PRELIMINARY

ECONOMIC AND ENGINEERING STUDY

DEVELOPMENT OF HARBOR FACILITIES FOR THE PORT OF DA NANG

FOR

THE GOVERNMENT OF VIET-NAM

AND

THE UNITED STATES

OPERATIONS MISSION TO VIET-NAM

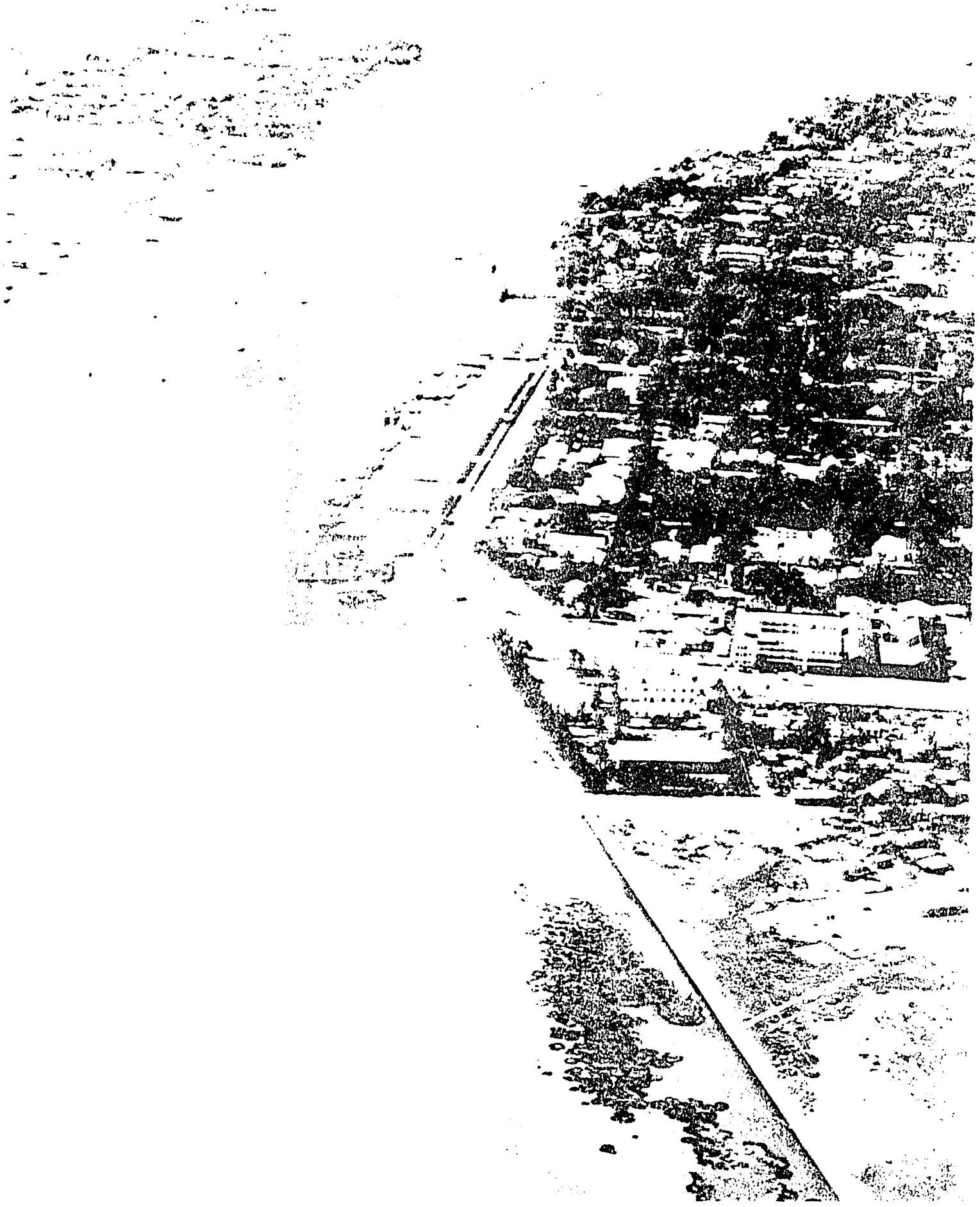
Contract No. AID-430-990
PIO/T 430-303-3-50142

DMJM

DANIEL, MANN, JOHNSON, & MENDENHALL

40 HONG THAP TU SAIGON, VIET-NAM

PLANNING § ARCHITECTURE § ENGINEERING § SYSTEMS



The Port of Da Nang

Looking South Southeast

PRELIMINARY ECONOMIC AND ENGINEERING STUDY

DEVELOPMENT OF HARBOR FACILITIES

at the

PORT OF DA NANG

Based upon Field Studies Conducted
April through December 1965

for

THE GOVERNMENT OF VIET-NAM

and

THE UNITED STATES
OPERATIONS MISSION TO VIET-NAM

February 1966

Contract No. AID-430-990
PIO/T 430-303-3-50142

DANIAL, MANN, JOHNSON, & MENDENHALL
40 Hong Thap Tu, Saigon - Viet-Nam

and

3325 Wilshire Blvd., Los Angeles, California

DMJM

DANIEL, MANN, JOHNSON, & MENDENHALL

Saigon, Viet-Nam
January 31, 1966

His Excellency
Ngo Trong Anh
Minister of Public Works & Communications
Republic of Viet-Nam
Saigon, Viet-Nam

Re: Contract No. AID 430-990
PIO/T 430-303-3-50142
DMJM Project No. 840-5-2

Your Excellency:

We are pleased to submit herewith, in accordance with the terms of the above referenced contract, our PRELIMINARY ECONOMIC AND ENGINEERING STUDY ON THE PORT OF DA NANG.

This is one of a series of seventeen volumes prepared under this contract and we suggest reference to some of these other reports for information on specific subjects defined in our overall contract scope of work. In particular, we suggest review of the volume entitled "BASIC INFORMATION - CONDITIONS AND CRITERIA" relative to general oceanographic and economic data on Viet-Nam which is common to all reports. As Hue and other cities to the north will depend upon the Port of Da Nang for coastal and ocean transportation, the report on the Port of Hue, though negative as to feasibility of improvement, will be of some special interest.

This report, unlike any of the others, goes into considerable detail. This has come about because we were encouraged to find a solution to the future needs of the Port of Da Nang that would also satisfy the immediate urgent military needs. This goal was not achieved. According to the last report we have had, the military choice is still Observatory Point, which, in our opinion, is a poor solution as a cargo handling facility.

It has been a pleasure to be of service to the Government of Viet-Nam and we would like to express our appreciation to Vice Minister Tuan and others of your Saigon staff and Port Director Thao, Messrs. An, Nguyen and others at the Port of Da Nang for their assistance in our work in Viet-Nam.

Yours very truly,

DANIEL, MANN, JOHNSON, & MENDENHALL

Donald A. Walsh

Donald A. Walsh
Project Manager

/jk

DMJM

TABLE OF CONTENTS

PORT OF DA NANG

NOTE:

(1) See volume titled "Basic Information, Conditions & Criteria" for general background.

(2) This report is one of a series of individual reports covering the Ports of Hue, Da Nang, Quang Ngai, Qui Nhon, Nha Trang, Cam Ranh, Phan Thiet, Vung Tau, Saigon, Can Tho, Rach Gia and Ha Tien, and the subjects of Cargo Handling, Warehousing, Tugs & Barges, and Dredging.

I. INTRODUCTION

Summary

There can be no doubt about the need for more and better port facilities at Da Nang. Completely discounting present military loads, there will be sufficient traffic destined for Da Nang to justify facilities to take advantage of savings inherent in water transportation. The problem is the type of facility, and where.

Probably more port studies have been made at Da Nang than at any other site in Viet-Nam. This report considered the prior proposals in addition to some new, or at least forgotten, alternatives.

An attempt was made to devise a facility that would solve the urgent military unloading cargo problems and later phase into the long range commercial needs. Because of the urgency and the self-evident long range requirements for improved port facilities, plans were carried to somewhat more detail and scope than would ordinarily be done in a preliminary study. The most significant of these drawings are submitted in reduced form; full scale originals are available.

At this time, military planning includes one or two ocean cargo piers at Observatory Point. Each of these piers will berth a ship on each side, but they are to be relatively narrow and poorly suited to cargo handling as opposed to operational fleet use. The truck haul to

Da Nang is about 15 kilometers, and much of the tonnage would need to be hauled through or around Da Nang. There is now no rail connection to Observatory Point.

A new military shallow-draft landing facility with peacetime coastal potential, is going into operation just below the Da Nang River bridge. However, a new low-level bridge across the river downstream of this facility is in the planning stage. If built, this bridge could seriously restrict the future commercial use of the river facility.

Viet-Nam's present low lightering and stevedoring costs as compared to wharf, equipment, and material costs, make it somewhat difficult to justify deep water facilities. However, weather delays, cargo damage, loss and pilferage are compelling arguments against lighterage. Also, it is very likely that the labor/material cost ratio will increase. These factors, plus reduced ship turn-around, strongly favor direct ship-to-shore cargo handling.

From the port designer's point of view, Rocher Noir Bay would be a most interesting harbor site. But ship-to-shore is only part of the port function. Rail and/or highway transport must then take over.

It is largely this land transport consideration that leads to a site on the south side of Da Nang Bay, close to the north-south Highway 1, as well as the railroad. This recommended location for the deep water

port provides excellent direct connections to highway, rail and air without going through Da Nang. Only the traffic to the city ever goes into the city. No major bridge crossings are involved. Master planning has been obscured by several years or overriding military expedients, but the proposed port site should very well fit in with the future of Da Nang.

