islands. Underground distribution will be used for primary feeders as well as secondary feeders and branch circuits serving instrumentation loads on experiment islands (see Page IV-102 of Report).

COMMUNICATIONS:

The Proving Ground operation will require reliable communication between stations located on Parry, Eniwetok, Japtan, the experiment islands, the Photo Towers, and ships anchored in the lagoon. These needs are particularly vital during the period before each experiment. The Armed Forces will require the use of communication facilities on Eniwetok and the experiment islands for security personnel operations. Construction personnel will utilize communications between the various islands during the construction period. In

order to meet these requirements, a wire telephone system will be provided.

The number of stations required on each island has not been firmed up as yet, and it is believed that the total number of instruments (480) assumed in the Reconnaissance Report (see Pages IV-109 to IV-111) is still reasonable although facilities on Bogallua are no longer required.

A manual telephone system will be employed. The main switchboard will be located in the Administration building on Parry Island. Subswitchboards will be provided on Eniwetok, Japtan and each of the three experiment islands. Submarine telephone cable will be installed for trunking between these switchboards. Two 16 pair cables will be used between Engebi, Biijiri-Rojoa, Runit, and Parry; three 16 pair cables will be used between Parry and Eniwetok; two 6 pair cables will be used to Japtan and to each of the new Photo Tower locations mentioned elsewhere and one 6 pair cable will be provided to buoys in the lagoon at moorings adjacent to Parry, Eniwetok and each of the three experiment islands. Plate No. 24 shows these cables. One of the cables between the various switchboards is a spare intended to provide continuity of service in the event of damage to one cable. A four-channel radio back-up system will be provided to supplement the submarine cable trunking for emergency use.

A public address system will be provided on each experiment island to call personnel from the field to a telephone.

CONTROL AND SIGNAL CABLES:

Existing Control and Signal Cable Installed Submarine. There are existing submarine control and signal cables which were installed on the floor of the lagoon in January, February, and March of 1948 for use in Operation Sandstone. Tests were made on these cables in October, 1948 and February, 1949 to check the condition of these cables. Refer to Plate 50 of the Reconnaissance

Report for the location of the following cables. Their condition judged from these previously mentioned tests are as follows:

O-201	good
O-202	good
O-203	good
O-204	good
O-205	questionable - probably good
O-206	good
O-207	good
O-208	good
O-209	questionable - not terminated at either end
O-210	questionable - cable damaged on beach at Runit
O-211	good
O-212	good
O-213	good
O-214	probably good
O-215	good
O-216	bad
O-217	partly bad

Thus it appears probable that most of the existing control and signal cable installed submarine will be usable for future operations. Because this existing cable is exposed on the beach where brought ashore from the lagoon in many cases, it is thus subject to possible damage by landing craft, construction operation, etc. That portion on shore and within two feet below low tide will be repaired where necessary, grouped where feasible, placed in a trench, and covered with sand and concrete. Signs of sufficient size will be posted to adequately mark all cable landings and trench locations.

Existing Submarine Control and Signal Cable, not installed. The Reconnaissance Report indicated that a total of 218,900 feet of surplus 10-conductor armored submarine cable was supposed to be on Eniwetok and Parry. A total of approximately 137,000 feet of this cable has been located, identified, and tested on Eniwetok. A number of the 28 reels located had been outdoors exposed to the weather. These have been brought into warehouse D on Eniwetok Island where the other reels were stored. Eight of the 28 reels were in poor to severely damaged condition but all of the cable was in good condition. The balance of the 10-conductor cable reported to be on Parry Island will also be located, identified and tested to determine whether or not it can be used for future operations.

There is reported to be approximately 348,000 feet of 3 conductor submarine cable on the Atoll. It is doubtful if any of this cable can be used on the next operation, since it was abandoned on Operation Sandstone as being unsatisfactory. However a portion of this cable will be tested and may be used to provide temporary telephone trunking between Eniwetok and Parry during the construction period prior to the installation of the telephone submarine cable described under the COMMUNICATIONS section of this Report.

FUEL HANDLING AND STORAGE

The following is intended to supplement and revise the information contained in the Reconnaissance Report relative to this subject, Section IV, Pages 126 through 128.

Storage Capacity. In the light of latest information regarding expected fuel consumption, it appears that adequate storage capacity can be obtained by providing the following tankage:

On Eniwetok Island:

(a) 73 and 80 Octane Aviation Gasoline-storage will be in drums

(b) 115/145 Octane Aviation Gasoline-three (3) 10,000 gallon horizontal tanks; total storage, 30,000 gallons.

(c) Motor Gasoline-four (4) 5,000 gallon horizontal tanks and one (1) 1,000 barrel (42,000 gallon) vertical tank; total storage, 62,000 gallons.

(d) Diesel Oil-Two (2) 1,000 barrel (42,000 gallon) vertical tanks; total storage, 84,000 gallons.

On Parry Island:

(a) Motor Gasoline-four (4) 10,000 gallon horizontal tanks and one (1) 1,000 barrel (42,000 gallon) vertical tank; total storage, 82,000 gallons.

(b) Diesel Oil-five (5) 10,000 gallon horizontal tanks and two (2) 1,000 barrel (42,000 gallon) vertical tanks; total storage, 134,000 gallons.

All tanks will be set above ground in order to permit inspection and to facilitate maintenance. The vertical tanks will be set on concrete pads with the bottoms of the tanks protected from contact with the concrete by means of a heavy coating of hot-mopped asphalt. The horizontal tanks will be set on steel cradles on concrete foundations at sufficient elevation to provide for gravity filling of tank trucks.

Other Facilities. On Parry Island fuel will be received from tankers through two 4-inch submarine lines; one for motor gasoline, the other for diesel oil. Incoming fuel will be dewatered, deaerated, and metered before introduction into on-shore storage tanks. Metering equipment, flow control valves, and fuel transfer pumps will be contained in a pump house for protection against salt spray. Tank truck loading stands will be provided for both gasoline and diesel oil. In addition, diesel oil will be transferred

by pumping through underground lines to the Diesel power plant and the Laundry boiler plant. Diesel oil will be transferred by truck to the Mess Hall boiler plant and to the boat fuel storage tank located on-shore adjacent to the Freight Pier. Fuel will be transferred to boats by pumping from this storage tank to two boat fuelers located on the Freight Pier. Motor gasoline will be transferred by truck to a Service Station storage tank located adjacent to the Motor Repair Shop and will be dispensed to vehicles by means of two metering service-station type gasoline pumps.

On Eniwetok Island fuel handling facilities will, in general, be similar to those described for Parry Island. In addition, 115/145 aviation gasoline will be received from tankers. Incoming motor gasoline and 115/145 aviation gasoline will be received through the same 4-inch submarine line by degrading a metered portion of aviation gasoline to motor gasoline storage tanks to prevent decontamination of aviation gasoline. A truck loading stand will be provided for 115/145 aviation gasoline. 73 and 80 aviation gasoline will be received and stored in drums.

PAVING, ROADS & AIRSTRIPS

It is desired to have an asphaltic concrete pavement for the area within a 1000 foot radius of the Zero Towers. This pavement would be 3 inches thick for the inner 400 foot radium and 1½ inches thick for the remainder of the 1000 foot radius.

As this area comprises approximately 90% of all paving on experiment islands it is considered advisable to use the same type for all other paving operations on these islands. This then would include roads, airstrips and living quarters area.

A complete hot mix plant will be constructed but so built that the component parts can be readily moved on T boats to other islands. Considerable

drying and heating of aggregate is required and protected storage of screened coral is necessary after it leaves the crusher and drying plants.

Eniwetok and Parry Islands do not require this type of pavement and the use of MC3 oil is indicated for such roads, airstrips and paved areas are required.

Due to the light traffic on Japtan it is considered necessary to do only light blading to grade such roads as may be required.

SOIL STABILIZATION:

Excepting for the required paving of roads, airstrips and Zero Tower areas it is planned to plant Bermuda and Australian crab grass to stabilize the soil.

This cover grass will be used on all islands, where the loose soil presents an undesired problem, although not as extensively as on the experiment islands.

CAUSEWAY:

The location of proposed causeway between Biijiri and Rojoa as described in the Reconnaissance Report remains unchanged but the method of construction differs from the various methods described therein.

Due to the development of efficient pile driving methods in coral shelf areas it is now planned to use a method similar to the pier construction described hereinafter.

Besides being more economical than other methods contemplated the pile bents will not interfere with the free flow of currents and does not require the extensive quarry operations to provide necessary coral rock for a fill type causeway.

PIERS:

It has recently been determined that wood piles can be driven

successfully in coral of the type found on the lagoon side of the Eniwetok group of islands. In view of this it is planned to construct the piers by driving creosoted wood piles in 4 pile bents about 12 feet on center. Freight piers are planned with a T shaped end in order to provide docking space for a LCT at the end of the pier. This type of pier will have the advantage of additional strength and space for cargo handling at the end of the pier. Where feasible the new pier will be constructed alongside of the existing piers in order to take advantage of protection afforded by the fill. The pile driver will build out from the shore and will be supported by piling working progressively toward the outer end. In this way the construction work will not interfere with the existing piers, leaving them available for freight handling during construction.

In order to put the existing piers in shape to use while new piers are being built it is anticipated that use will be made of steel plates now available on Eniwetok. These plates will be laid on both sides of the present coral fill and tied together. Fill will then be placed to provide a level deck.

SECTION IV

CONSTRUCTION

PURPOSE:

The purpose of this section is to comment briefly on decisions reached and progress made within the planning structure projected in the basic Reconnaissance Report of 7 January 1949, and is intended to be used in conjunction with that Report.

LOGISTICS SUPPORT:

For planning purposes the project was divided into five (5) phases. These are defined in Section V of the Reconnaissance Report. As a result of a request by the Atomic Energy Commission for military assistance during Phase I, the Chief of Naval Operations, in a letter dated 31 December 1948, directed the Commander-in-Chief, Pacific to extend all practical assistance. In the series of conferences during the week of 12 January 1949 at CINCPAC, working agreements were set up which established the function of CINCPAC in certain particulars of logistics and administration. By the authority of this command, COMWESEAFRON was named as West Coast contact for Holmes & Narver in the military air and ship transport of personnel and things. Following conferences at that Headquarters and by delegation from COMWESEAFRON, the Port Director, Long Beach, was established to clear civilian personnel for travel, and as an entry and departure point for radio communication in the military network. Satisfactory working arrangements were established with all agencies concerned.

Decision by the Atomic Energy Commission to proceed with subsequent phases outlined in the basic Reconnaissance Report was made on 21 April, 1949. Planning conferences followed with Laboratory representatives and site planning and engineering studies were sufficiently advanced that a budget analysis and

forecast of funds required was made to the Atomic Energy Commission, as well as detailed scheduling for FY-1950. Subsequently, by dispatch dated 17 May 1949, CINCPAC was directed to proceed with planning for the military support of subsequent phases. Representatives of AEC and Holmes & Narver conferred at CINCPAC during the week of 6 June 1949 for this purpose. Pertinent Phase I agreements were extended or modified to meet Phase II requirements, and forecasts for FY-1950 were drawn up. During Phase II, which is a major mobilization period, shipping will be at peak loads and personnel movement will accelerate to substantially a peak. In general, this Phase will be characterized by the continued maintenances of existing facilities and the installation of new facilities, and procurement necessary to sustain and utilize large numbers of people in the field. Military assistance from the Eniwetok garrison will diminish during the transition period 1 July to 31 September. However, military assistance will continue to be required in a number of particulars, which are outlined in the basic Reconnaissance Report. Subsequent phases covering that period of activity during which installations which characterize the Atoll as a proving ground are designed and constructed, are adequately covered in the Reconnaissance Report until such time as more detailed comments can be made, in view of the scientific operating plan. The scope of work for which Holmes & Narver is responsible is contained in a Secret document referred to and made a part of a definitive contract number AT-(29-1)-507, executed 17 May 1949.

PHASE I OPERATIONS:

The operational philosophy outlined in the Reconnaissance Report of 7 January 1949 is referred to and is in principle unrevised as the criteria for following phases of the project. The Phase I mission was principally a follow-up of the previous Atomic Weapons experiments at Eniwetok Atoll.

The major problem and the one of highest priority was the reduction of radio-activity in the test areas to establish a level of safe daily tolerance for personnel. The secondary problem was clean-up, maintenance and repair. Both of these problems were unexpectedly complex and placed unanticipated requirements on personnel and logistic support. There were no existing precedents for the engineering and construction problems involved in making this area radio-logically safe, and it is consequently not surprising that the job was not accurately predicted.

The grading operation designed to reduce the hazard of radio activity, described on page V-15 of the Reconnaissance Report, was approched substantially, as described and was made effective with the modification that extensive filling has been judged to be unnecessary in view of most recent investigations. Experimentation with the radiological problem was carried on in several alternative discussions, and the most effective and economical solution was determined and approved by Radsafe representatives and officials of the Atomic Energy Commission during the field inspection trip during May 1949. Phase I mission can therefore be regarded as having been accomplished, although routine progress will continue into Phase II.

BEGINNING OF PHASE II:

There remains at the beginning of Phase II the following major items of effort, all of which are being carried forward on a high priority:

Decontamination of Sandsone test areas.

Parry Camp Construction.

POL Facilities.

Piers and air strips.

Construction Plants.

Repair and maintenance as required.

Procurement of construction equipment and maintenances.

Field surveys supporting engineering design and construction layout. In addition, and as a result of conferences during the last week in June, it was anticipated that a directive will be received to activate Japtan Island for experimental purposes during Phase II.

Phase I contemplated the approach of Phase II, with very limited force in the field due principally to the inability of the garrison to sustain an excess of 30 persons, to which extent the Project was supported by special agreement. Due to effective rehabilitation work by our initial forces in the field, both as to buildings and mechanical installations, it was found that on 1 June the civilian components of the project were able to become selfsustaining. By authority of AEC and the concurrence of the military establishment, program was then augmented as to manpower to provide more effective accomplishment in the initial period of Phase II.

GENERAL CONCEPTS:

The general concepts outlined in Section V of the Reconnaissance Report remain a valid guide to operational policy, with the following comments on portions thereof:

a. The sub-contract concept now appears to be a minimum necessity except for tower erection.

b. Extensive experimentations in the field have developed technics of adequately handling contaminated areas. This, together with a substantial decay of the intensity of radio-activity during Phase I has resulted in an effective procedure which has been demonstrated and approved by laboratory representatives.

c. Personnel forecasts on which estimates were based are still substantially valid, with the exception that the peak personnel will

not rise quite so sharply or be of such short duration.

d. As was anticipated by the comment in Section V, page 7, the schedules must be more or less regularly revised to meet changing conditions, delivery dates, etc. We have revised all logistic schedules shown in the Reconnaissance Report, and have additionally made them more effective by the development in considerable more detail for FY-1950. These schedules are attached hereto.

e. The sequence of operations outlined in the Reconnaissance Report, Page V-7, contemplated construction first on Parry Island, then Eniwetok, followed by other Islands. This has been modified, placing construction on Eniwetok lower in the sequence of operations due to:

(1) Ultimate military requirements on Eniwetok are not yet firm.

(2) The introduction of Japtan Island as added scope of activity was placed on time schedule which required a high priority.

OPERATIONS SUPPORTING CONSTRUCTION:

Procurement as predicted in the Reconnaissance Report has been approached primarily through the National Military Establishment, and the principal tonnage of construction equipment has been furnished by transfer to the Project under fiscal agreements separately executed.

The off-loading of ships is being handled in accordance with the prediction of the Reconnaissance Report and is successful within the limitations of the Site. Supplementing the facilities referred to in that Report, however, six (6) LCT's were requested from and supplied by CINCPAC, which materially facilitated this operation.

The temporary communication requirements within the Atoll have been accomplished, with the exception of the connection between Parry and

Eniwetok, at which point existing cables are inoperative. Field forces are operating effectively with a radio link until repair replacement can be effected.

Field surveys and acquisition of construction plant facilities have proceeded in accordance with schedule.

The Reconnaissance Report limits the feasibility of aircraft operation to L-5 types. The successful placing in production by the Air Forces of the L-13 has enabled field forces to place such planes in operation with added efficiency due to their greater passenger carrying capacity within the air strip limitations that exist.

AGGREGATES AND TESTING:

Certain alternate recommendations were made on page V-25 as to concrete aggregate. That portion of the recommendations pertaining to the use of coral may now be considered firm.

The recommendation in the Reconnaissance Report, page V-28, that special testing laboratory procedures be authorized has been accomplished and is in progress through the services of the Physical Testing Laboratory of the Corps of Engineers in Los Angeles. In addition, our own testing personnel have been engaged in analysis of actual soil samples obtained from the Site, which will lead to design mixes for both concrete and paving. An advance base type of Field Testing Laboratory is expected to be installed during Phase II at the Project Site for the purpose of construction control.

TRANSPORTATION:

On page V-35 alternate recommendations as to Air Transport between commercial and military resources were made. During conferences at CINCPAC, during the week of 6 June 1949, the personnel movement forecast by schedules attached hereto, during the Fy-1950 were committed by MATS and commercial

arrangements have been suspended, with the exception of the flight between the Mainland and Oahu.

Alternate shipping recommendations were discussed on page V-36. By agreement with CINCPAC the Navy has undertaken this mission, to the extent that is forecast by tonnage curves attached hereto, and they are in effective performance in this mission. However, it is recommended that in the case of both air and surface transport, the highest priority, consistent with the national welfare, be assigned to this project to enable lower echelons of the system to effectively perform this obligation, in view of somewhat limited facilities.

On page VI-6 of the Reconnaissance Report a central transhipment point for all out-bound cargo in connection with this project was recommended. A subsequent agreement with CINCPAC and COMWESEAFRON, Naval Supply Center, Oakland, has been designated as this central transhipment point. Holmes & Narver has placed a representative in the Naval Supply Center for the purpose of assisting and expediting such freight handling. Minimum warehousing and re-packaging is conducted in Los Angeles by Holmes & Narver employees.

CONSTRUCTION CAMP:

Arguments were presented on page V-40 for alternate sites of the Base Camp. Decisions subsequent to the publication of the Reconnaissance Report have firmly placed this base camp on Parry Island.

The discussion of outlying camps, on page V-41, has been modified as an interim expedient by a proposal to adopt one of the LCT's for a houseboat.

FACILITIES FOR PERSONNEL:

Recommendations as to Camp Services and recommendations as to measures to be taken for personnel morale are established as a matter of agreement between AEC and CINCPAC. Special Services, Commissary, and Club will be

operated by Holmes & Narver, at the expense of AEC, but will be revenue producing. Any profits therefrom will accrue as a credit to the Government, being accounted for as a "Welfare Fund".

Recommendations previously outlined as to Medical facilities have been substantially carried out by agreement with all Agnecies concerned. During Phase II, Holmes & Narver will provide advance base type medical and dental care for its own employees, and the military establishment will provide emergency evacuation, surgery, and emergency hospitalization as required.

Recommendations in the Reconnaissance Report as to the means of providing currency at the Project Site has been modified to the extent that by agreement with CINCPAC, Holmes & Narver will transport currency to the Project Site in the safekeeping of Captains of Naval Vessels, for the purpose of issuing payrolls. These payrolls will consist of a small partial payment of wages or salaries, the remainder to be paid to a bank or dependent on the Mainland, designated by the employee. After the token payment is issued, the employee may purchase Script, which will be a mode of exchange in camp commissary, club, and similar installations.

FINALLY:

Sections VI and VII of the Reconnaissance Report pertaining to the Test and Roll-up periods are not yet accompanied by sufficient new information for intelligent revision.

Section VIII of the Reconaissance Report itemizes 28 specific recommendations. These have all been accomplished or been accepted as criteria, or are in progress with the exception of No. 8 and 13, which are not yet firm as to policy and No. 23, which was modified to make use of the planting of grass.

Section IV of the Reconnaissance Report consists of detailed cost estimates. Nothing has transpired to date to indicate that these cost estimates are unrealistic, with the exception of such added scope of work as the activation of Japtan Island, which will be treated separately.

S E C T I O N V

P L A T E S

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Plate Number	Description
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11.	Post Office
20.	P.O.L. Facilities
23.	Power Plant Layout-Parry Island
21.	Power Demand Estimate
22.	Power Plants-Number, Location & Capacity
6.	Quarters-18 Man
7.	Quarters-36 Man
10.	Recreation Building
13.	Reefer Building
1.	Schedule-Construction
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16.	Scientist-Administration Building
11.	Shoe Repair Shop
5.	Site Plan-Engebi
4.	Site Plan-Parry
20.	Storage Oil & Gasoline
24.	Telephone System-Inter Island

JOB 640 - PHASE II III
CONSTRUCTION SCHEDULE

1949 1949 1950 1950

	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE
PARRY BLDGS	SLABS	ERECTION					BLDG ERECTION					
PARRY WATER	SHIP	INSTALL										
" POWER	SHIP	TEST-TRANS INSTALL					COMMUNICATION					
SEWERS	SHIP	INSTALL										
BOAT REPAIR	PARRY											
UTILITY REPAIR	CONTINUOUS AND RECURRING											
GRAVEL	RUNIT	ROMEN		ENGEBI					GENERAL GRADING			
TRF PARRY							GRADING					
" RUNIT							GRADING					
" BIJIRI							GRADING					
" ENGEBI							GRADING					
CABLE TEST & R												
SLOP DEMOLITION PARRY												
SLOP DEMOLITION ENIWETOK												
PLANTING	PARRY TRF ISL											
PERSH PIERS	ENI / PARRY	/ RUNIT, BIJIRI / ENGEBI			BOAT CHANNELS						EXPER REQUIREMENTS	
SHOPS		TEMP	PERM BLDG									
SURVEYS	TRANSLATION TOPO EXPER			ISLAND CONTROL SURVEYS			CONSTRUCTION CONTROL		CABLE CONTROL			
CONCRETE	BLDG SLABS PARRY	BLDG SLABS ENIWETOK		QUARRY NS	SHOT FILL SLABS	OPERATION	CRUSHER OPR	SPECIAL	CONCRETE	PLANT OPERATION		
PAVING		SHIP PLANT		PLANT SETUP	SHIP	ASPHALT	AIRSTRIPS		ROADS		EXPER ISL AND AREAS	
ROADS ENI	GRADE					REGRADE		PAVING				
ROADS PARRY	GRADE					REGRADE			PAVING			
ENI BLDGS	INTERIM MEN CAMP						ERECTION					
WATER												
POWER										COMMUNICATION		
SEWERS												
RUNIT CAMP			ERECTION	TEMP UTILITIES								
ROJOA CAMP			ERECTION		TEMP UTILITIES					PERM UTILITIES		COMM & CONTROL
ENGEBI CAMP					ERECTION		TEMP UTIL					
PERM POWER												
" COMM												
" PAVING												
TOWERS								FOUNDATIONS		ERECT TOWERS		
EXP BLDGS						TILT SAMMIAS		BLAST PROOF	BLDGS	ALL EXPER ISL		
CAUSEWAY						ROJOA TO BIJIRI						
CABLE LAYING									ALL ISLANDS			
POL												
JAPTAN												
CAPACITY												
PARRY QUARTERS		300		400	500	550		600		300		
POWER	180 KW			450 KW								
WATER			14400 GPD			43200 GPD						
ENIWETOK QTRS.	INTERIM 200						ERECTION FOR 200		ADD 100 EXISTING GARRISON + 200 MEN INTERIM			
POWER							540 KW					
WATER						43200 GPD						