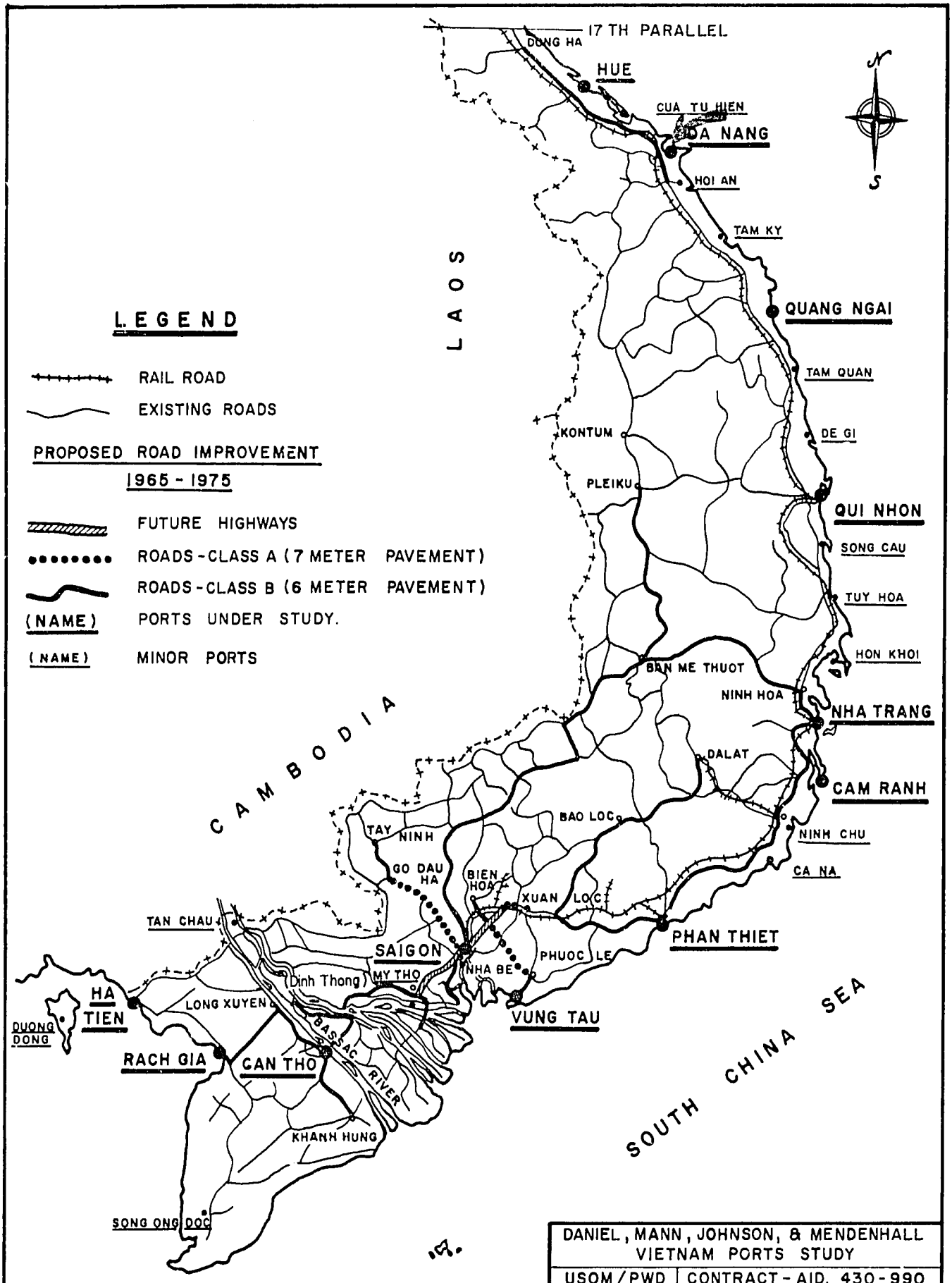
It is assumed that any military port development will remain in military use. On that basis, a three-berth deep water terminal, located on the south shore of Da Nang bay, has been found to be economically feasible.

Specific plans considered, and conclusions, are as follows:

Scheme	Location	Burdened principally by:
I	Rocher Noir Bay	R. R. & highway costs, inland traffic problems.
II	Tien Sha Bay	Same, also high const. and maint. cost.
III	Da Nang River	Channel dredging cost and maint. difficulty.
IV	Nam O Pt.	Distance from Da Nang and support.
V	Lien Chieu Bay	Distance from Da Nang and support.
VI	Naval Base	Temporary emergency pier only.
O	Ibservatory Point	Military. Same as I, distance.
VII*	Da Nang Bay (recommended)	Oceanographic problems.

* Similar to Scheme "X" of Interim Reports.

Scheme VII would require careful study of the entrance conditions, but it promises to be the least expensive site and it ties perfectly to inland transportation.



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VIETNAM PORTS STUDY

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REPUBLIC OF VIETNAM

TRANSPORTATION MAP

BY: A. F. BENSCHEIDT. DATE: OCT. 1965.

EXHIBIT # 1

Historical Background

Da Nang was called Cua Han, i.e., mouth of the Han River until the name "Tourane" was applied by the French. During the Japanese occupation, the name Da Nang, as Cham word meaning "Long Time River", came into use, after the name of the Da River. Da means water; Nang means long time.

Da Nang was part of the Amaravati locality of the Champa Kingdom that covered the present Quang Nam and Quang Ngai Provinces. These were conquered by the Vietnamese in 1402. At the time, Da Nang's role as a port was insignificant as compared with that played by Faifo, about 20 kms to the east. Faifo was once called Dai Chiem Hai Khau, or Sea Port of the Great Champa Kingdom, which had been developed by Chinese merchants by 500 A. D. About 1800, when the French were becoming interested in the country, they dispatched a Lt. De-Richery "to make a thorough survey of the harbors and approaches to the big cities between the 11th and 18th parallels, particularly the Bay of Tourane and its strategic value."

It was not until 1901, eighteen years after the establishment of the French protectorate, that Da Nang was designated as a major port for Central Viet-Nam. Projects were also considered for the establishment of a port at Qui Nhon. Some of the thinking of that time is illustrated by Exhibit 2.

Though open for traffic for the first time in 1907 for 1,500 - 2,000 ton vessels with a maximum draft of 5 meters, development of the Port of Da Nang really started after 1928, when two breakwaters or jetties were

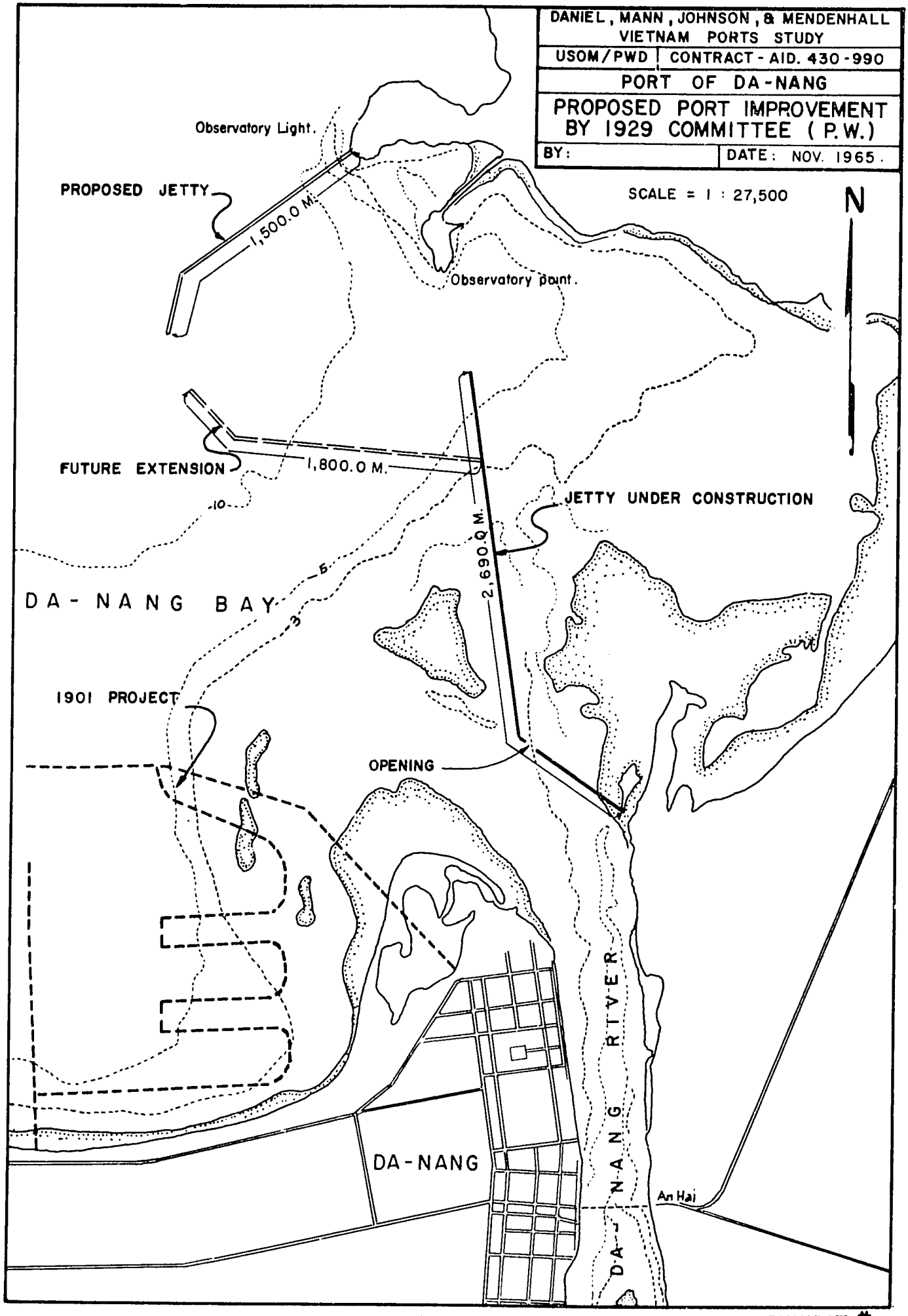

DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM/PWD | CONTRACT - AID. 430-990
PORT OF DA-NANG
PROPOSED PORT IMPROVEMENT
BY 1929 COMMITTEE (P.W.)
BY:
DATE: NOV. 1965.
SCALE = 1 : 27,500
N
Observatory Light.
PROPOSED JETTY
1,500.0 M.
Observatory point.
FUTURE EXTENSION
1,800.0 M.
JETTY UNDER CONSTRUCTION
2,690.0 M.
10
5
3
DA - NA N G BAY
1901 PROJECT
OPENING
DA-NANG
DA-NANG RIVER
An Hai

EXHIBIT # 2

started, as shown by Exhibit 2. Their construction was motivated by heavy silting in the river channel. Five dredging operations had been executed during the 1906 - 1928 period. Loading/discharging operations by ocean-going ships were carried out at the mooring station at the base of Observatory Islet, from which cargoes were moved to and from Da Nang.

In 1928, the installations at the Port of Da Nang already included one public wharf and twelve private wharves totalling 2,100 meters in length. The main berth was 161.60 meters long with the depth of water varying between -2.50 and -4.00 meters. Warehouses and other facilities had not been built yet.

The cargoes handled yearly were then estimated at about 100,000 metric tons. At that time, the Nha Trang - Da Nang section of the coastal railway had not been completed due to lack of funds. Main facilities as they are now seen at the Port were achieved after the 1930's.

Da Nang city became a municipality with autonomous financial status under Ordinance No. 12 of May 30, 1954. The Port of Da Nang operates as an autonomous agency under decree of August 22, 1960.