JOB 640 - PHASE II III
SHIPPING SCHEDULE

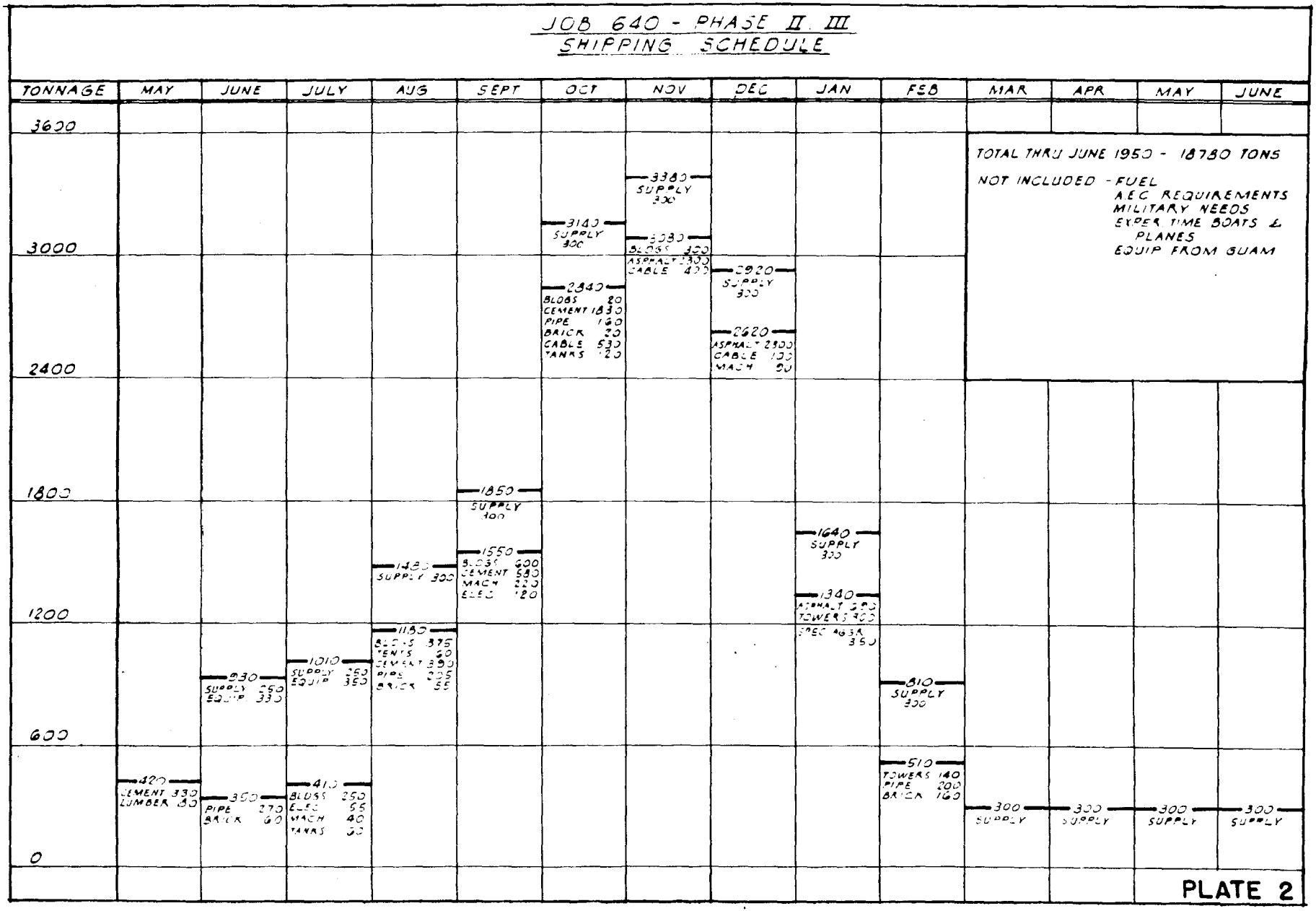


PLATE 2

AIR LIFT
PERSONNEL & FREIGHT
PROJECT 640

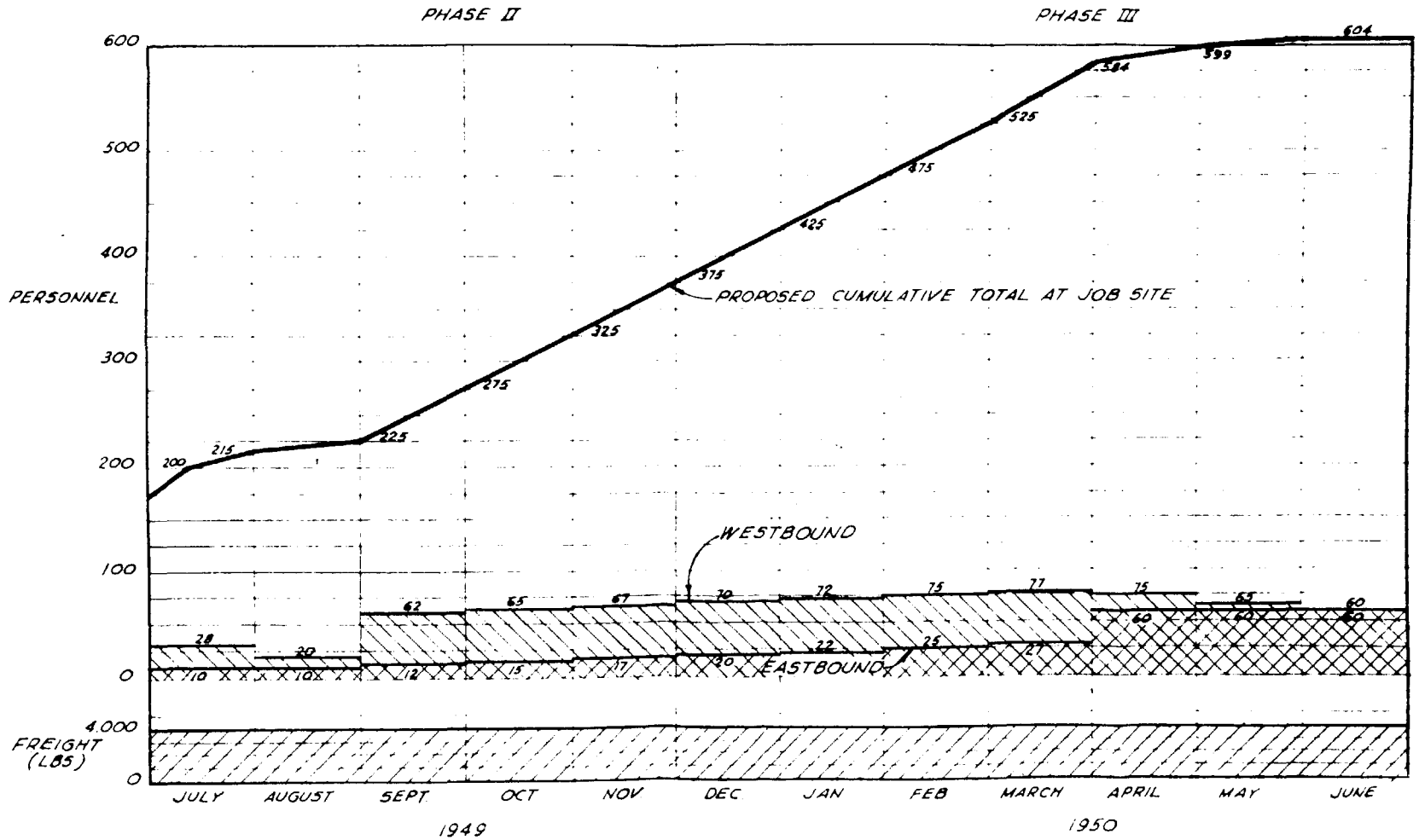
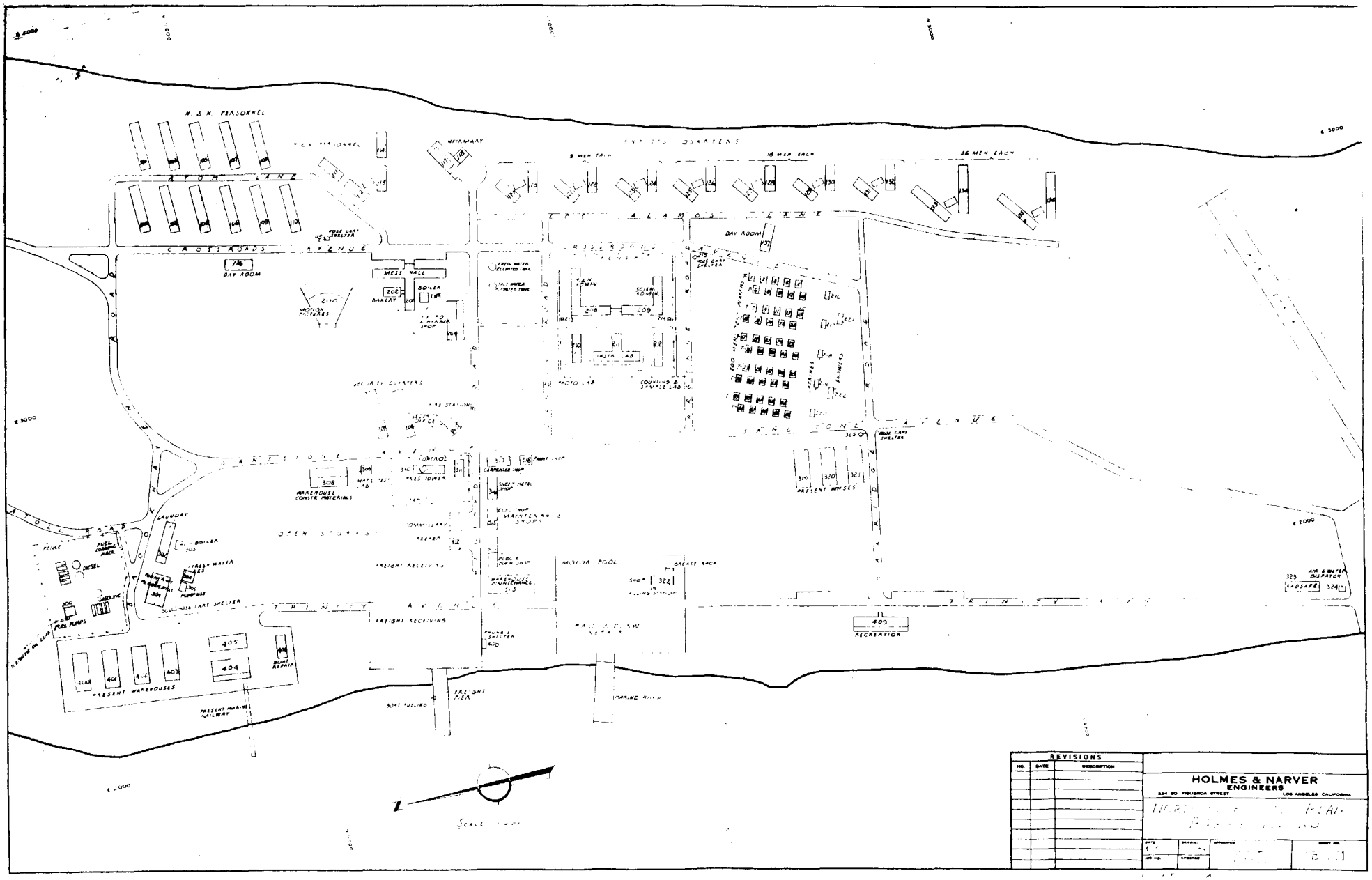
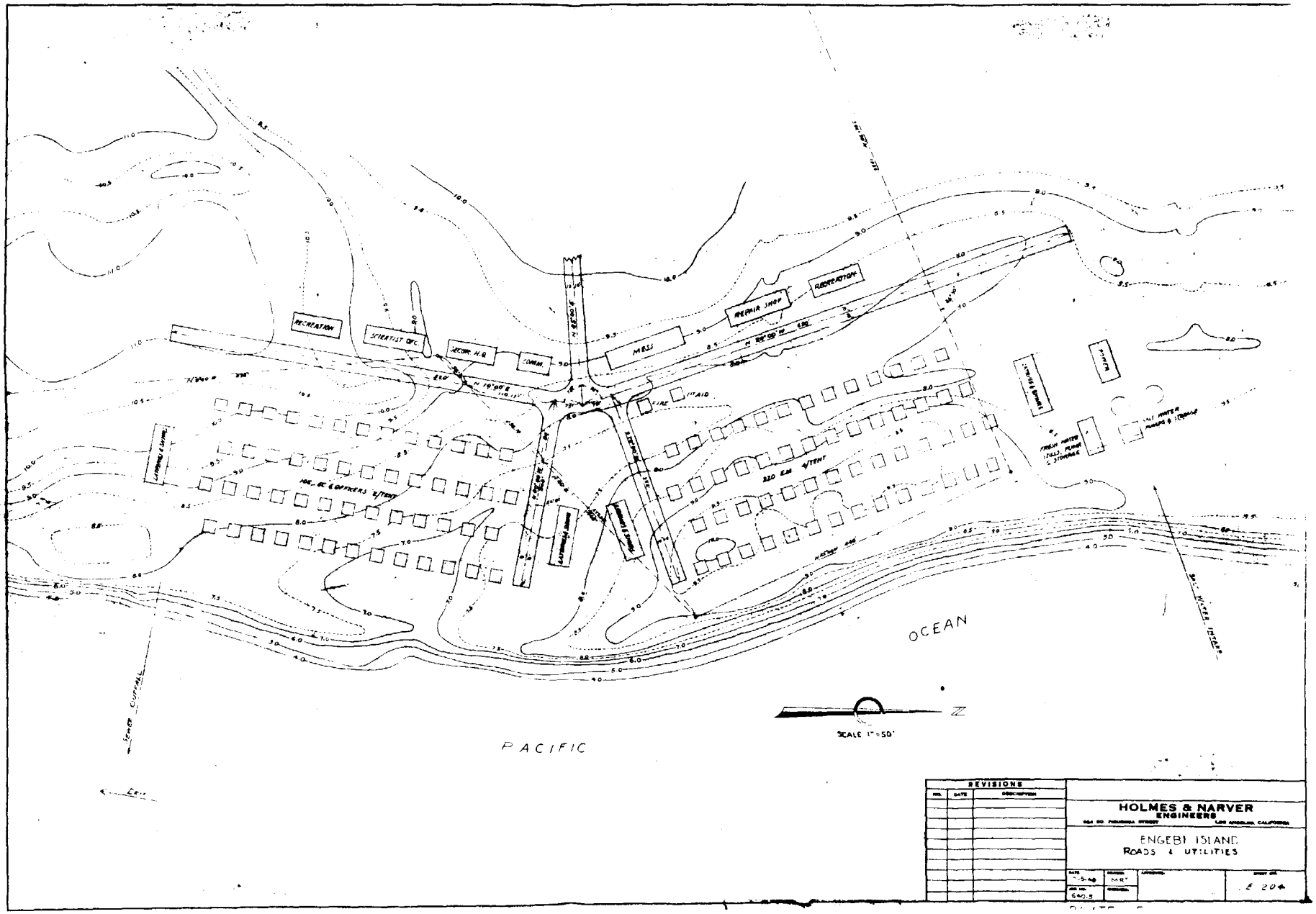


PLATE 3



REVISIONS		
NO.	DATE	DESCRIPTION

HOLMES & NARVER
ENGINEERS
624 SO. FIGUEROA STREET LOS ANGELES CALIFORNIA


RECREATION
SCIENTIST OFC.
SECOM H.Q.
COMM.
MESS
REPAIR SHOP
RECREATION
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FIRST AID
OCEAN
PACIFIC
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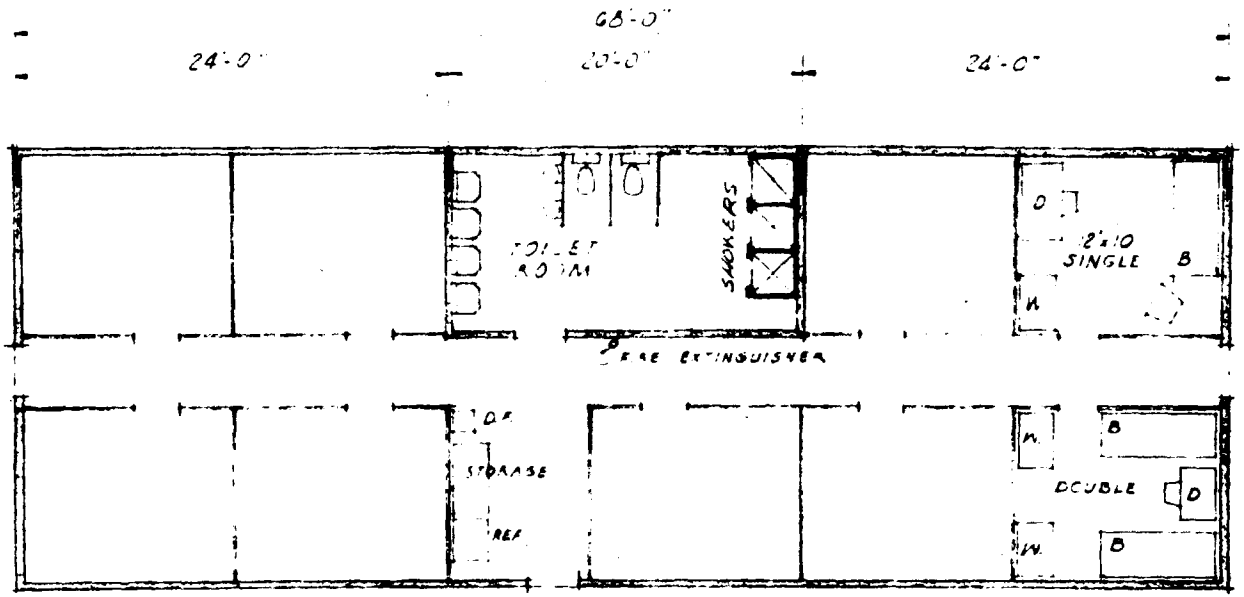
ENGINEERS
ENGEBI ISLAND
ROADS & UTILITIES
E 20



TYPICAL SINGLE OR DOUBLE QUARTERS

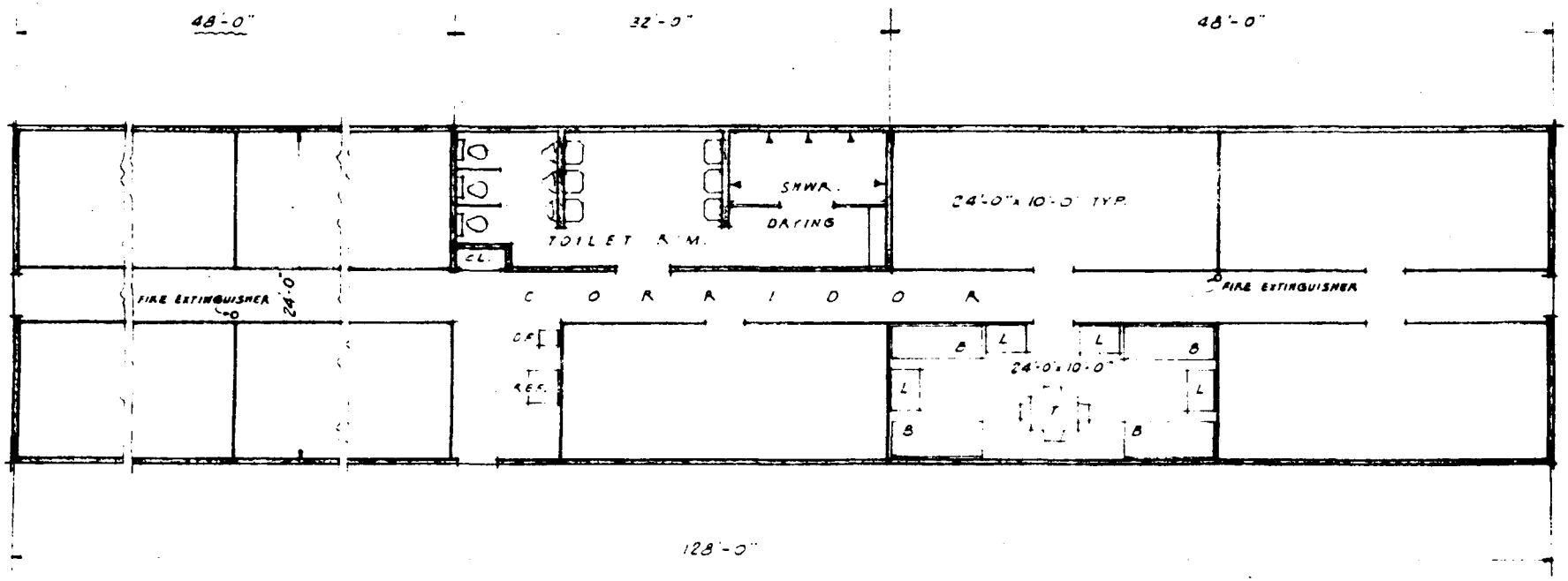
SCALE 3/8" = 1'-0"

NO	DATE	DESCRIPTION
2	6-14-49	TITLE CHANGED
1	5-9-49	1 LAV ADDED TO 9 MAN QTRS.

REVISIONS

18 MAN QUARTERS

DATE: APRIL '849	HOLMES & NARVER ENGINEERS 824 S. FIGUEROA ST. LOS ANGELES	JOB NO. 640.5
DRAWN BY: R.E.S.	APPROVED	SHEET NO. SK-108
CHECKED: H.C.S.		

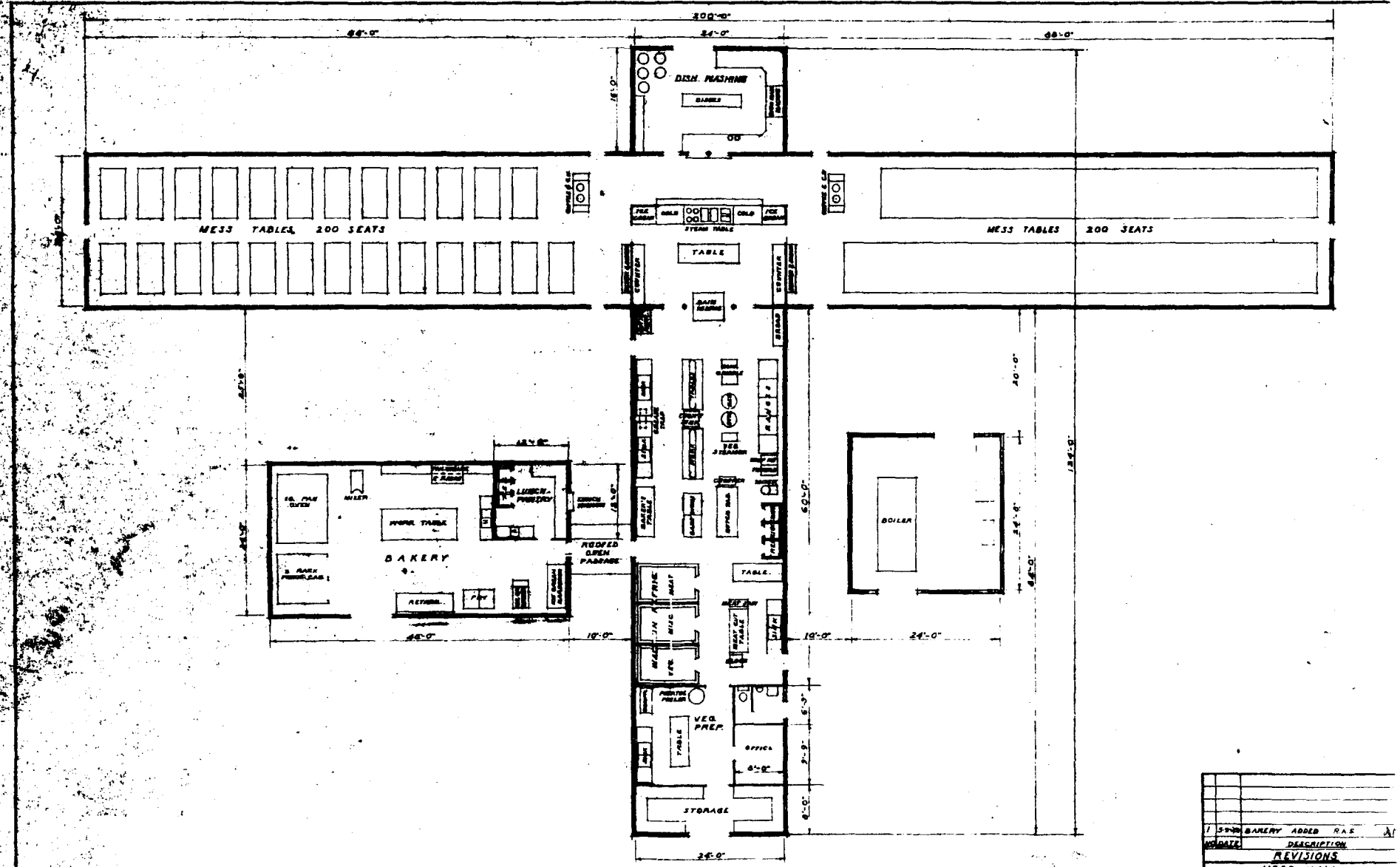


FLOOR PLAN

SCALE: 1/8" = 1'-0"

36 MAN QUARTERS

DATE: APRIL 1942	HOLMES & NARVER ENGINEERS 824 S. FIGUEROA ST. LOS ANGELES	JOB NO. 640.5
DRAWN BY: R.E.C.	APPROVED	SHEET NO. SK-109
CHECKED: H.J.		

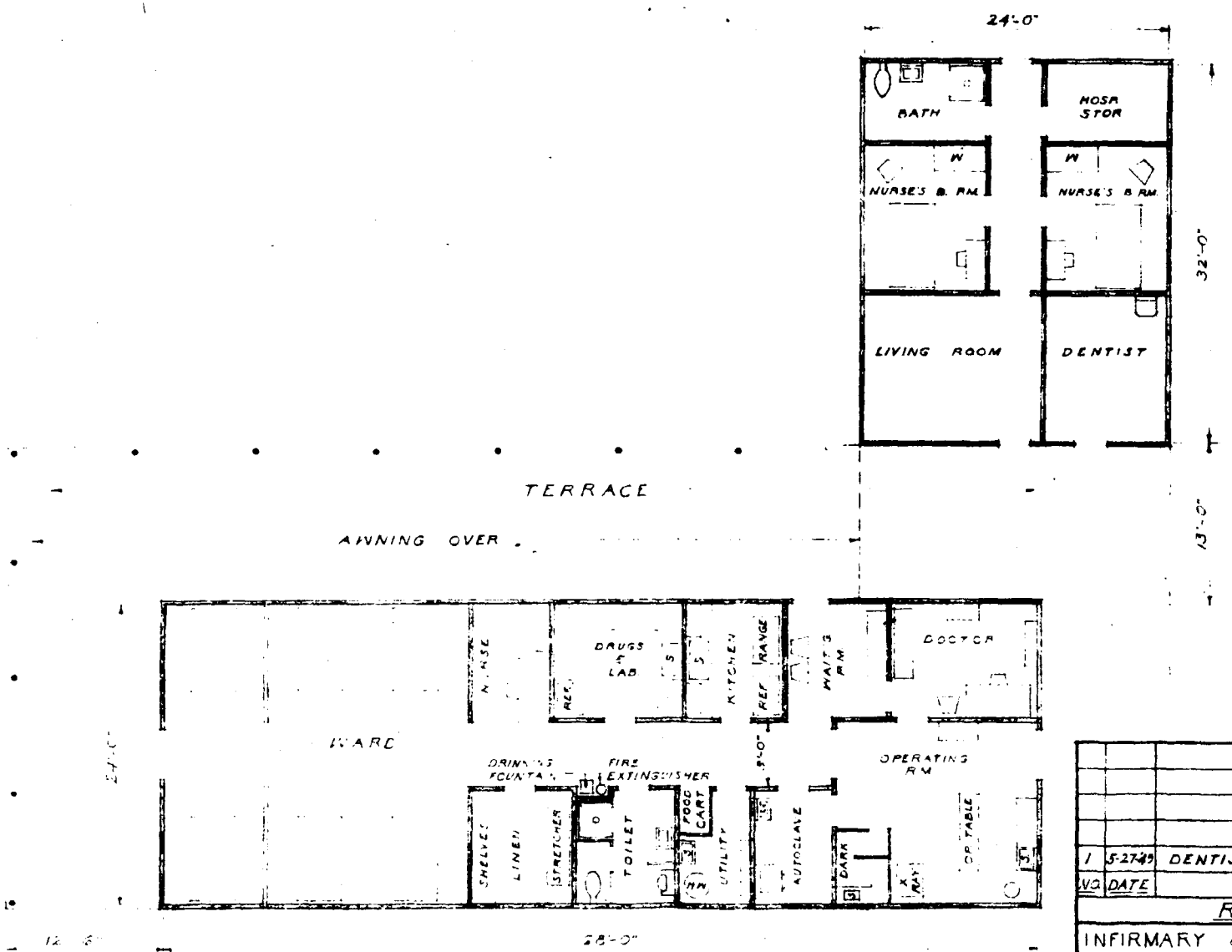


NO.	DATE	DESCRIPTION
1	5-9-45	BAKERY ADDED R.A.E.

REVISIONS

MESS HALL
BAKERY
BOILER HOUSE

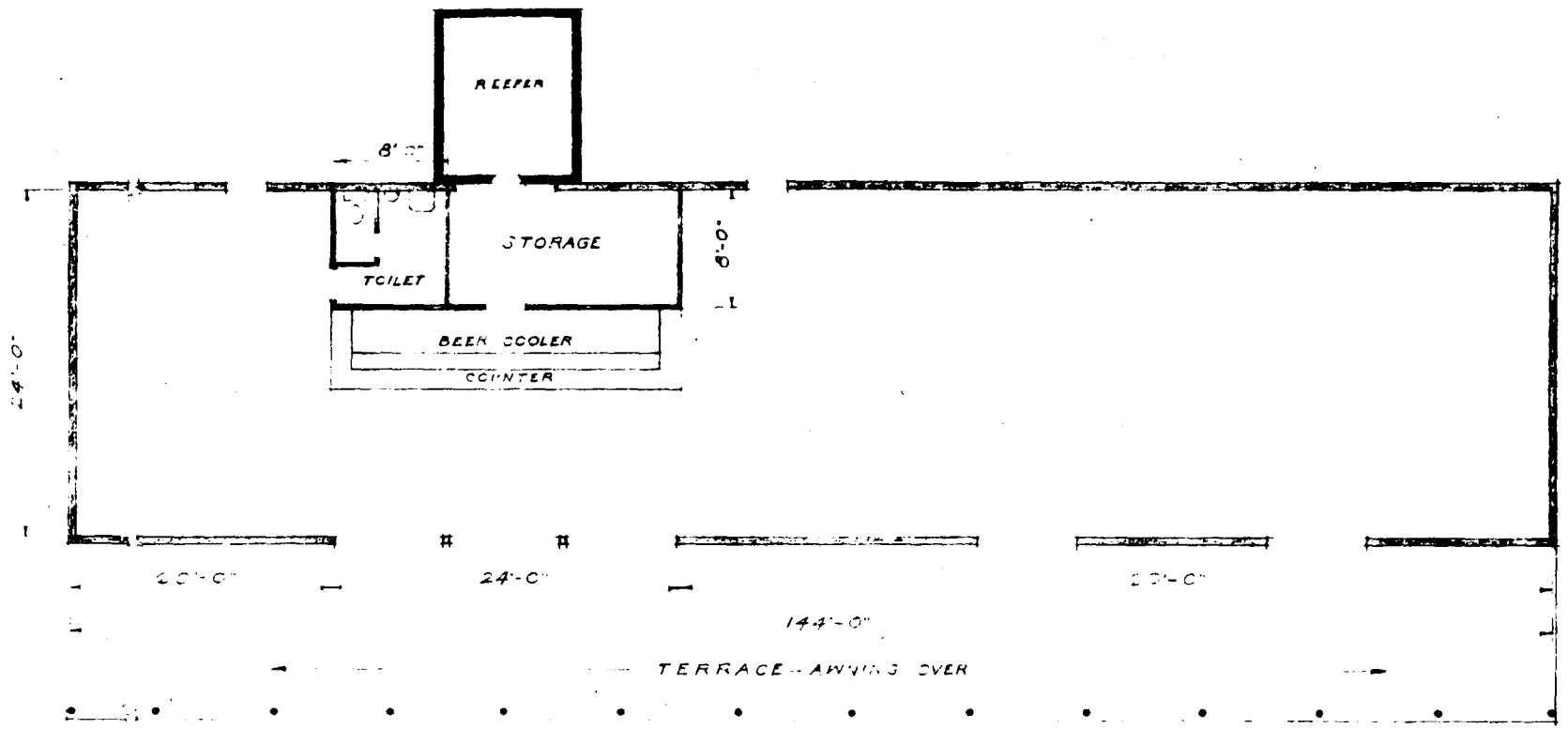
DATE MAY 9, 45	HOLMES & NARVER ENGINEERS 634 S. Flowers St. Los Angeles	640.
DRAWN BY R.A.E.		
CHECKED BY H.C.T.		SK-10



NO.	DATE	DESCRIPTION
		REVISIONS
1	5-27-49	DENTIST'S OFFICE ADDED

INFIRMARY & NURSES' QUARTERS

DATE APRIL '43	HOLMES & NARVER ENGINEERS 544 S. FIGUEROA ST. LOS ANGELES	JOB NO. 640.5
DRAWN BY R A G	APPROVED	SHEET NO. SK-107
CHECKED HOS		



RECREATION BUILDING

SCALE 1/8" = 1'-0"

NO.	DATE	DESCRIPTION
2	4/64	TOILET ENLARGED
1	5/10/49	REEFER RELOCATED

REVISIONS

RECREATION BUILDING

DATE APRIL 1948

DRAWN BY R.A.F.