Sources: "Port de Tourane" by General Inspection of Public Works, '30
"Les Travaux Publiques de l'Indochine et le Developement Economique du Pays" by general Inspection of Public Works, '26
"Viet-Nam Gam Voc" by Phan-Xuan-Hoa
"Nien-Lich Cong-Dan" by Nguyen-Ngoc-Linh
"A Modern History of Viet-Nam"

Probably no port in Viet-Nam has received as much planning attention as has Da Nang. The studies of record include the following:

Date	Report Identity	Comment
1901	Terminal Northerly of RR Station	Abandoned in 1904
1926	Mardon Project	Too expensive
1928	Jumeau Project	Jetties & Slips
1930	Perrier de Rouville Commission	Revision of Mardon Project
no date	Lien Chieu Project	Exposed to waves
no date	Ministry of Public Works Report	Rocher Noir Bay site
1954	French Army Engineers Project	Observatory Island site
1960	Jacques Gruot of SOGREAH	Tien Sha Bulk Cargo site
1962	TECPAE Engineers	Observatory Island Naval Facility
1962	Gruot & Tourmen	Observatory Island site

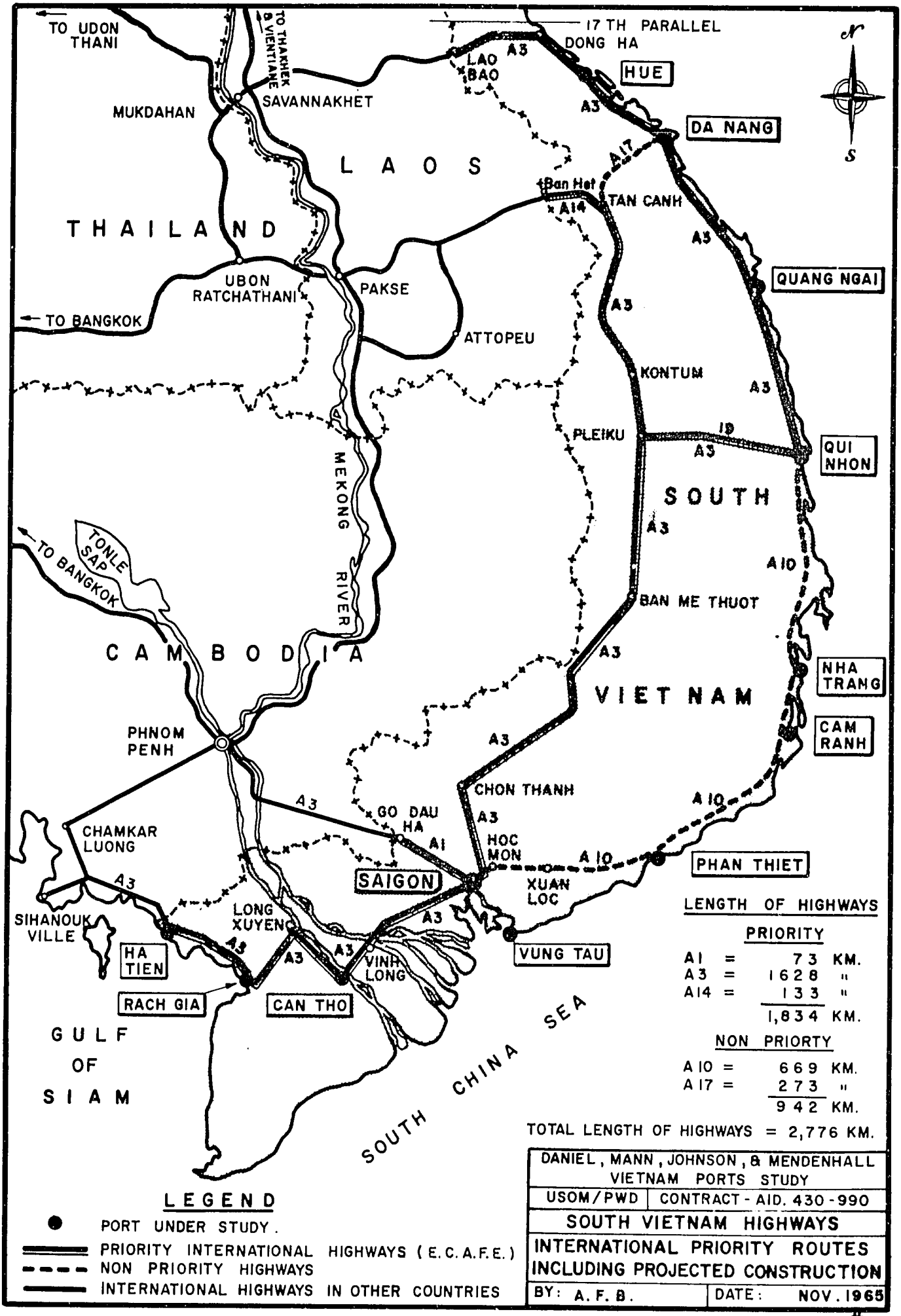
II. ECONOMIC

Area Description

Exhibit 6 shows Da Nang and the resources of the surrounding area. The city is the capital of Quang Nam Province, which has a population of about 575,000. Since approximately 1900, Da Nang has been the most important port in the northern part of South Viet-Nam. The city is one of six in Viet-Nam carrying the distinction of municipality status. The Port of Da Nang is separate and, like Saigon, is autonomous. The significance of these distinctions is discussed more fully in the Basic Information Volume.

A major distribution center, Da Nang's tributary area ranges from the 17th parallel in the north to about the 15th parallel to the south in the vicinity of Quang Ngai, and half way to Qui Nhon. The population now supported by the city is about 160,000 of which approximately 5,000 are refugees from the war zones. Da Nang is served by an all weather airport immediately west of the city. This airport has benefited by extensive improvement of runways, sufficient for any commercial aircraft. It is located on the coastal railway between Hue and Hoi An. It is served by Highway 14 leading to Kuntum and Pleiku, as well as by Highway 1, parallel to the coastal railroad.

A project for the improvement of a 400 kilometer westerly route leading to Laos from Da Nang has been scheduled. This project will provide improved connections with Savannakhet through Hue. It is shown on Exhibit 3.



LENGTH OF HIGHWAYS

PRIORITY

A1	=	73 KM.
A3	=	1628 "
A14	=	133 "
		1,834 KM.

NON PRIORTY

A10	=	669 KM.
A17	=	273 "
		942 KM.

TOTAL LENGTH OF HIGHWAYS = 2,776 KM.

LEGEND

- PORT UNDER STUDY.
- PRIORITY INTERNATIONAL HIGHWAYS (E.C.A.F.E.)
- NON PRIORITY HIGHWAYS
- INTERNATIONAL HIGHWAYS IN OTHER COUNTRIES

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VIETNAM PORTS STUDY

USOM/PWD | CONTRACT - AID. 430-990

SOUTH VIETNAM HIGHWAYS

INTERNATIONAL PRIORITY ROUTES INCLUDING PROJECTED CONSTRUCTION

BY: A. F. B. | DATE: NOV. 1965

EXHIBIT # 3

Resources

Deposits of several minerals have been found or reported in the area near Da Nang, although the prospects for commercial exploitation are by no means clear. Among these minerals are coal, limestone, copper, oil and a number of others.

Coal. South Viet-Nam's only known major deposit of anthracite is located at Nong Son about 45 kilometers southwest of Da Nang. A reserve of 3 million metric tons (before cut-off grade) has been reported with an additional 10 million tons in place. Under conditions of stability, it has been estimated that the production of the Nong Son mine could reach 300,000 tons by 1972. Hematite, laterite, lead, zinc, gold, graphite, silica sand and mica are also reported close by to Nong Son.

Limestone deposits have been found at Vinh Phuoc on the north side of the Nong Son coal basin, at Quang Nam (20 kilometers to the south of Da Nang), and at the "Marble Mountain", near Da Nang. Vinh Phuoc deposits are reported suitable for the manufacture of calcium carbide, while the Quang Nam limestone can be used for agricultural lime. The limestone in the "Marble Mountain" is highly siliceous with a low iron and aluminum content. Marble from this deposit has been used for building and could be employed as a base for clinker paste.

Copper prospects are not considered promising, though there is an old copper mine at Duc Bo in Quang Nam Province.

Oil seeps have been discovered in shallow wells near Da Nang. The commercial potential is not considered promising here either.

Phosphate deposits are located on Paracel Island 370 kilometers east of Da Nang. Once logistics problems are solved, these deposits could become an important source of fertilizer.

Fishing is a basic industry in the area served by Da Nang. The village of Nam O is renowned for its very high quality fish sauce made exclusively from anchovies. This concentrated product is often diluted at distribution centers. The fishing industry is stimulated by the presence of cold storage facilities at Da Nang.

Mulberry cultivation in Quang Nam once covered an area of some 6,000 hectares, producing 80,000 kilograms of raw silk annually. Due to widespread destruction by the war, sericulture has been reduced to a small, crudely operated cottage industry. Expansion possibilities exist.

Cinnamon trees are found near Da Nang. The bark is stripped from these trees and exported. A plant is to be placed in operation to distill cinnamon oil from leaves and twigs left behind after the stripping process.

Sugar and tobacco are raised to the southwest of Da Nang. Peanuts are also grown nearby.

Textiles. Sicovina operates a cotton textile mill in Da Nang, which is equipped with 20,000 spindles and 400 automatic looms. This mill is a substantial employer in the area.

Industrial Development

The An Hoa Industrial Complex idea grew out of the Nong Son coal deposits mentioned above. An Hoa lies about 35 km southwest of Da Nang, on the Thu Bon River, which empties to the sea below Hoi An (Faifo), as shown by Exhibit 4. Nong Son is about 12 km upriver from An Hoa, and 10 km above that there is the site of a planned power development.

An Hoa is to have a series of chemical plants having as the principal end product 42,000 tons or urea and 48,000 tons of ammonium sulphate fertilizers per year. Included is to be a 25,000 KW thermal power plant. Financing included a French Government load of 70 million francs, and a German Government loan of 50 million marks. Equipment was estimated in 1963 at 27 million dollars, and the local currency costs at 581 million piastres.

Equipment for the complex has been arriving principally at the Port of Saigon from France and Germany for about a year, and continues to arrive regularly. A pressure vessel weighing approximately 60 tons, and a

reactor almost as heavy, have been stored at the port, but other items have generally been removed to other storage, and some is believed to be in Da Nang. Access to the site has been ringed by Viet Cong, so only token work at the site has continued.

In later phases, the Nhon Trach Hydroelectric dam, on the Thu Bon, would regulate flow, and carry two 45,000 KW generating units. High voltage distribution lines were planned at least to Da Nang and down-coast to Quang Ngai. Mineral ores, particularly the Mo Duc deposits about 25 km south of Quang Ngai, figure in the future planning, together with a bamboo plantation for raw materials for a pulp plant. Dry ice for the fishing industry, and a glass factory, are under consideration.

At this time, the equipment must be substantially all built, and much has been seen moving through the Port of Saigon, so completion of the first phase of the complex appears certain.

Related Development. Meanwhile, the Ministry of Public Works and Communications, by a study reported in June, 1965, have reviewed and carried the Industrial Complex a step further.

The Nhon Trach dam project is described as a 58.7 million dollar project, with power intertie to Danhim. The Mo Duc iron mine development is viewed as possibly one million tons of export. (The report of this series on the Port of Quang Ngai, of questionable feasibility, considers the possibility

of a mineral shipping facility at Sa Huynh.) The building of the petroleum refinery at Nam-O (planned for Nha Trang since 1962) is considered.

Other possibilities suggested are a plant for processing ore at Mo Duc, a 150,000 ton cement plant at Van Xa just north of Hue, and a petroleum port at Lien Chieu in Tourane Bay where the present Esso plant is established. These and a proposed Industrial Zone are indicated on Exhibit 4.

The flow of raw materials, with imponderables like Mo Duc in the picture, make the output equally difficult to analyze. The resolution of such questions is beyond the scope of this study, but it is clear that as long as coal is mined at Nong Son, efforts will be made to use it , not only at An Hoa.

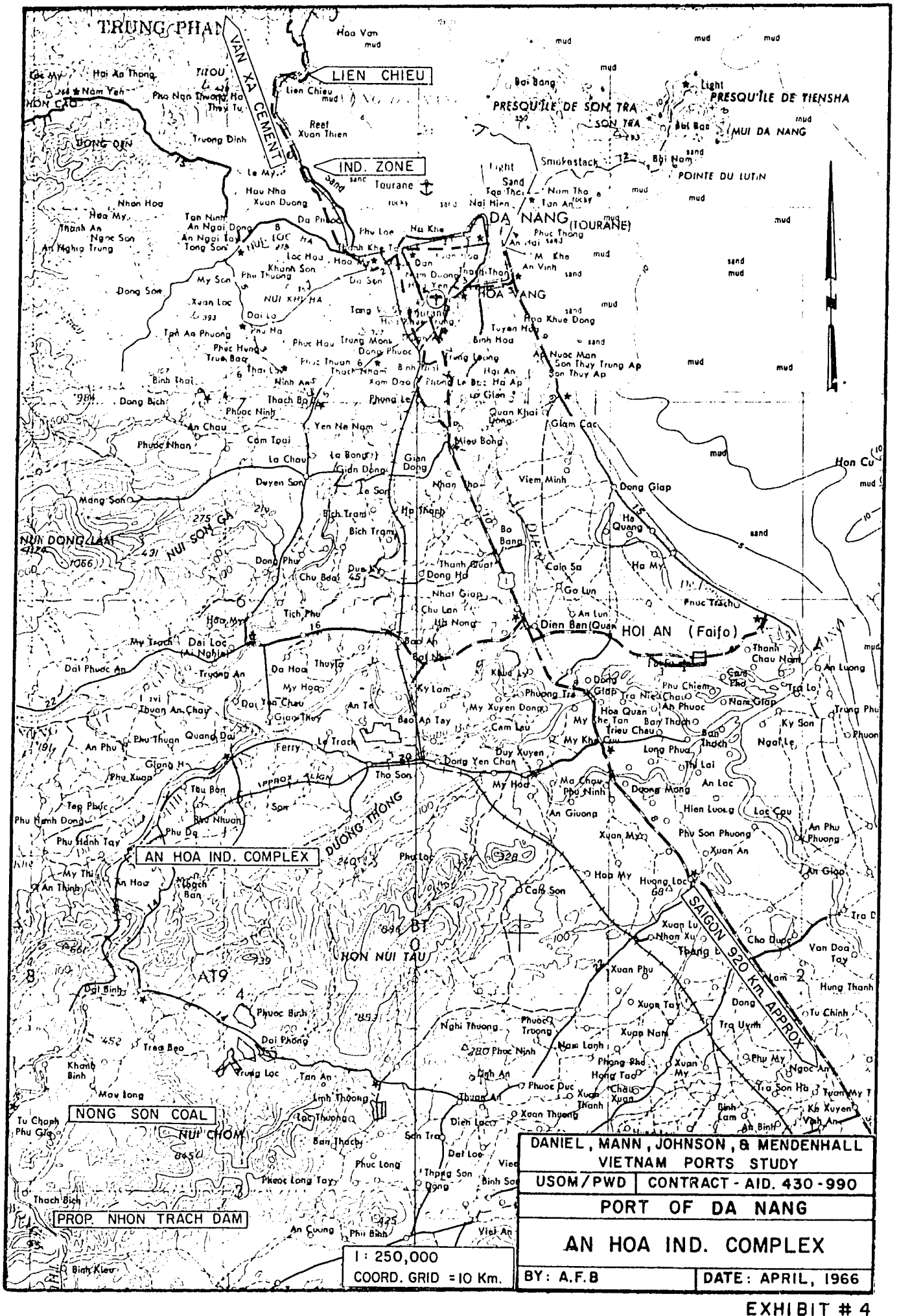
Nong Son coal was originally planned to be used for clinker production near Ha Tien, but obvious shipping difficulties, and the low grade of coal, lead to the use of oil. One of the uses of coal from Nong Son could develop through the construction of a portland cement plant at limestone deposits north of Hue. As pointed out in the Port of Hue study, the tonnage of coal required would be only about a quarter of the cement tonnage, and not enough to warrant development of better port facilities at Hue.

It is sufficient to note that as long as coal is mined at Nong Son and consumed in areas other than Da Nang, its shipment is likely to have a significant impact on port traffic. There is no more likely outlet to the sea than Da Nang. Though on the Thu Bon River, which could be made navigable

for perhaps 4 meter junks or barges, the outlet to the sea is barred by difficult shoals, as pointed out in the Quang Ngai report. It would be more practicable, probably, to reach Da Nang directly by way of improvement of one of the inland channels shown on Exhibit 4.

To the extent that the factories are set up in the complex, it is clear that capital equipment is likely to be delivered through the Port of Da Nang. Once these factories come into production, the port is likely to handle both their output and their supplies. Should only the present programs be completed, significant port requirements will be generated.

The Mekong Delta Committee and the Pan Asian Highway Committee of ESCAFE have assigned highest priority to highway improvements in the connections between Da Nang and Savannakhet. Both organizations have included this project in their Five-Year Plans. The improvements will offer Laos an effective outlet to the sea, some 400 kilometers in length from its western border at the Mekong. This constrasts with a proposed 800 kilometer highway to Bangkok, which has been assigned a lower priority by the two international organizations. Construction in South Viet-Nam was scheduled to commence in 1966. Given conditions of stability, this project could substantially increase Da Nang's port traffic. Another international priority highway project will stimulate traffic between Pakse and Attopeu in Laos and Da Nang. As shown in Exhibit 3, Ubon in Thailand will have two approaches to Da Nang by international routes.



DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY

USOM/PWD	CONTRACT - AID. 430-990

PORT OF DA NANG

AN HOA IND. COMPLEX

BY: A.F.B	DATE: APRIL, 1966

EXHIBIT # 4

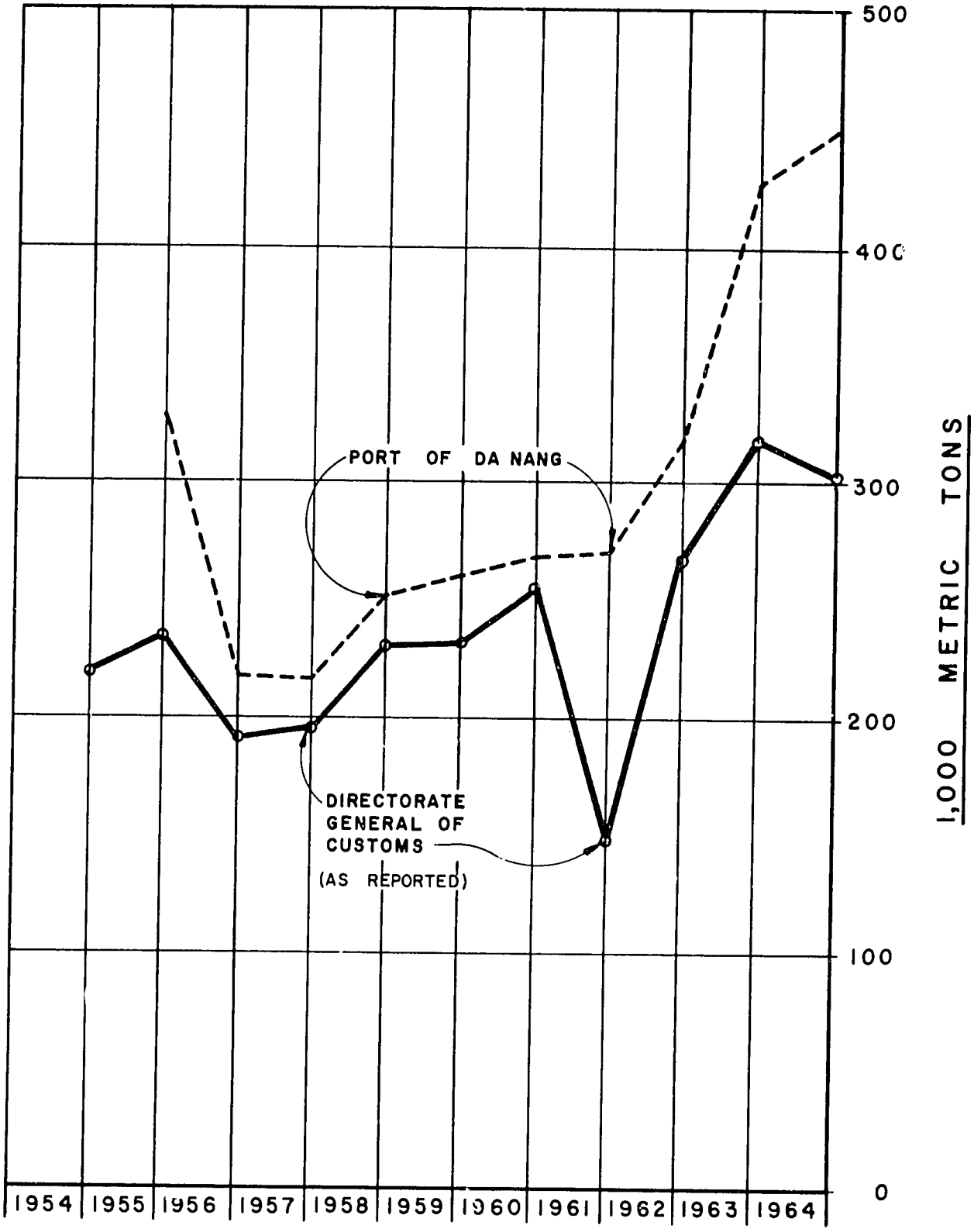
Exhibit 5 compares Da Nang port traffic as reported by the Directorate General of Customs and by the Port of Da Nang. The differences between the two figures may be attributable to procedures which exclude military and other items passing across the dock from the Customs statistics, to special practices governing the time periods in which the weight of imports are recorded, and to the nature of the documentation underlying the data. These matters are discussed in greater detail in the Basic Information report which constitutes a separate volume of this study.

For purposes of determining across-the-dock tonnages, the figures maintained by the Port of Da Nang appear clearly superior to those reported by Customs.

The commodity and tonnage summaries obtained from the Port of Da Nang are presented in Tables I and II. It should be noted that the terms "Imports" and "Exports" refer to total tonnage entering and leaving the port.

Table III provides a summary of the figures compiled by Customs. The commodity breakdowns contained in Table IV are those compiled by Customs and appear to pertain only to coastal traffic.

Table V presents projections for Da Nang general cargo, 1966-1985, under conditions of stability. These projections were made on the basis of the considerations discussed above and upon a review of statistics on port traffic.



SOURCE : - DIRECTORATE GENERAL OF CUSTOMS
- PORT OF DA NANG

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
PORT OF DA NANG	
TONNAGE COMPARISON	
BY: A. F. B.	DATE: NOV. 1965.