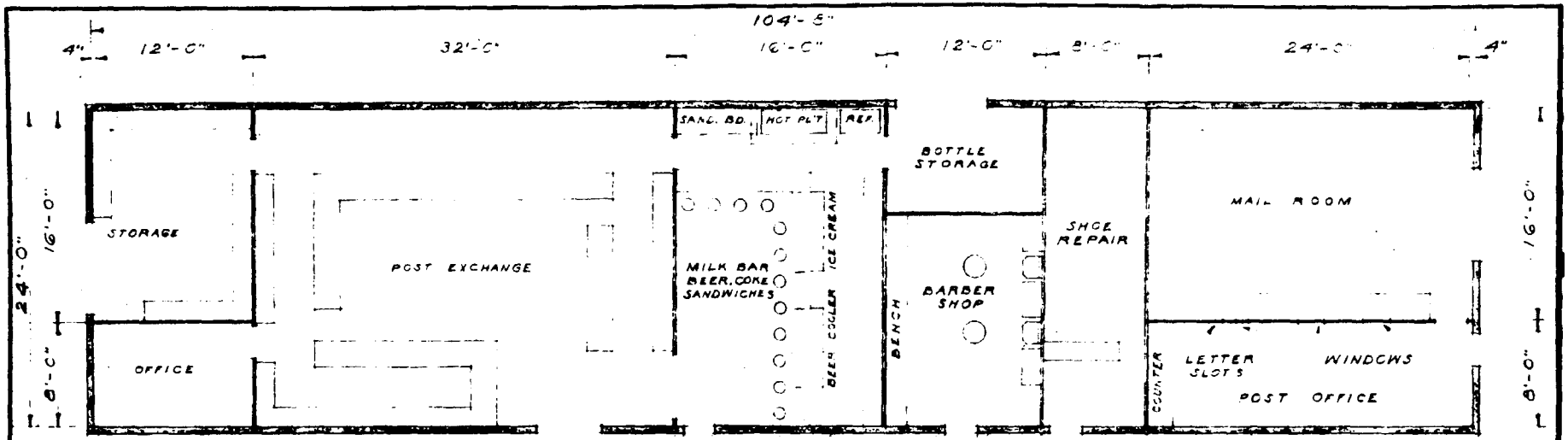
CHECKED H

HOLMES & NARVER ENGINEERS 624 S. Figueroa St. Los Angeles

APPROVED

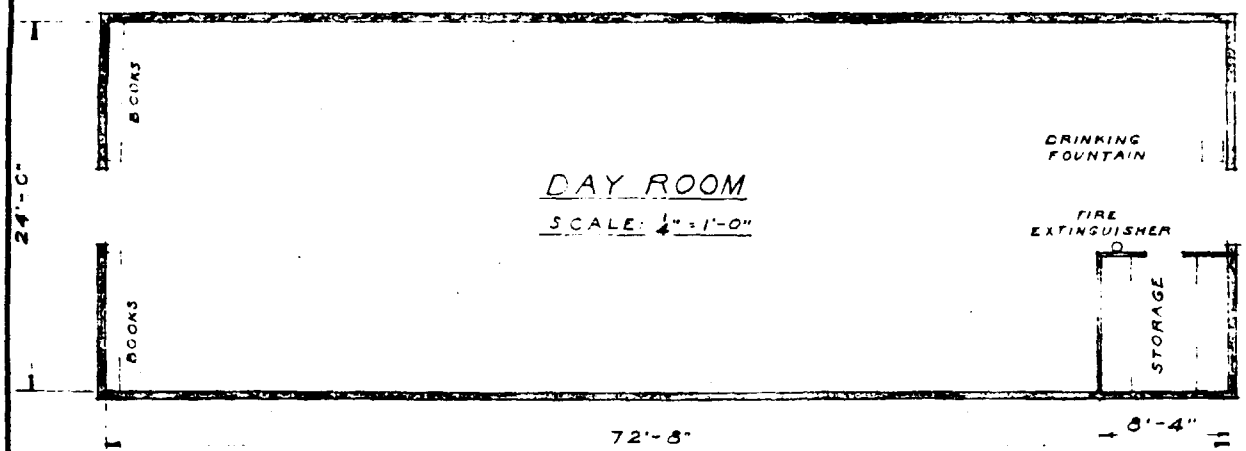
JOB NO. 6405

SHEET NO. SK-116



P.X., BARBER SHOP, SHOE REPAIR, & P.O.

SCALE: 1/4"=1'-0"



DAY ROOM

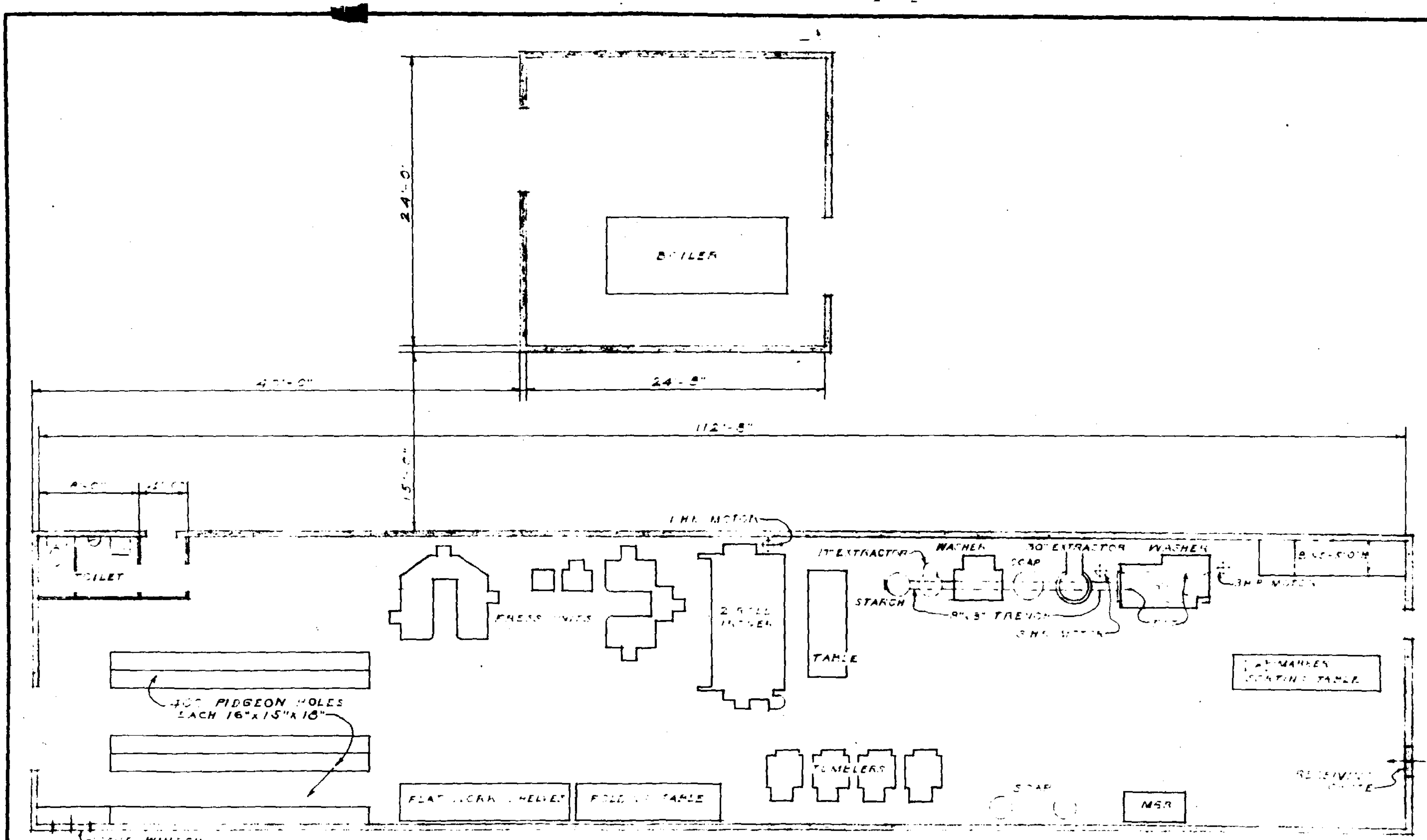
SCALE: 1/4"=1'-0"

NO	DATE	DESCRIPTION
2	5-25-49	SHOE REPAIR ADDED TO P.X
1	5-2-49	TOILET DELETED FROM DAY ROOM
1	5-2-49	BARBER S. ADDED - TOILET DELETED

REVISIONS

P.X., BARBER S., SHOE REP'R., & P.O.
DAY ROOM

DATE MAY 2 '49	HOLMES & NARVER ENGINEERS 824 S. Figueroa St. Los Angeles	JOB NO. 640.5
DRAWN BY R.A.G.	APPROVED CHIEF ENGINEER	SHEET NO. SK-120
CHECKED HCS		



LAUNDRY & BOILER HOUSE

No.	Date	Description
2	6-5-42	EQUIP. REARRANGED
1	5-27-42	BOILER RM ISOLATED

REVISIONS

DATE: APRIL 1942

DRAWN BY: R.A.G.

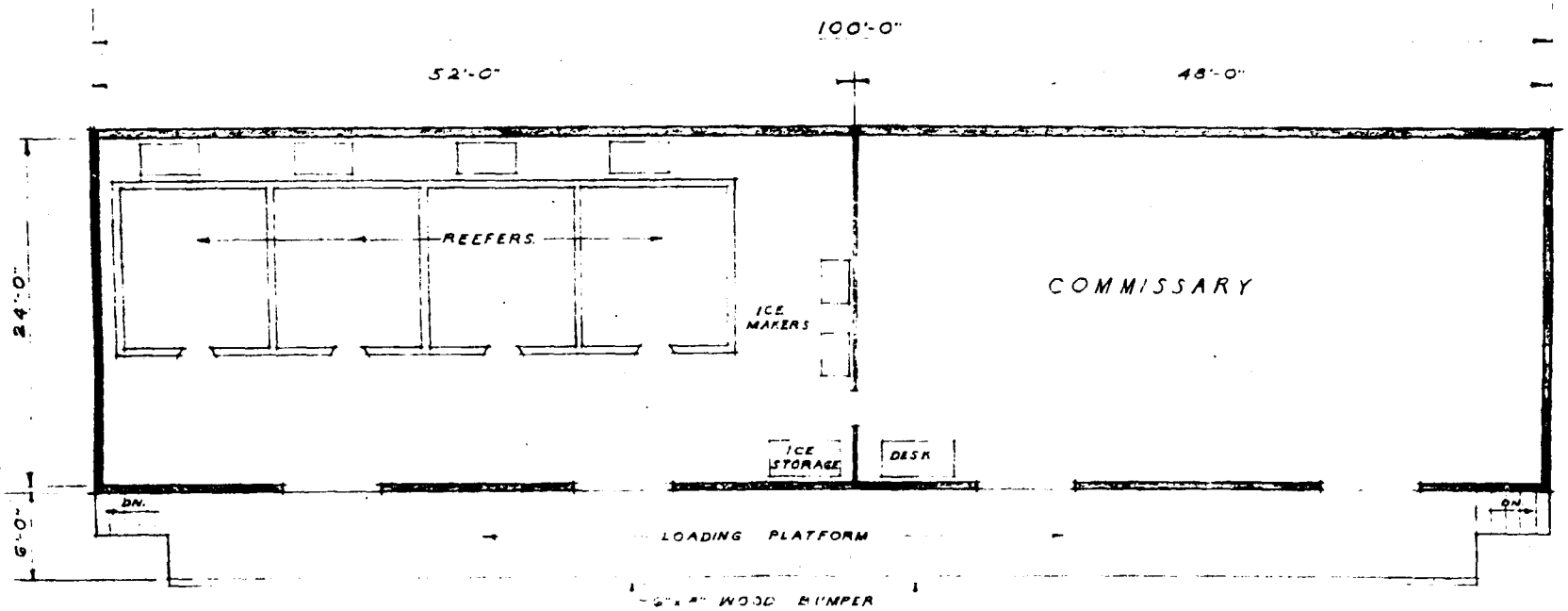
CHECKED: HOS

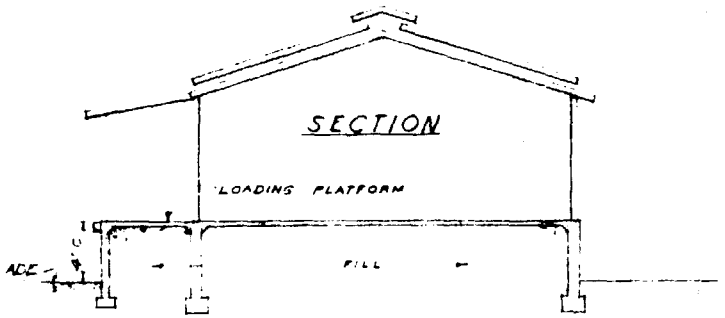
HOLMES & NARVER
ENGINEERS
LOS ANGELES

APPROVED: ______ CHIEF ENGINEER

JOB NO. 6405

SHEET NO. 31-118





SCALE: 1/8" = 1'-0"