EXHIBIT # 5

TABLE I

PORT OF DA NANG

ANNUAL CARGO TONNAGE BY COMMODITY

(Metric Tons)

IMPORT

NO.	COMMODITY	1962	1963	1964	1965 Jan-May
1	Rice seeds	-	-	237	-
2	White rice	97,982	113,320	84,679	29,358
3	Red rice	13,036	6,496	3,741	32,028
4	Broken rice	12,993	3,769	2,894	1,545
5	Glutinous rice	7,308	6,996	8,232	4,206
6	Other cereals	1,037	21,172	24,992	1,822
7	Condensed, powdered milk	572	733	792	869
8	Flour	2,242	2,738	3,212	2,110
9	Noodles	67	54	168	284
10	Potatoes	5	2	7	25
11	Fish sauce	165	362	459	894
12	Salted fish, shrimp, dry octopus	11	9	113	243
13	Dry vegetables	51	26	24	26
14	Fresh vegetables	4	-	77	85
15	Dry fruit	18	15	12	64

NO.	COMMODITY	1962	1963	1964	1965 Jan-May
16	Fresh fruit	207	231	185	190
17	Canned food & fruit	34	201	475	85
18	Canned fish	32	109	115	47
19	Eggs	5	11	14	4
20	Sugar	2,498	2,159	2,010	1,472
21	Jam, delicacies	6	12	160	387
22	Tobacco	154	311	531	437
23	Salt	230	141	604	538
24	Spices, vinegar, soja sauce	13	13	43	65
25	Tea, coffee	91	97	149	188
26	Beer	4,594	5,224	8,225	1,862
27	White wine	610	711	1,602	684
28	other drinks	455	87	1,192	204
29	Gasoline	28,634	34,112	66,757	54,097
30	Kerosene	8,209	7,581	9,800	2,906
31	Other petroleum products	33,148	43,466	40,307	18,276
32	Stones, bricks	41	103	47	17
33	Cement	57,449	92,207	34,030	29,130
34	Cement articles, cement by-products	647	148	407	196
35	Steel	2,162	14,870	5,265	1,400
36	Chemical by-products	857	1,435	3,775	1,149

NO.	COMMODITY	1962	1963	1964	1965 Jan-May
37	Fertilizer	3,161	17,719	29,966	2,912
38	Coal, charcoal	7	221	28	7
39	Paint & dye	141	187	116	126
40	Tar, asphalt	1,770	6,326	1,348	445
41	Paper, paper articles	785	701	689	829
42	Soap	16	16	34	55
43	Pottery, earthenware	417	403	191	133
44	Glass	282	615	992	155
45	Textiles, blankets, clothes	989	520	792	772
46	Thread, cotton, wool	802	2,515	2,957	1,092
47	Hemp bags, hemp thread	199	8	6	71
48	Rattan, rush articles	9	11	17	44
49	Chinese medicine	14	12	50	239
50	Pharmaceutical products	171	182	76	198
51	Cinnamon	-	-	22	-
52	Vegetable oil, grease	380	450	1,588	1,165
53	Wood	429	739	1,126	557
54	Wooden articles	183	52	335	1,072
55	Machinery & equipment	9,796	19,607	21,439	25,980
56	Metal sheets, metal by-products	4,977	4,824	4,234	1,998
57	Cars, motor vehicles	6,677	1,056	457	60
58	Parts for cars	78	17	7	138

NO.	COMMODITY	1962	1963	1964	1965 Jan-May
59	Rubber articles, tires & tubes	325	346	212	282
60	Leather & by-products	26	5	2	10
61	Other products	496	477	761	623
62	Miscellaneous	325	175	252	152
63	Food	-	814	-	-
64	Breeding cows	7	-	-	-
	TOTAL	308,002	416,919	373,029	226,008

TABLE II

PORT OF DA NANG

ANNUAL CARGO TONNAGE BY COMMODITY

(Metric Tons)

EXPORT

NO.	COMMODITY	1962	1963	1964	1965 Jan-May
1	White rice	-	-	50	-
2	Other cereals	63	37	501	292
3	Flour	-	-	-	1
4	Salted fish, shrimp, dry octopus	-	-	-	3
5	Fresh fruit	1	-	-	-
6	Sugar	-	12	-	27
7	Jam, delicacies	-	-	-	1
8	Tobacco	-	1	2	1
9	Beer	3	-	-	-
10	Other drinks	6	6	-	-
11	Gasoline	-	-	-	144
12	Kerosene	1	1	69	3
13	Steel, iron	277	164	271	-
14	Chemicals	4	-	-	-
15	Fertilizers	-	-	-	1,200
16	Coal, charcoal	2,865	2,993	3,025	-

NO	COMMODITY	1962	1963	1964	Jan-May 1965
17	Paper, paper articles	1	1	4	4
18	Glass & articles	1,764	1,635	2,566	1,052
19	Textiles, blankets, clothes	51	644	687	364
20	Cotton thread, cotton, wool	-	374	872	331
21	Hemp bags, hemp thread	544	574	353	335
22	Rattan, rush articles	21	28	17	3
23	Pharmaceutical products	8	-	-	-
24	Cinnamon	284	313	589	228
25	Vegetable oil, grease	11	-	8	16
26	Wood	-	-	1	-
27	Wooden articles	13	26	22	6
28	Machinery & equipment	447	1,105	7,080	2,878
29	Metal by-products, metal sheet	543	320	574	202
30	Cars, motor vehicles	731	245	262	73
31	Parts for cars	11	-	-	7
32	Rubber articles, tires & tubes	141	48	43	2
33	Leather and by-products	66	27	72	152
34	Other products	-	-	-	3
35	Miscellaneous	25	21	10	12
36	Areca	-	-	-	35
	TOTALS	7,881	8,575	17,078	7,375

TABLE III

PORT OF DA NANG

CUSTOMS TONNAGE SUMMARY

1954-1964

(1000 Metric Tons)

YEAR	OCEAN TRAFFIC			COASTAL TRAFFIC			GRAND TOTAL
	IMPORT	EXPORT	TOTAL	TONNAGE IN	TONNAGE OUT	TOTAL	
1954	10.0	-	10.0	192.7	15.4	208.1	218.10
1955	8.0	1.50	9.5	204.8	20.1	224.9	234.40
1956	38.2	-	38.2	144.3	8.5	152.8	191.00
1957	48.1	2.1	50.2	133.6	12.0	145.6	195.80
1958	78.9	1.7	80.6	140.0	9.5	149.5	230.10
1959	63.9	1.0	64.9	156.1	10.4	166.5	231.40
1960	69.9	2.9	72.8	171.3	9.6	180.9	253.70
1961	66.0	1.3	67.3	73.3	8.2	81.5	148.80
1962	95.9	-	95.9	166.2	6.6	172.8	268.70
1963	166.4	-	166.4	144.8	5.8	150.6	317.00
1964	151.0	-	151.0	140.52	10.05	150.57	301.57

Source: Directorate General of Customs

TABLE IV

PORT OF DA NANG

COMMODITIES HANDLED

1960-1964

(Metric Tons)

COMMODITY	SHIPPED		RECEIVED	
	1960	1964	1960	1964
Rice	-	-	95,040	70,060
Broken rice	-	-	13,122	-
Glutinous rice	32	-	10,374	8,302
Rice powder	-	-	2	-
Other powder	-	-	244	155
Wheat flour	-	-	1,575	890
Maize	-	-	200	-
Bran	-	-	-	2,996
Bean	-	-	685	428
Fruit	-	-	40	157
Coco	-	5	-	-
Raw sugar	-	-	11	-
Sweet potatoes	-	-	9	-
Fish sauce, shrimp paste	30	-	809	856
Soya sauce	-	6	61	164
Salad oil	-	-	2	-
Peanut	-	1	-	-
Peanut oil	-	-	3	-
Oil vegetable	-	-	4	-
Oil cakes	-	-	32	-
Eggs	-	-	4	-
Spices	61	-	59	-
Cakes, sweets	-	-	-	193
Soft noodle	-	-	55	-
Canned milk	-	-	279	3,200
Wine	-	-	7	-
Soft drink	-	-	24	1,145
Beer	-	-	1,907	8,223

COMMODITY	SHIPPED		RECEIVED	
	1960	1964	1960	1964
Rice alcohol	-	-	1,735	1,643
Refined sugar	-	-	1,378	1,470
Salt	76	-	2,451	1,492
Chemical fertilizer	14	18	1,825	534
Chemical products	-	-	213	146
Cement	149	-	62	-
Gas	-	-	207	696
Bulk oil	-	60	-	1,273
Gasoline	-	-	8,584	5,357
Fuel oil	-	-	8,132	3,924
Kerosene	12	38	8,126	4,918
Gasoil	6	-	3,282	2,816
Diesel oil	-	-	3,220	3,762
Paraffin	-	-	370	266
Fire wood	201	-	-	-
Wood, wooden articles	23	62	195	962
Iron, empty metallic & gas	1,521	1,529	2,879	772
Asphalt	-	-	1,196	-
Roofing sheet	-	-	1	-
Metal	-	-	-	2,157
Construction material	-	-	-	205
Paint	-	-	135	-
Coal tar	-	-	-	956
Caoutchouc	1	-	-	-
Textile	-	682	-	-
Cotton	-	71	-	-
Coal	4,060	3,225	-	-
Charcoal	-	-	-	130
Engine	29	1	33	-
Bazaar articles	-	-	232	-
Josstick	-	-	51	-
Motor vehicle & Parts	24	103	33	-
Empty bottle	956	2,418	22	1,429

COMMODITY	SHIPPED		RECEIVED	
	1960	1964	1960	1964
Soap	-	-	19	-
Bag	-	-	12	-
Sack	591	401	2	-
Bicycles & accessories	-	-	1	-
Ceramic	-	-	299	-
Paper, office supplies	1	-	805	
Candle	-	-	-	189
Fat from pig	-	-	7	-
Local medicine	-	-	1	-
Stones, stone articles	464	399	-	-
Cattle bones	114	46	-	-
Cinnamon bark	1,147	48	-	-
Thread	-	706	-	-
Rattan	-	2	-	-
Hide	-	38	-	-
Miscellaneous	354	58	1,352	8,895
TOTAL	9,630	9,917	171,408	141,133

TABLE V

PORT OF DA NANG

GENERAL CARGO PROJECTIONS (1)

CONDITIONS OF STABILITY

1966-1985

(1,000 Metric Tons)

1965	ADJUSTED (2)	350
1966	. . . . .	450
1967	. . . . .	560
1968	. . . . .	670
1969	. . . . .	780
1970	. . . . .	900
1975	. . . . .	1,300
1980	. . . . .	1,700
1985	. . . . .	2,100

(1) Excludes liquid bulk cargo.

(2) Based on data obtained from the Directorate General of Customs with adjustments to exclude bulk cargo and to include certain tonnage not reflected in Customs figures.