NO	DATE	DESCRIPTION
3	5-[illegible]-49	WOOD BUMPER ADDED
2	5-20-49	PLATFORM & DOORS ADDED
1	5-9-49	COMPLETELY REPLANNED

REVISIONS

REEFER BUILDING & COMMISSARY

DATE APRIL [illegible] 49

DRAWN BY R.A.S

CHECKED

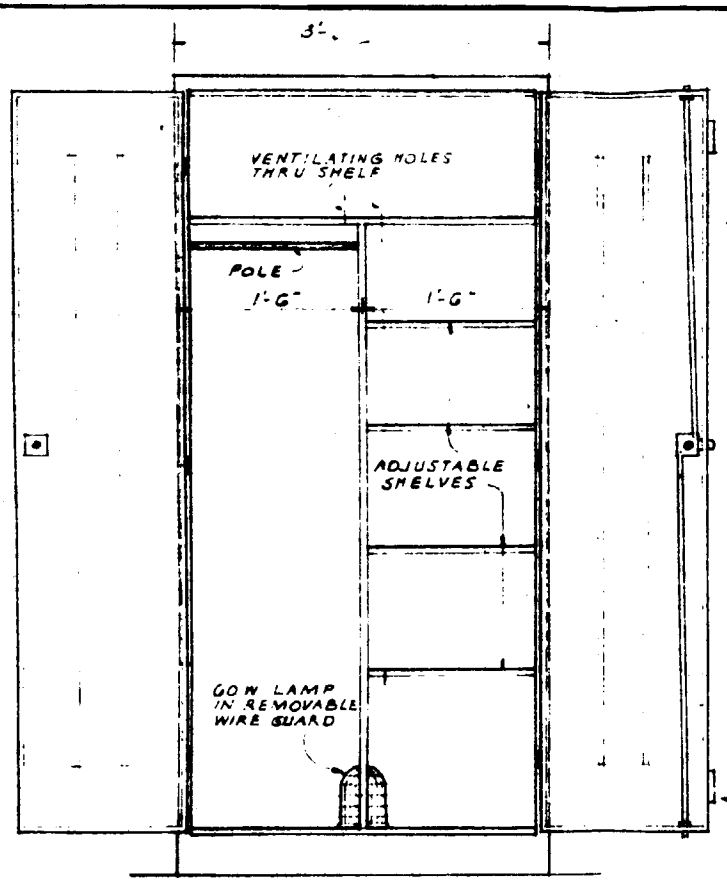
HOLMES & NARVER
ENGINEERS
[illegible] Los Angeles

APPROVED

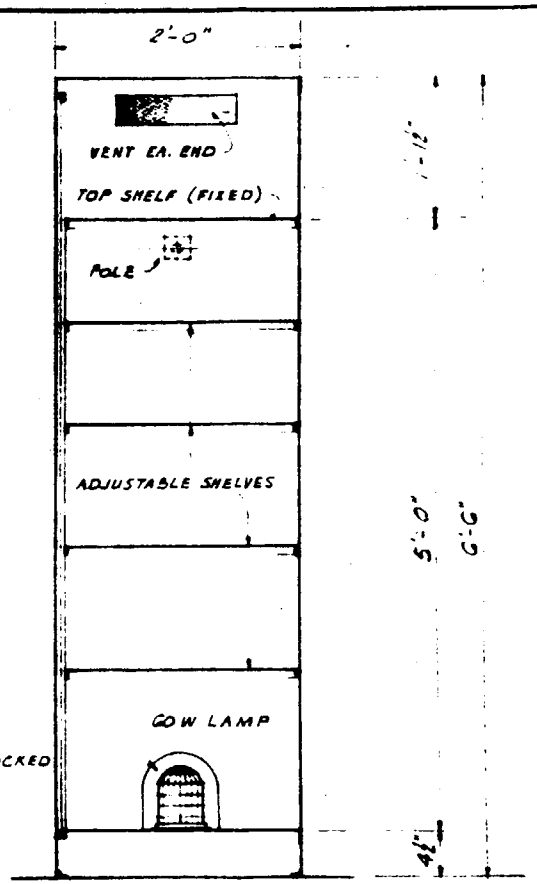
[illegible]
CHIEF ENGINEER

JOB NO. 640.5

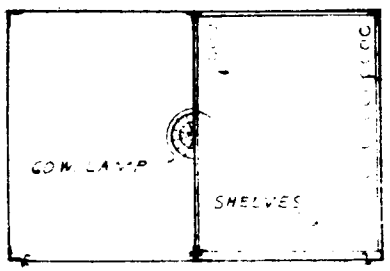
SHEET NO. SK-113



FRONT
DOORS SHOWN OPEN



CROSS SECTION

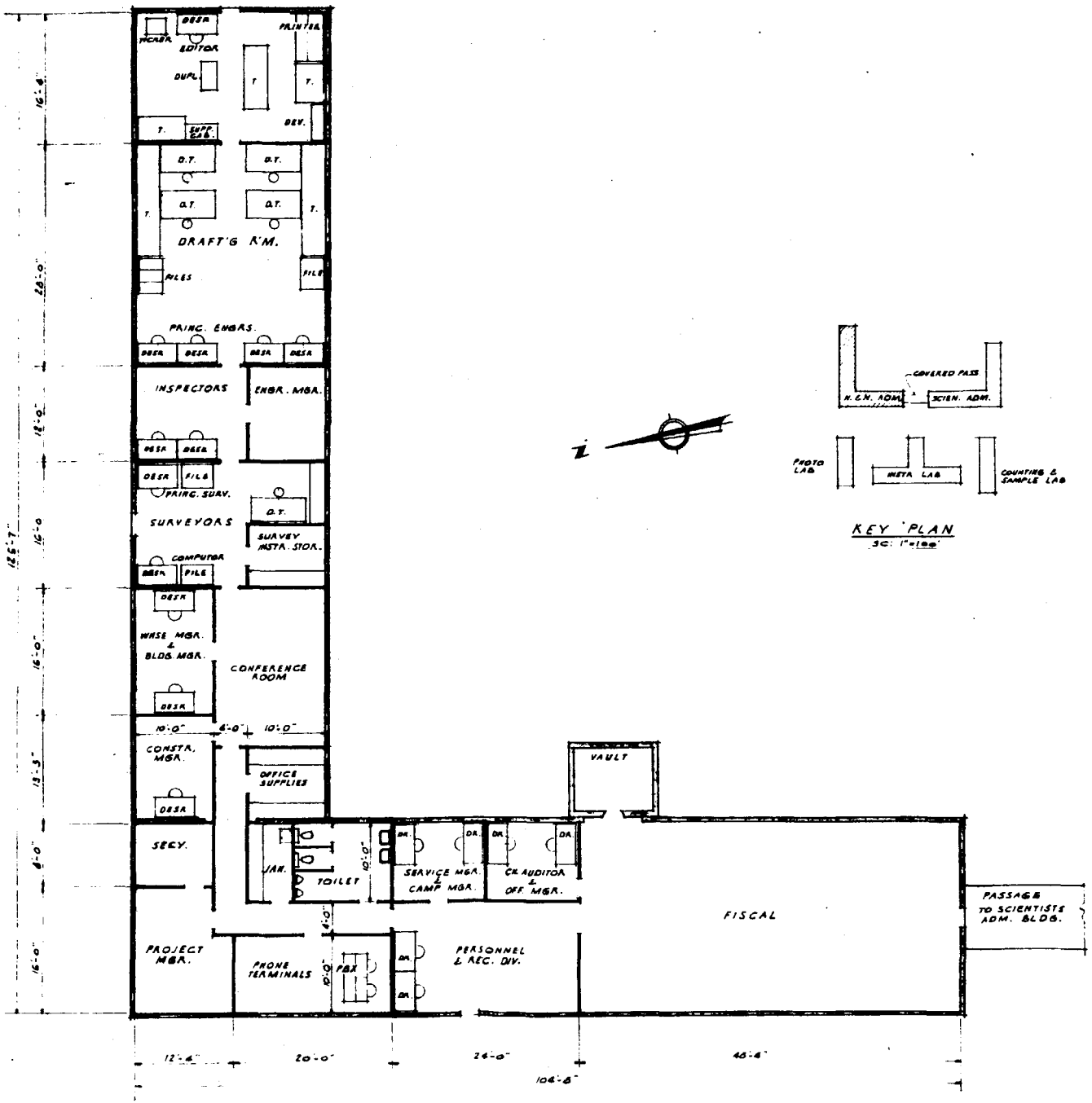


PLAN SECTION

CONSTRUCT LOCKERS FOR KNOCKDOWN" SHIPMENT

TYPICAL ALUMINUM LOCKER FOR LIVING QUARTERS

DATE APR. - 71 45	HOLMES & NARVER ENGINEERS 624 S. FIGUEROA ST. LOS ANGELES	JOB NO. 640.5
DRAWN BY	APPROVED	SHEET NO.
CHECKED		



Scale: 1/8"=1'-0"

KEY PLAN
Sc: 1"=100'

NO.	DATE	DESCRIPTION
1	5/2/49	GENERAL REARRANGEMENT

REVISIONS

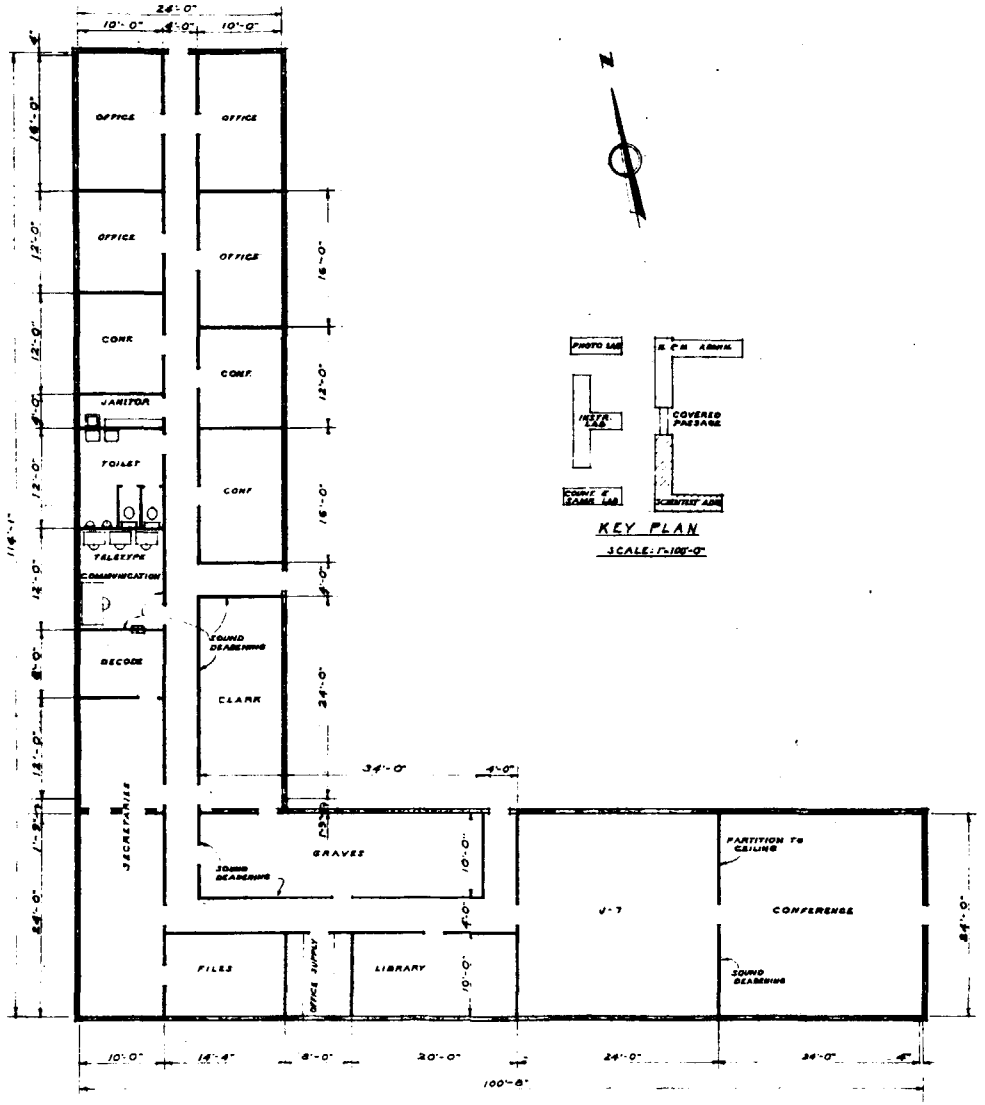
H & N ADMINISTRATION BLDG.

DATE: JUNE 2 '49
DRAWN BY: R E S
CHECKED:

HOLMES & NARVER
ENGINEERS
524 S. Flower St. Los Angeles

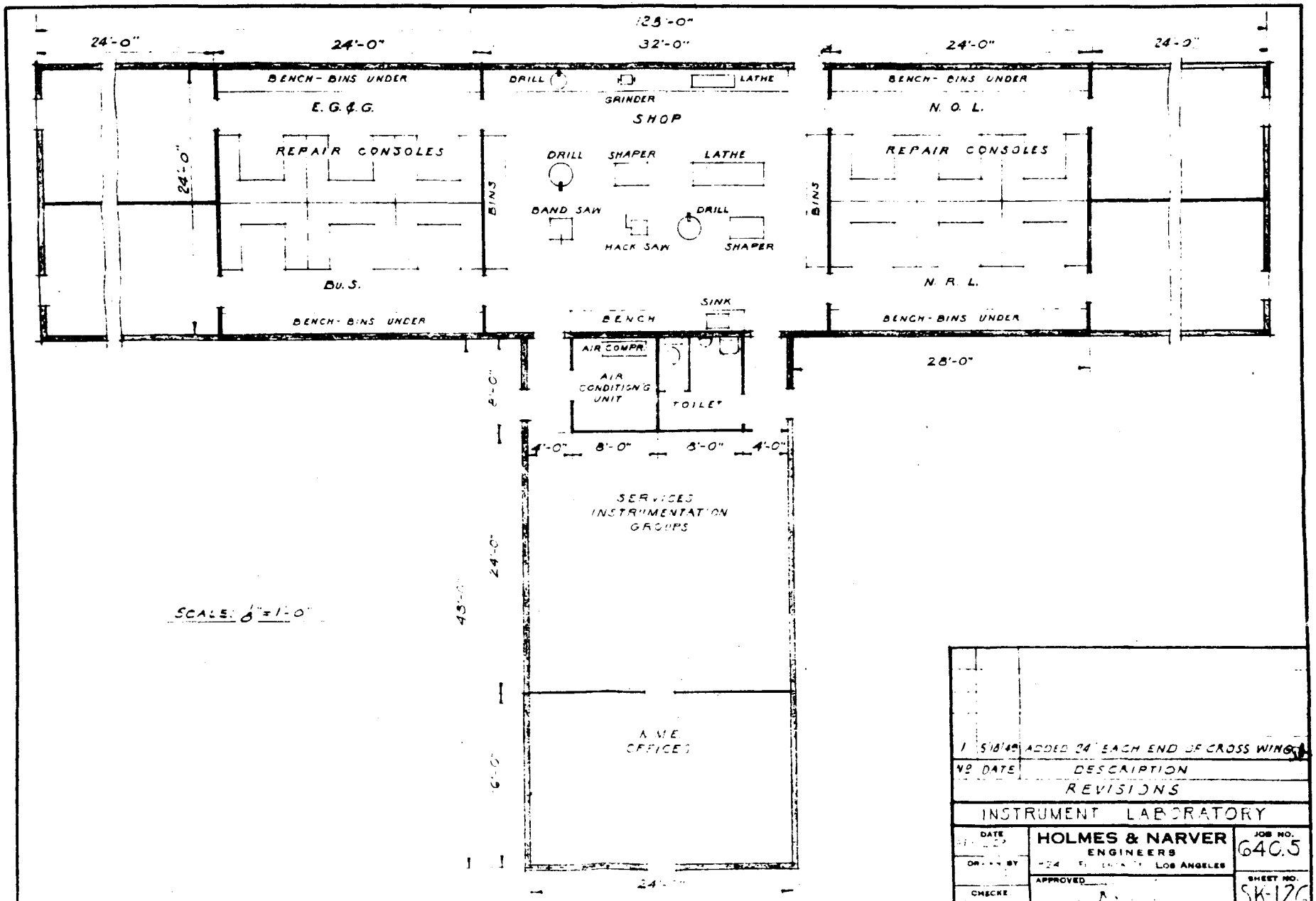
APPROVED:

JOB NO. 640.5
SHEET NO. SK-125



SCALE: 8"-1'-0"

SCIENTIST ADMINISTRATION BLDG SCHEME C		
DATE MAY 19 49	HOLMES & NARVER ENGINEERS 624 S. BROADWAY LOS ANGELES	JOB NO. 640
DRAWN BY		
CHECKED	APPROVED	DRAWING NO. SK-13



No	DATE	DESCRIPTION
1	5/18/49	ADDED 24' EACH END OF CROSS WING

REVISIONS

INSTRUMENT LABORATORY

DATE

DRAWN BY

CHECKED

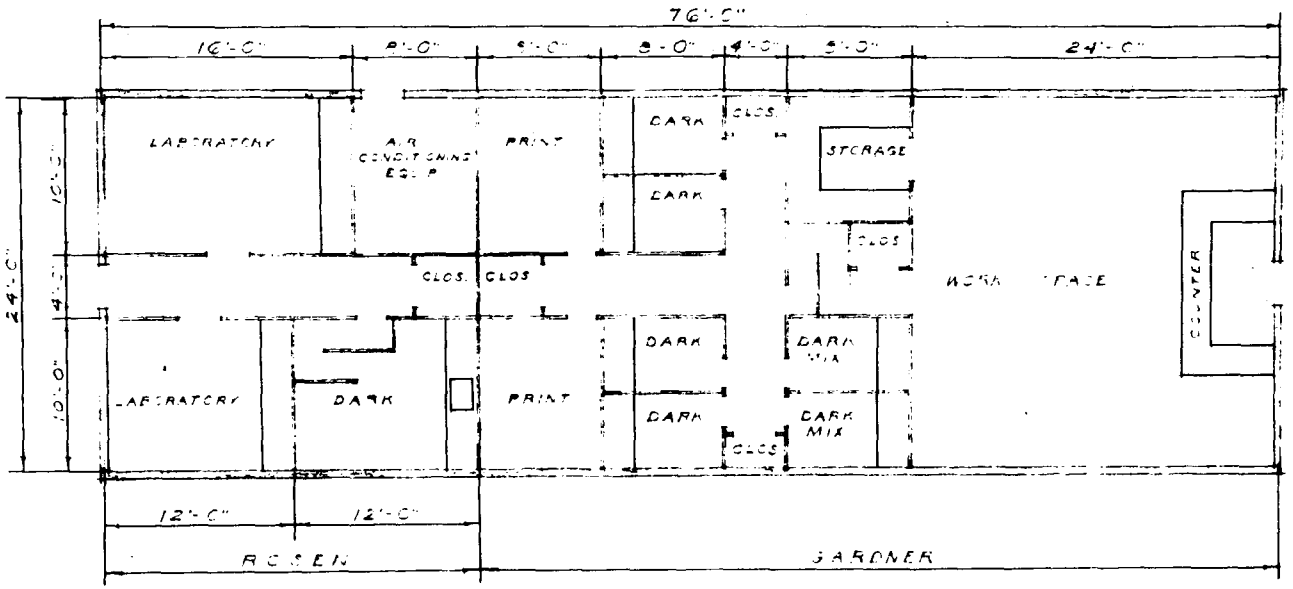
HOLMES & NARVER
ENGINEERS
224 E. [illegible] ST. LOS ANGELES

APPROVED

CHIEF ENGINEER

JOB NO. 640.5

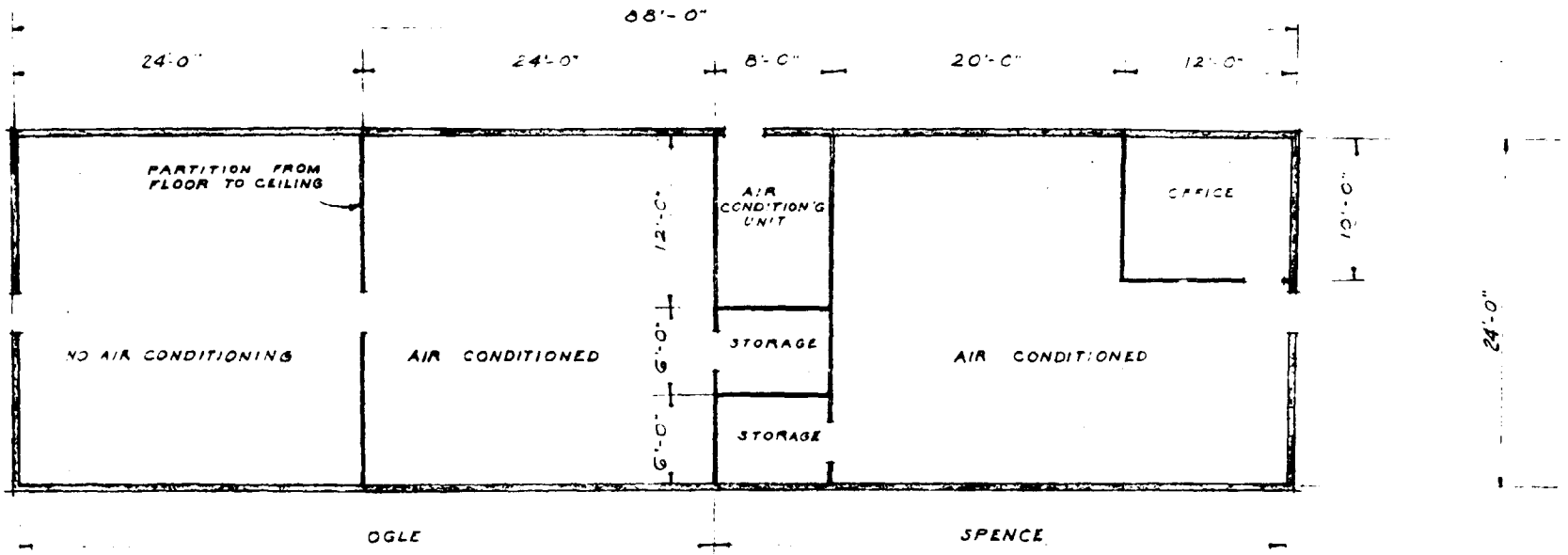
SHEET NO. SK-126



SCALE 1/4"=1'-0"

COMPLETE AIR CONDITIONING

PHOTO LAB		
DATE	HOLMES & NARVER ENGINEERS 811 [illegible] St. Los Angeles	JOB NO. 640[illegible]
DRAWN BY		
CHECKED	APPROVED CHIEF ENGINEER	SHEET NO. SK-12



SCALE: $\frac{1}{8}$" = 1'-0"

No	DATE	DESCRIPTION
1	5/18/49	ADDED 24'x24' ROOM R.A.S.

REVISIONS

COUNTING & SAMPLE LAB

DATE MAY 5, 49

DRAWN BY R.A.S.