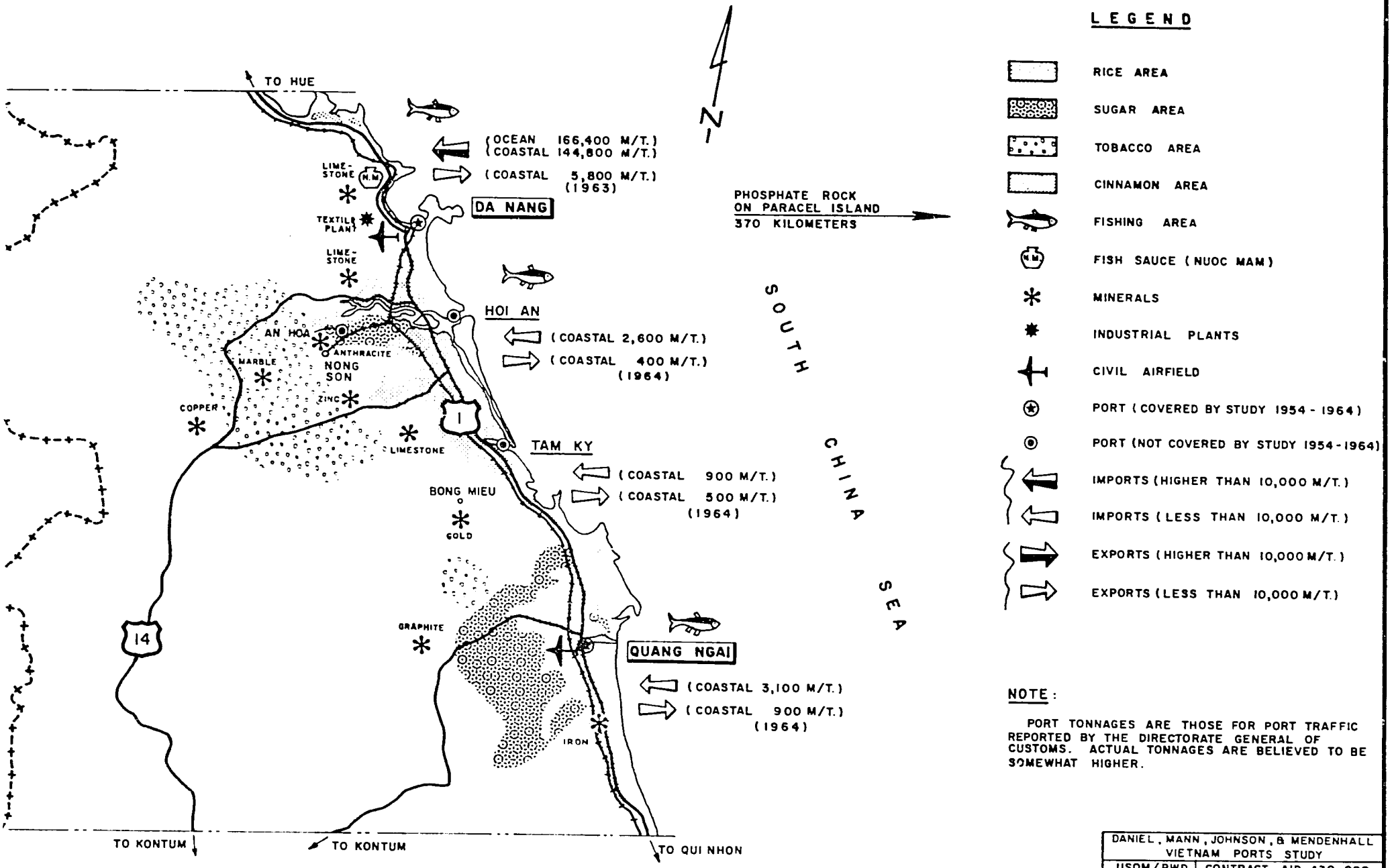

TO HUE
(OCEAN 166,400 M/T.)
(COASTAL 144,800 M/T.)
(COASTAL 5,800 M/T.)
(1963)
LIME-STONE
H.M
TEXTILE PLANT
DA NANG
LIME-STONE
PHOSPHATE ROCK
ON PARACEL ISLAND
370 KILOMETERS
HOI AN
(COASTAL 2,600 M/T.)
(COASTAL 400 M/T.)
(1964)
AN HOA
ANTHRACITE
MARBLE
NONG SON
ZINC
COPPER
LIMESTONE
1
TAM KY
(COASTAL 900 M/T.)
(COASTAL 500 M/T.)
(1964)
BONG MIEU
GOLD
SOUTH CHINA SEA
GRAPHITE
14
QUANG NGAI
(COASTAL 3,100 M/T.)
(COASTAL 900 M/T.)
(1964)
IRON
TO KONTUM
TO KONTUM
TO QUI NHON
N
LEGEND
RICE AREA
SUGAR AREA
TOBACCO AREA
CINNAMON AREA
FISHING AREA
FISH SAUCE (NUOC MAM)
MINERALS
INDUSTRIAL PLANTS
CIVIL AIRFIELD
PORT (COVERED BY STUDY 1954 - 1964)
PORT (NOT COVERED BY STUDY 1954-1964)
IMPORTS (HIGHER THAN 10,000 M/T.)
IMPORTS (LESS THAN 10,000 M/T.)
EXPORTS (HIGHER THAN 10,000 M/T.)
EXPORTS (LESS THAN 10,000 M/T.)
NOTE:
PORT TONNAGES ARE THOSE FOR PORT TRAFFIC REPORTED BY THE DIRECTORATE GENERAL OF CUSTOMS. ACTUAL TONNAGES ARE BELIEVED TO BE SOMEWHAT HIGHER.
20 0 20 40 60 80 KM
GRAPHIC SCALE
STATISTICAL BULLETIN NO 7 - 1963
ZIMMERMANN REPORT - 1958
IAL DEVELOPMENT IN VN. BULLETIN - 1964
RATE GENERAL OF CUSTOMS
DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM/PWD
CONTRACT - AID. 430-990
PORT OF DA NANG
RESOURCES MAP
BY: N.V.GIAU
DATE: NOV. 1965

EXHIBIT # 6

III. EXISTING PORT FACILITIES

Oceanographic

Waves. Exhibit 7 shows the general northeasterly China Sea exposure of the coastline, in the vicinity of Da Nang. The regular deep-water contour is modified by offshore Cu Lao Cham island group off the River Cua Dai. At a few points such as Tourane Bay, it is evident that the irregular coast will subject a wave front to significant refraction effects.

A general discussion of the problem is presented in the Basic Information Volume, with tabulations of the deep water sea and swell conditions. Exhibit 8 shows graphically the sea, swell and wind conditions for the Central Viet-Nam coast.

An estimate of the pattern of significant wave heights and periods for Rocher Noir Bay are given in Table VI.

Tides at Da Nang normally have a relatively narrow range, as follows:

	Feet	Meters
Highest High Water		1.97 **
Mean Higher High Water	4.1 *	1.25
Mean Lower High Water	3.5 *	1.07
Mean Higher Low Water	3.2 *	0.98
Mean Lower Low Water	2.1 *	0.64
Lowest Low Water		0.42 **

* From H.O. 93 and Chart H.O. 6210
** From Directorate of Navigation

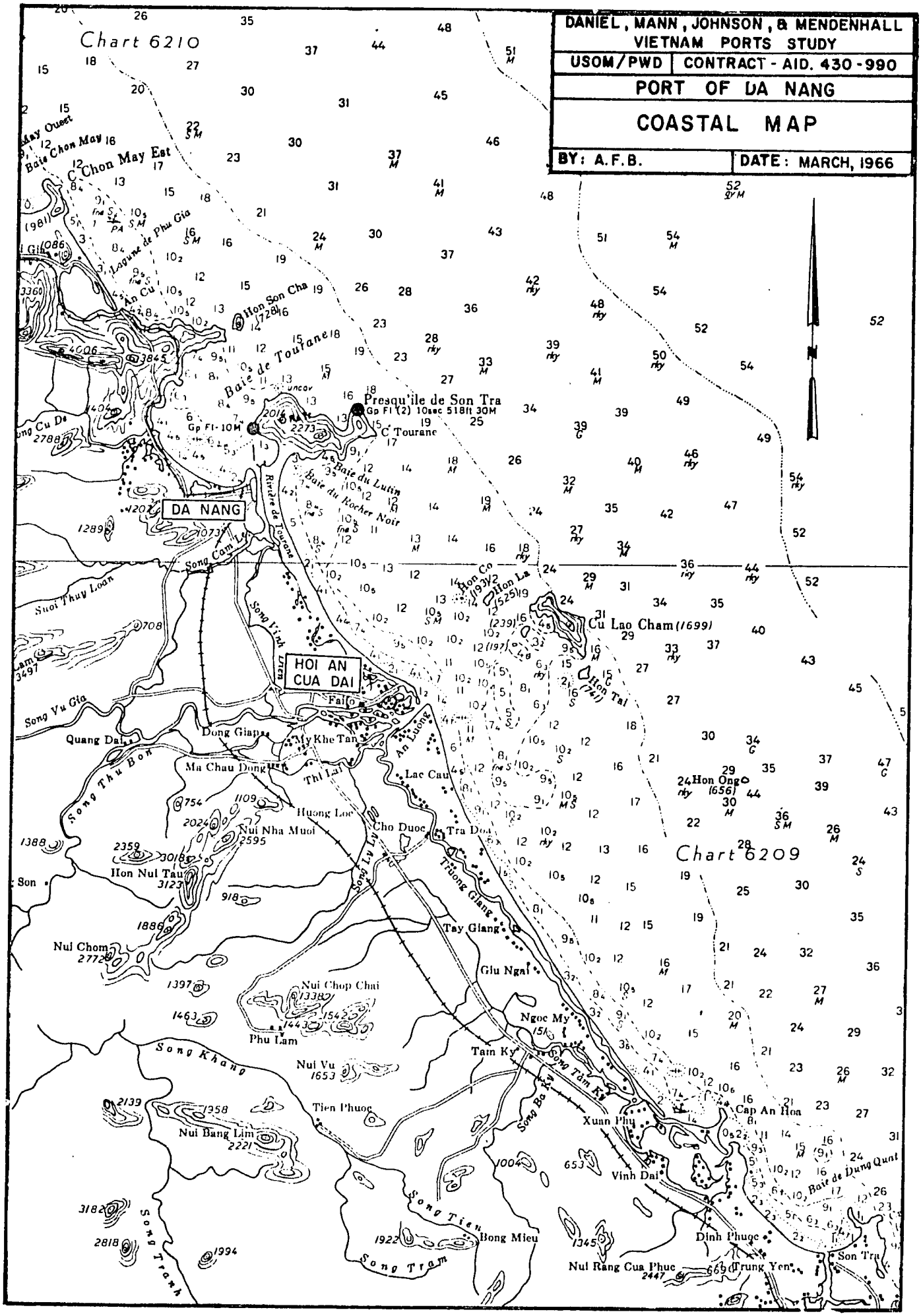

DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM/PWD | CONTRACT - AID. 430-990
PORT OF DA NANG
COASTAL MAP
BY: A.F.B. | DATE: MARCH, 1966
Chart 6210
Chart 6209
DA NANG
HOI AN
CUA DAI
Presqu'ile de Son Tra
Gp Fl (2) 10sec 518ft 30M
C Tourane
Baie de Tourane
Baie du Lutin
Baie du Rocher Noir
Riviere de Tourane
Song Cam Le
Song Vinh Loi
Song Vu Gia
Song Thu Bon
Song Lu Lu
Song An Truong
Song Khang
Song Tien
Song Tram
Song Tra Khuc
Song Ba Ky
Song Tam Ky
Truong Giang
Tay Giang
Hon Co
Hon La
Cu Lao Cham (1699)
Hon Tai
Hon Ong (656)
Dong Giang
My Khe Tan
Ma Chau Dong
Thi Lai
Lac Cau
Huong Loc
Cho Duoc
Tra Doa
Nui Nha Muoi
Hon Nui Tau
Nui Chom
Nui Chop Chai
Phu Lam
Nui Vu
Tien Phuoc
Nui Bang Lim
Glu Ngai
Ngoc My
Tam Ky
Xuan Phu
Cap An Hoa
Vinh Dai
Bong Mieu
Nui Rang Cua Phuc
Trung Yen
Dinh Phuoc
Son Tra
Baie de Dung Quat
Quang Dai
Laguna de Phu Gia
Hon Son Cha
Suoi Thuy Loan

EXHIBIT #7

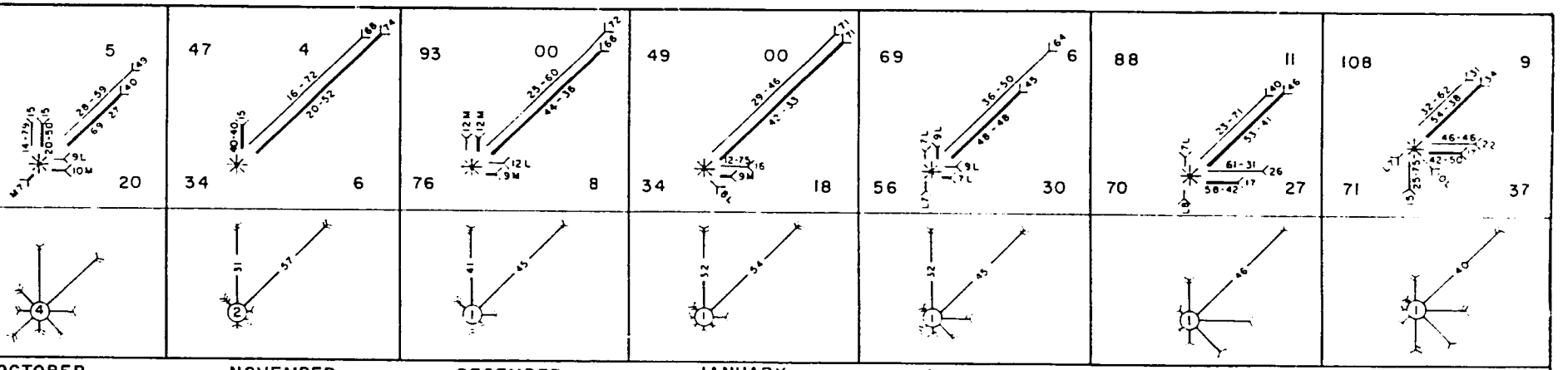
TABLE VI

ROCHER NOIR BAY

Estimated Percentage of Time of Occurrenc of 'Significant' Wave Heights* and Average Wave . eriods

Parameter	Winter	Spring	Summer	Fall
Percent of time significant height is equal or greater than 5 feet	21	17	14	19
Percent of time significant height is between 5 and 10 feet	6	5	4	5
Percent of time significant height is equal or greater than 10 feet	15	12	10	14
Median significant height (feet)	2.4	1.9	1.5	2.1
Median average period (seconds)	4.0	3.1	2.3	3.3
Percent of time average period is equal to or greater than 5 seconds	35	24	17	28
Percent of time average period is between 5 and 10 seconds	7	5	4	6
Percent of time average period is equal or greater than 10 seconds	28	19	13	22

SEA AND SWELL

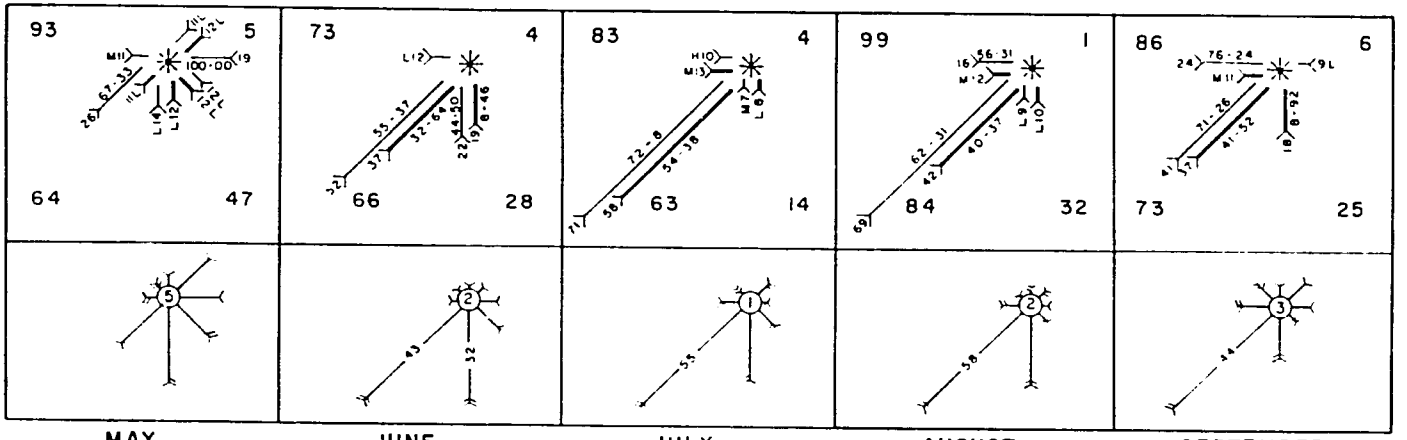


WIND

OCTOBER | NOVEMBER | DECEMBER | JANUARY | FEBRUARY | MARCH | APRIL

NE MONSOON
OCTOBER - APRIL

SEA AND SWELL



WIND

MAY | JUNE | JULY | AUGUST | SEPTEMBER

SW MONSOON
MAY - SEPTEMBER

LEGEND : EXAMPLE : SEPTEMBER

SEA (LIGHT LINE ARROW)
86 OBSERVATIONS, CALMS 6 %
- 24 % WEST { 24 % LOW ; 76 % MEDIUM }
- 9 % EAST, PREDOMINATELY LOW
- 41 % SOUTHWEST { 26 % LOW ; 71 % MEDIUM ; (3 % HIGH) }

SWELL (HEAVY LINE ARROW)
73 OBSERVATIONS, CALMS 25 %
- 11 % WEST, PREDOMINATELY MEDIUM
- 18 % SOUTH { 92 % LOW ; 8 % MEDIUM }
- 37 % SOUTHWEST { 52 % LOW ; 41 % MEDIUM ; (7 % HIGH) }

WIND : AVERAGE FORCE GIVEN BY NO. OF TAILS
3 % CALMS, LIGHT, OR VARIABLE
S W 44 % (NOT TO SCALE WHEN FIGURE STATED), FORCE 3
W. 10 % , FORCE 4 ; N W. 8 % , FORCE 5 ;
N. 4 % , FORCE 2 ; N.E. 6 % , FORCE 2 ;
E. 5 % , FORCE 2 ; S.E 3 % , FORCE 4 ;
S. 12 % , FORCE 4 .

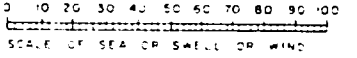
SEA, SWELL, AND WIND - FROM SEA AND SWELL CHARTS H.O. AND PILOT CHARTS H.O OF INDIAN OCEANS, U S. HYDROGRAPHIC OFFICE, FOR CENTRAL VIETNAM COAST

SEA AND SWELL

LIGHT	1 AND 2 FEET
MEDIUM	3 AND 4 FEET
HEAVY	5 FEET AND OVER

BEAUFORT WIND SCALE

BEAUFORT NO.	DESCRIPTION OF WIND	MILES PER HOUR (NAUTICAL)	BEAUFORT NO.	DESCRIPTION OF WIND	MILES PER HOUR (NAUTICAL)
0	CALM	LESS THAN 1	5	FRESH BREEZE	17 - 21
1	LIGHT AIR	1 - 3	6	STRONG BREEZE	22 - 27
2	LIGHT BREEZE	4 - 6	7	MODERATE GALE	28 - 33
3	GENTLE BREEZE	7 - 10	8	FRESH GALE	34 - 40
4	MODERATE BREEZE	11 - 16	9	STRONG GALE	41 - 47



DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM / PWD | CONTRACT - AID 430 - 990
REPUBLIC OF VIETNAM
GEN'L. METEOROLOGICAL CONDITIONS
BY. A F B | DATE NOV , 1965

EXHIBIT # 8

This moderate tidal pattern, with corresponding ebb and flow characteristics in the Da Nang River, contribute to the silting tendencies in the river channel.

For design purposes it is necessary also to take into account that typhoons occasionally visit this part of the coast, following paths as shown by Exhibit 9. Velocities of 130 knots have occurred in the China Sea. Winds of this force could produce an overtide of as much as two meters at a confined location such as Da Nang. The extent to which on-shore winds may affect the actual tide is suggested by the irregular patterns recorded in Exhibit 10.

Rainfall at Da Nang is concentrated in the last four months of the year, as shown by Table VII, which is characteristic of the north central coast. Comparative data for selected points in Viet-Nam is given in the Basic Information Volume.

Figure 1 shows the harbor anchorage on June 16, 1965. Vessels drawing over 5 meters discharge to lighters which then proceed to the wharves for unloading.

Navigation conditions, as viewed by the navigator, are fully described in the U.S. Hydrographic Office (now Oceanographic Office) publication H.O. 93. The most pertinent three pages are reproduced below. H.O. 93 does not reflect the constant dredging that went on throughout 1965 to restore the coaster channel to full usefulness. The 12" dredge, "Rach Gia" (Figure 2) was assigned to the task.

VUNG DA NANG (BAIE DE TOURANE) (DA NANG BAY)

4C–13 General—Aspect.—The bay offers good shelter at all seasons for vessels of any size. The bay has adequate depths, and is flanked on both sides of the entrance by high land. The port of Da Nang is located in the southeast part of the bay on the west bank of Song Da Nang. Larger vessels are accommodated at anchorages in the bay. The port is of importance being the outlet for the coal mined near Nangson, some 35 miles up-river. The bay is easy of access between the high land of the north side of Ban Dao Tien Sa on the southeast, and the high steep-to land of another peninsula about 4 miles northwestward. This well defined entrance was reported excellent for radar navigation (1964). Roche Canton, about 1/3 mile off the southern entrance point, is the only danger in the approach.