CHECKED

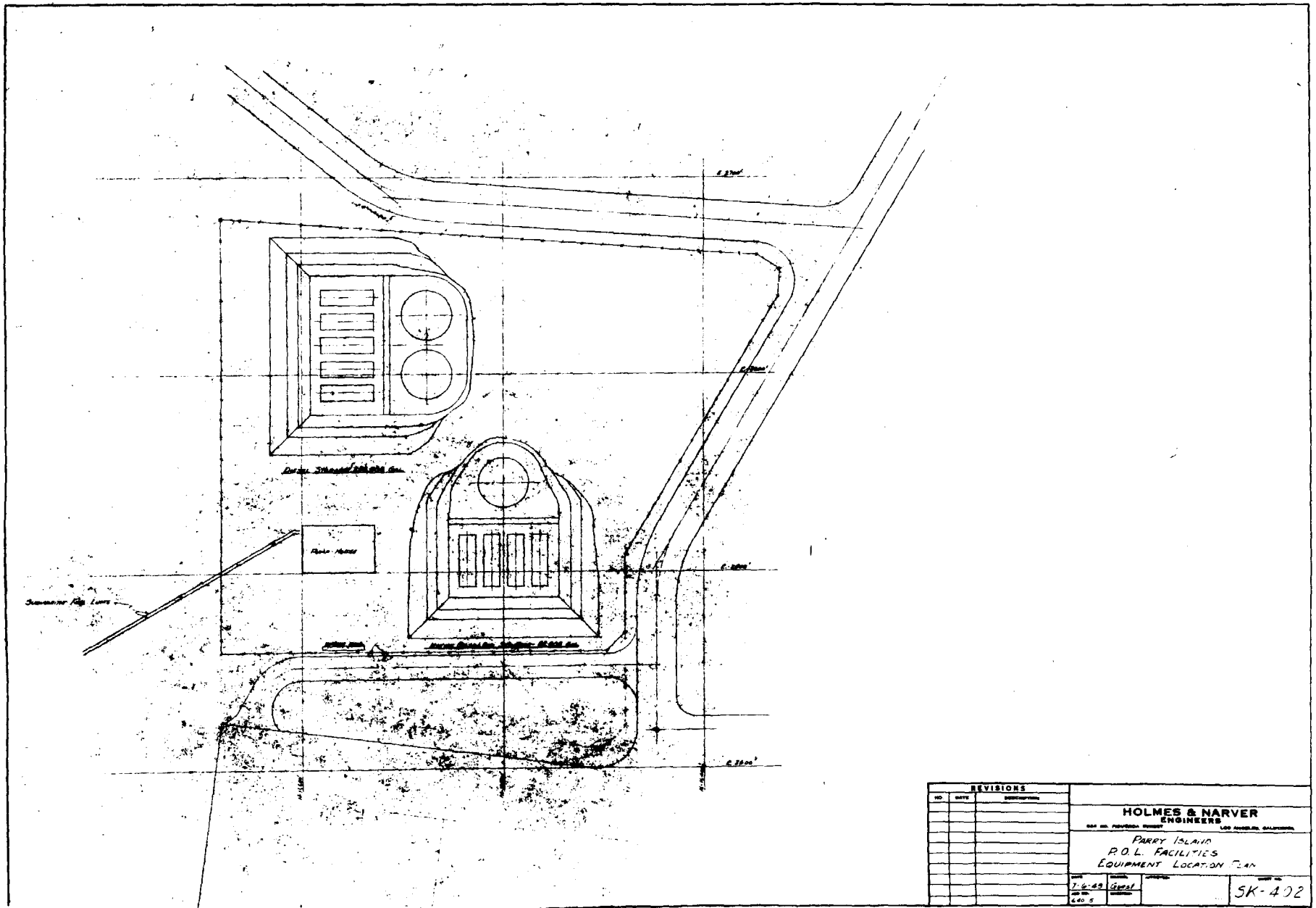
HOLMES & NARVER
ENGINEERS
824 S. FIGUEROA ST. LOS ANGELES

APPROVED

CHIEF ENGINEER

JOB NO. 6405

SHEET NO. SK-130



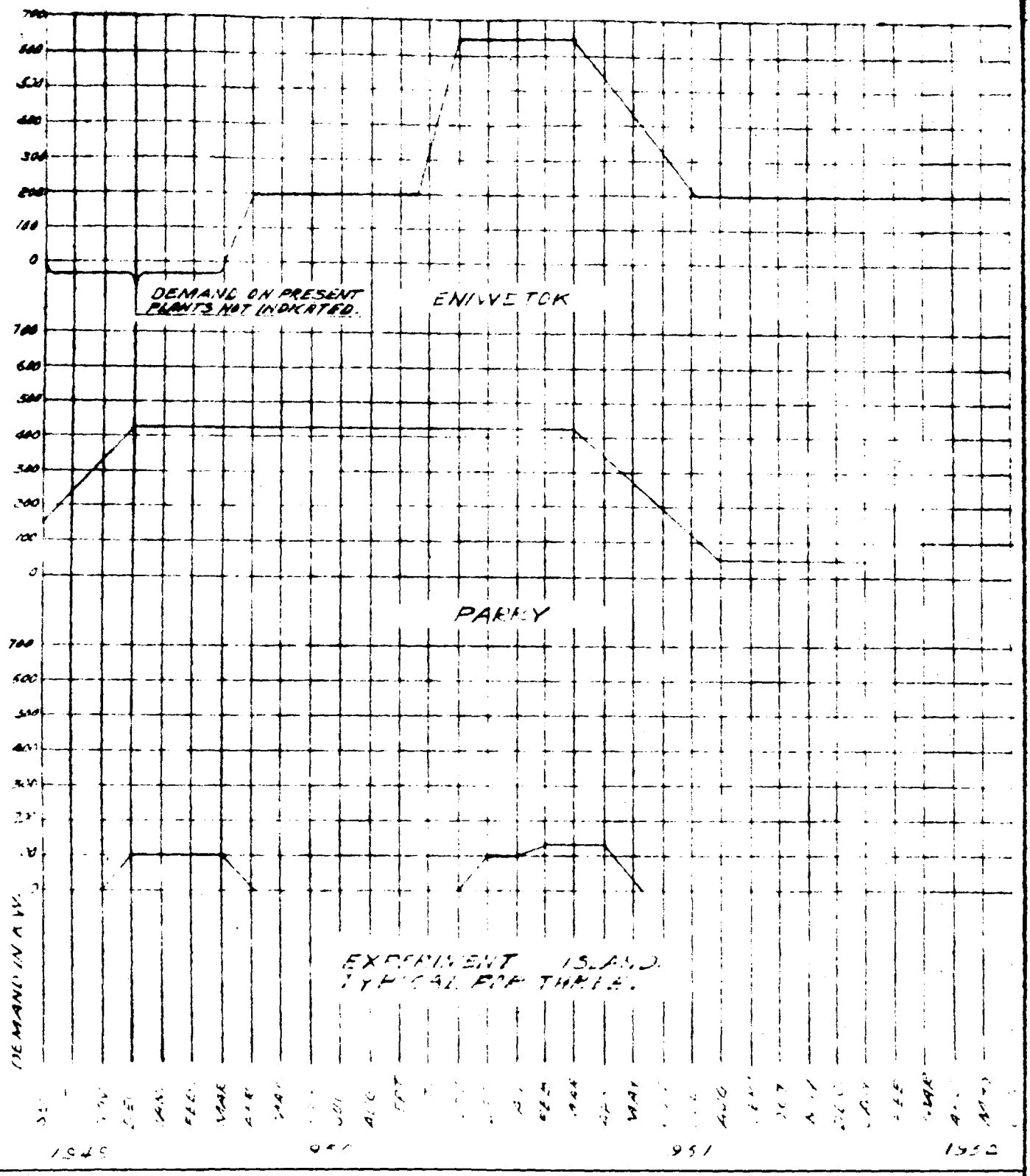
REVISIONS		
NO	DATE	DESCRIPTION

HOLMES & NARVER
ENGINEERS

PARRY ISLAND
P.O.L. FACILITIES
EQUIPMENT LOCATION PLAN

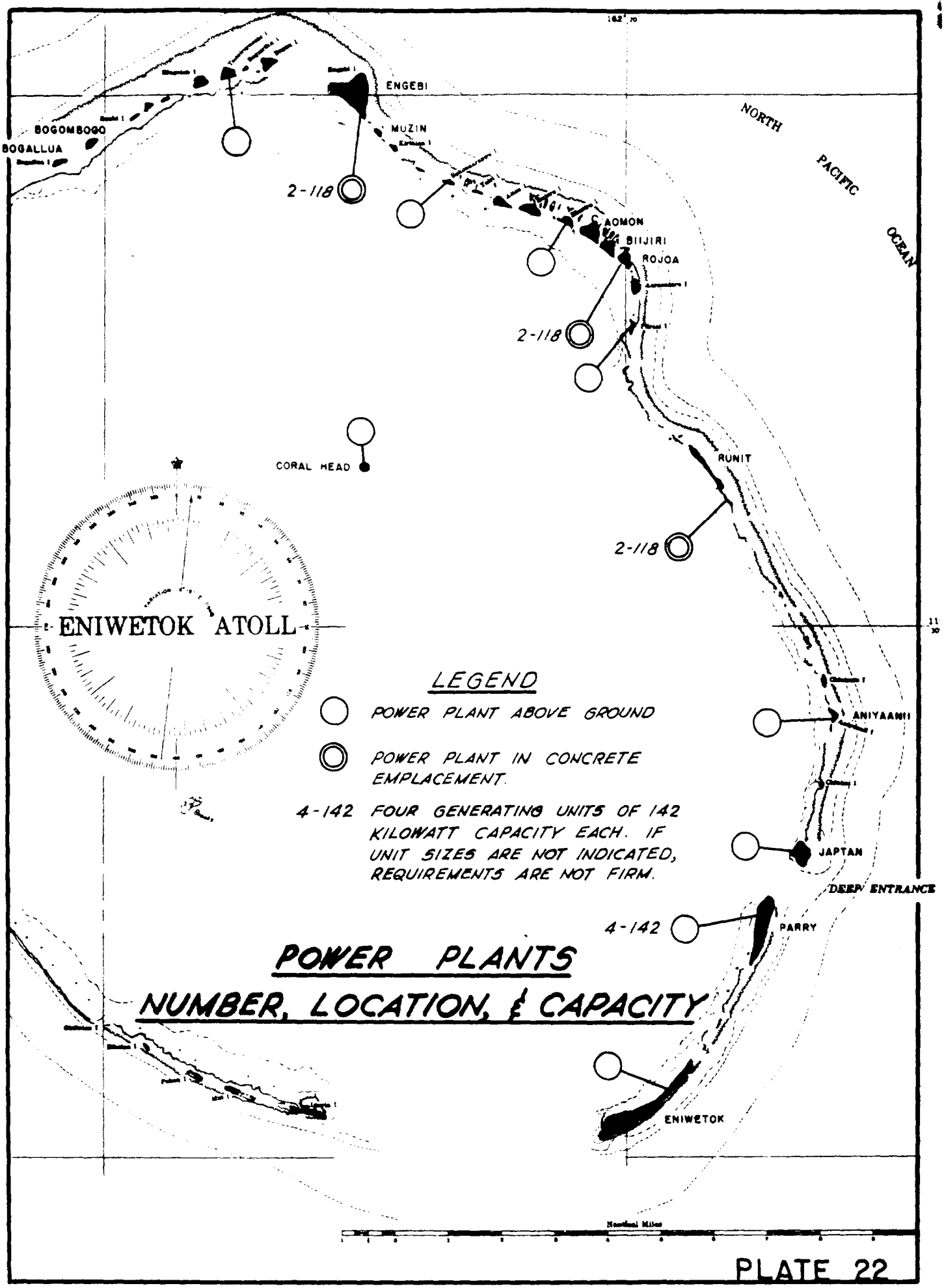
DATE	DRAWN	APPROVED	DRAWING NO.
7-6-49	Gmal		SK-402
JOB NO. 640.5			

PLATE 27



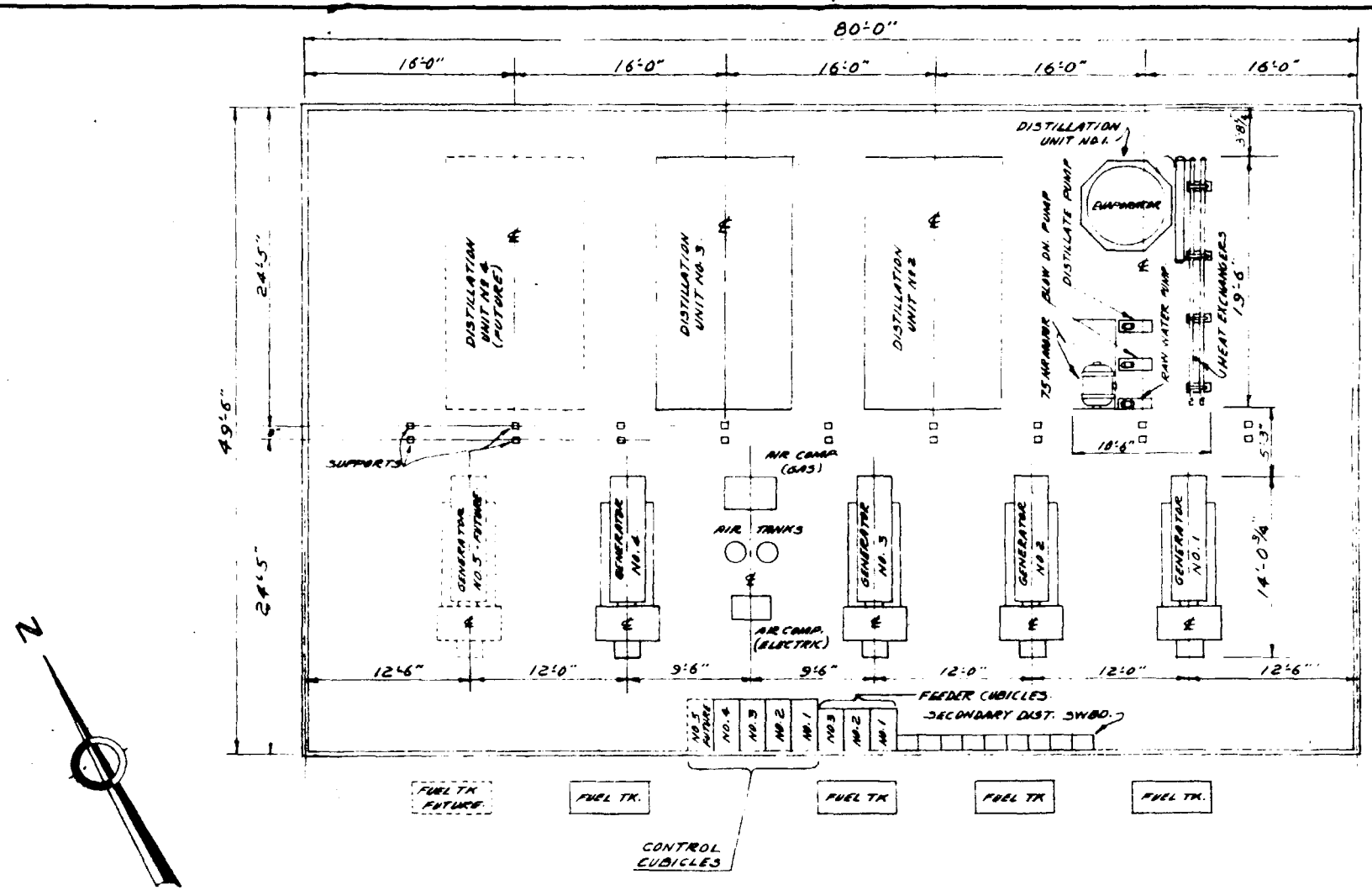
POWER DEMAND ESTIMATE

PLATE 21



POWER PLANTS
NUMBER, LOCATION, & CAPACITY

PLATE 22



POWER PLANT LAYOUT

PARRY ISLAND

SC: 1/8" = 1'-0"

75 KVA 100 KVA 75 KVA

TRANSFORMER BANK (T-1)

PLATE 23

DATE 7-6-49	HOLMES & NARVER ENGINEERS 924 S. FIGUEROA LOS ANGELES	JOB NO. 640.5
DRAWN BY P.R. Colón	APPROVED	SHEET NO. SK-313
CHECKED		

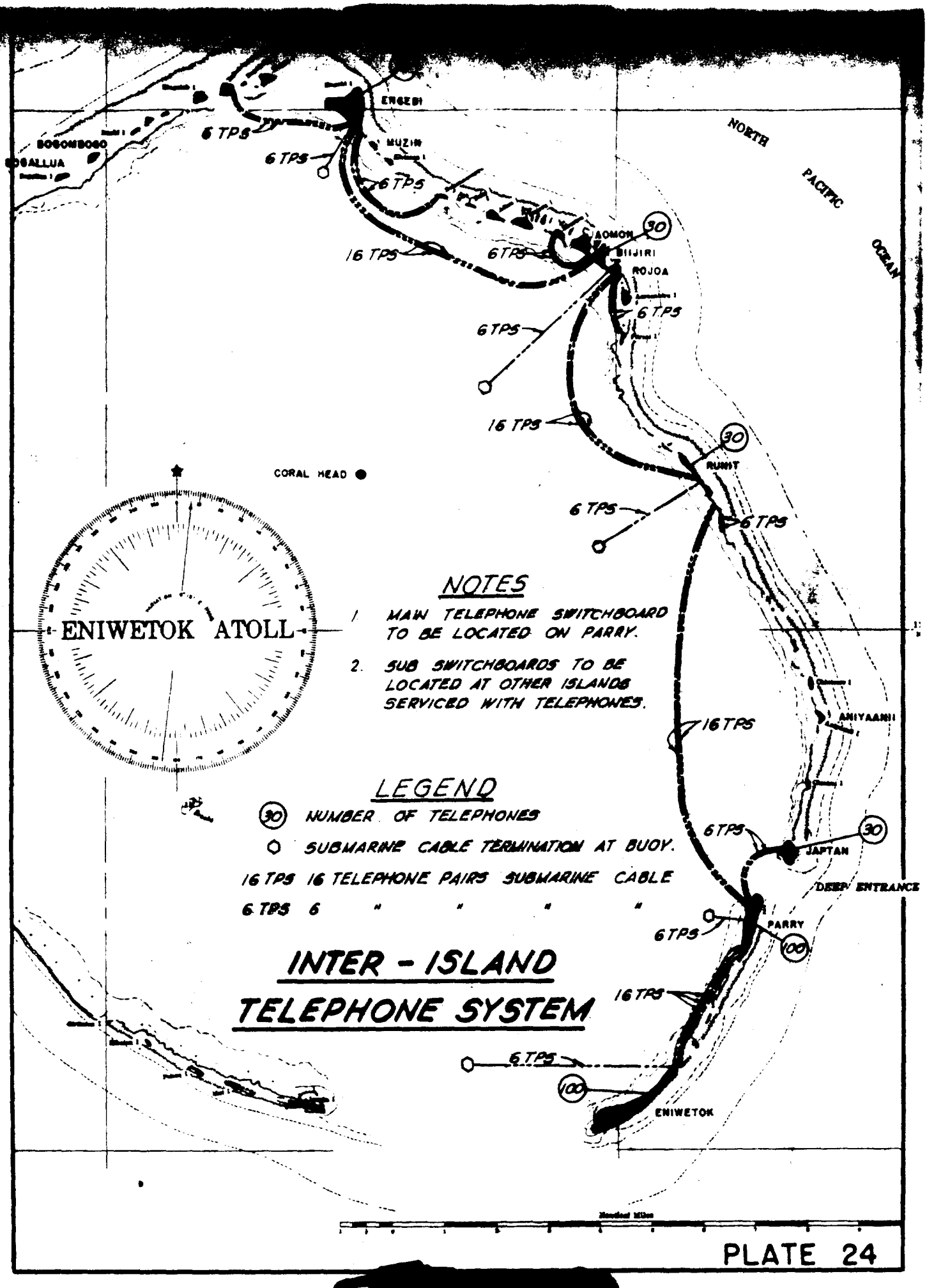

ENGEBI
BOGOMBOGO
GALLUA
MUZIN
6 TPS
16 TPS
AOMON
BIIJIRI
ROJOA
NORTH
PACIFIC
OCEAN
30
CORAL HEAD
RUNIT
ENIWETOK ATOLL
NOTES
1. MAIN TELEPHONE SWITCHBOARD TO BE LOCATED ON PARRY.
2. SUB SWITCHBOARDS TO BE LOCATED AT OTHER ISLANDS SERVICED WITH TELEPHONES.
ANIYAANII
LEGEND
30 NUMBER OF TELEPHONES
SUBMARINE CABLE TERMINATION AT BUOY.
16 TPS 16 TELEPHONE PAIRS SUBMARINE CABLE
6 TPS 6 " " " "
JAPTAN
DEEP ENTRANCE
PARRY
100
ENIWETOK
INTER - ISLAND
TELEPHONE SYSTEM

PLATE 24