A naval base is located on Ilot de l'Observatoire (Observatory Island), an islet close southeastward of the west end of Ban Dao Tien Sa, and connected to it by a causeway. An L-shaped jetty with a berthing space of 680 feet on its south side extends out from the southeast side of the islet. Depths of at least 7 feet are found alongside. It was reported (1962) that depths within the small natural basin in the north part of the inner harbor near the naval base were up to 24 feet at LLW. It was also reported (1962) that there are depths of 15 to 20 feet at LLW in the approach to this basin.

One or two small vessels with a draft of 16 feet can be accommodated at this protected anchorage; access is limited to vessels drawing less than the LLW controlling depth of 18 feet. Caution is advised.

A conspicuous tank, painted green, stands about 1¾ miles east-southeastward of the light on the south point of Observatory Island.

A radar tower, situated on the highest peak of the peninsula, is located about 2 miles east-northeastward of the light on the east extremity of Ban Dao Tien Sa.

An offshore oil berth is located on the west side of Vung Da Nang. The berth, which has a depth of 26 feet, is located in the north part of a small cove which is known as Baie de Lien Chieu. A buoy marks the seaward end of the submerged pipeline which extends offshore about 150 yards.

Depths.—The entrance of the bay has depths of 10 to 12 fathoms with a gradual decrease toward the head of the bay where the 6-fathom curve is about 2 miles from the shore. In the southeast part the 6-fathom curve is about 2 miles off the bar of the river.

A depth of 21 feet exists (1965) a little more than ¼ mile southwest of the south extremity of Observatory Island.

The harbor and bay are subject to silting. In 1964 a dredged channel, in which dredging was still in progress, led across the bar and had a least reported depth of 16 feet. The channel leads in a 114° direction for 1000 yards from a position about 900 yards 189° from the light on the west extremity of Ban Dao Tien Sa to a position about 300 yards 012° from the north head of a breakwater. A dredged channel, with a least reported depth (1964) of 15 feet, leads from this position in a 172° direction along the east side of the breakwater past the main wharf to the vicinity of the French Residency pier.

In late 1964 the channel had a maximum depth of 10 feet at high water.

An approximate low water depth of 6 feet was reported (June 1965) 300 yards 185° from Observatory Island light structure.

Coastal steamers are able to off-load alongside docks without lightering.

Dangers.—Roche Canton (Canton Rock), part of which dries 2 feet, lies about 1/3 mile off the extremity of Ban Dao Tien Sa. A black spar buoy is moored about 280 yards northeastward of Roche Canton. (Reported missing, 1959).

Dangerous, sunken wrecks lie in Vung Da Nang and are charted as follows (reckoned from the light about 1/3 mile northwestward of Observatory Island): a wreck, marked by a buoy (reported missing 1965), about ¾ mile 226°; a wreck, lying on an axis of 030°-210° and marked by a green buoy moored close north-northeastward of the wreck, about 1¼ miles 259°; a wreck about 2½ miles 263°. Buoys are reported to shift during storms.

Depths less than charted, apparently because of silting, were reported (1965) to exist in several places in the southeast part of the bay.

Patches of 12 and 13 feet lie about ¾ mile off the mid-position of the inner shore of the bay. An early 1962 sounding report states these patches could not be located.

Depths of less than 3 fathoms extend 1 mile off the mouth of the river. In early 1962 it was reported the 3-fathom curve, and shallower depths within, extended about 200 yards farther seaward then charted off the mouth of the river.

Caution is necessary to avoid the numerous fishing vessels which frequent the Vung Da Nang. Most of the vessels display no lights at night. Fishing nets encumber the areas between the 3-and 5- fathom curves. Vessels without local knowledge should take a pilot.

Weather.—During the Northeast Monsoon fresh breezes prevail and the climate is agreeable. Squalls from northward appear in February, warning of which is given by clouds collecting on the mountains northward. In April and May the heat is stifling, owing to prevailing calms. At this time vessels should anchor well out in the bay away from the high land in order to get any breeze. In June the heat is tempered somewhat by land and sea breezes.

Navigational Aids.—A light is shown from the west extremity of the peninsula on the east side of the bay, about ¼ mile northwestward of Observatory Island.

A light is shown on the south point of Observatory Island. Storm signals are displayed here.

White lights, reported (1964) to be clearly visible, in range 352°, are located just east of Observatory Island on the pier and causeway, respectively. They mark the centerline of the inner dredged channel leading to Da Nang.

A black buoy was located (1965) about ¼ mile southward of the light structure on the south end of Observatory Island.

Anchorages.—The best anchorage is in the east part of the bay southeastward or southwestward of Observatory Island, bottom of mud and shells. Vessels of up to 22 feet draft can anchor about ¼ mile southwestward of the islet, which position is more exposed to the Northeast Monsoon.

Large vessels should anchor westward or southwestward of the point of the islet from which the light is shown, in 6 to 8 fathoms.

Small craft can anchor off the east side of the islet, between the causeway that connects with the shore, and a small dike that juts eastward from the islet.

A prohibited anchorage area is established between Observatory Island and the detached breakwater.

A Vietnam ruling of January 13, 1955, states that "free" anchorage in the Vung Da Nang is obtained northwestward of a line passing 040° through the western extremity of Ban Dao Tien Sa. Southeastward of this line anchorage is "regulated" or "limited". In the regulated or limited anchorage, twelve berths are designated: four berths at 437-yard (400-meter) intervals on bearing 215° from the light at the west end of Ban Dao Tien Sa; four berths at 328-yard (300-meter) intervals on bearing 215° from the beacon about ¼ mile eastward of the above light; and four berths at 328-yard (300-meter) intervals on bearing 216° from the light at the south point of Observatory Island.

Pilots.—The Harbormaster, Da Nang, serves as pilot and he has experience in handling "LST's" and small coastal vessels. His services can be obtained for piloting deep-draft vessels to assigned anchorages.

The pilot boards vessels in the vicinity of Observatory Island. In 1962 the pilot boat, about 30 feet in length, had a red hull and green housing. Visual signals in the harbor with the port director are not maintained; a harbor frequency is available.

Pilotage is not compulsory for either the outer or inner harbor, but is recommended for the inner harbor.

Regulations—Directions.—All warships, commercial vessels, and fishing boats are directed by the Ministry of Foreign Affairs, as of 20 February 1965, to comply with the following regulations governing their entering and leaving Vung Da Nang (Baie de Tourane).

Vessels from the eastward should make their approach through positions A, C, and D.

Vessels from the northward should make their approach through positions B, C, and D.

Due to the eventual placing of H.O. charts

in this area on Indian 1960 Datum, the approach positions are located by bearings and distances, and are as follows:

A– 009°, 3 miles from Ban Sao Tien Sa (Presqu'ile de Tien Sha) Lighthouse, which is located about 1½ miles northwestward of Mui Da Nang (Cap Tourane).

B– 333°, 8.2 miles from the lighthouse in A.

C– 298°, 6.2 miles from the lighthouse in A.

D– 261°, 0.55 mile from Observatory Lighthouse located on the west extremity of Ban Dao Tien Sa, about ¼ mile northwestward of Observatory Island.

All vessels must be ready to answer with (colors or lights) the signals emitted by patrol units and control towers and to follow all instructions directing changes in course and speed.

Patrol units and control towers may open fire, without giving advance notice, upon vessels which do not comply with the above regulations.

The vessel's ETA and the number of tons of cargo aboard must be sent to the harbormaster 24 hours before arrival at Da Nang. On arrival, vessels will be assigned an anchorage or alongside berth. No shifting of of berth is permitted without the permission of the harbormaster. The harbormaster must be advised of the time of sailing 24 hours in advance.

Tides and tidal currents.—Tidal heights at Da Nang *(16°05'N., 108°11'E.)*:—M.H.H.W. 4.1 feet; M.L.H.W. 3.5 feet; M.L.L.W. 2.1 feet; M.H.L.W. 3.2 feet.

During large tides the currents in the bay do not attain ½ knot. During small tides there is no flood current in the river at Da Nang.

Song Da Nang (Riviere de Tourane).—The river is navigable by small vessels with local knowledge to the coal mines at Nangson about 35 miles from the mouth. It is connected by inland waterways with Song Cau Dai (section 4C–12). The entrance of the river is marked by a lighted beacon, and several beacons and buoys are situated to mark the channel within the bar. The axis of the dredged channel is indicated by two pairs of range beacons and a lighted beacon, which is a common front beacon for each range.

4C–14 Da Nang (Tourane) is located on the west bank of the Song Da Nang, close within its mouth. Da Nang is the second most important port in the Republic of Vietnam. The chief imports are rice, cement, and petroleum products. The chief exports are cinamon, charcoal, and coal. The town has a population of about 150,000 (1964).

Berths.—Da Nang has about 2,300 feet of wharfage most of which is on the west side of the river.

The main commercial wharf (Vietnam Cong Hoa Muon Nam) is located on the west side of the river, close within the entrance. It has a length of about 850 feet with a MLW controlling depth of about 14¾ feet alongside.

A pontoon wharf with a berthing length of 210 feet and a reported depth of 19 feet alongside is located southward of the above quay.

A T-head oil pier with a berthing length of 40 feet and a depth of 25 feet alongside is located about 1/3 mile southward of the Customs Quay.

A T-head oil pier with a length of 250 feet and a depth of 15 feet alongside is located about ¼ mile southward of the above oil pier.

A graded (clay and stone) landing beach, 100 yards wide, for LST's is located nearly ½ mile east by northward of the south point of Observatory Island.

Six mobile cranes at 2-to 10-ton capacity are available. Lighters and tugs are available for handling cargo at the anchorages. There was a shortage of barges (1965), causing delay in cargo operations. There is a water boat of 30-ton capacity.

Substantial areas of covered storage are available close northward of the main commercial wharf. There is refrigerated storage of about 2,000 cubic feet. POL storage capacity totals about 2,800,000 imperial gallons.

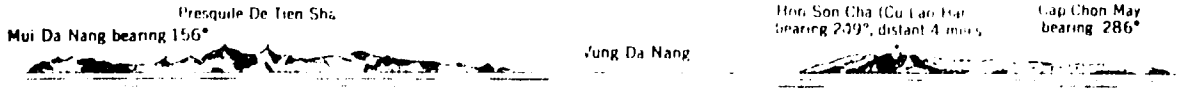
Supplies.—Water can be supplied in very limited quantities by water boat and should be treated. Fuel and diesel oil are available in limited quantities, about 2½ miles up the river at an oil pier. Coal in ample supply is available. Provisions, generally, are not available.

Repairs.—Only small repairs can be effected.

Communications.—Da Nang is connected to the general railroad and telegraph systems. A radio station is open to public correspondence. Steamers call regularly from Saigon, and Hue. Regular air service to Saigon is maintained.

Medical.—A civilian hospital with a capacity of 400 beds is available. There is also a military hospital with a capacity of 600 beds.

Deratization.—Deratization can be carried out, and Deratization and Deratization Exemption certificates are issued.



APPROACH TO VUNG DA NANG FROM NORTHEASTWARD

COAST NORTHWESTWARD OF CAP CHON MAY EST

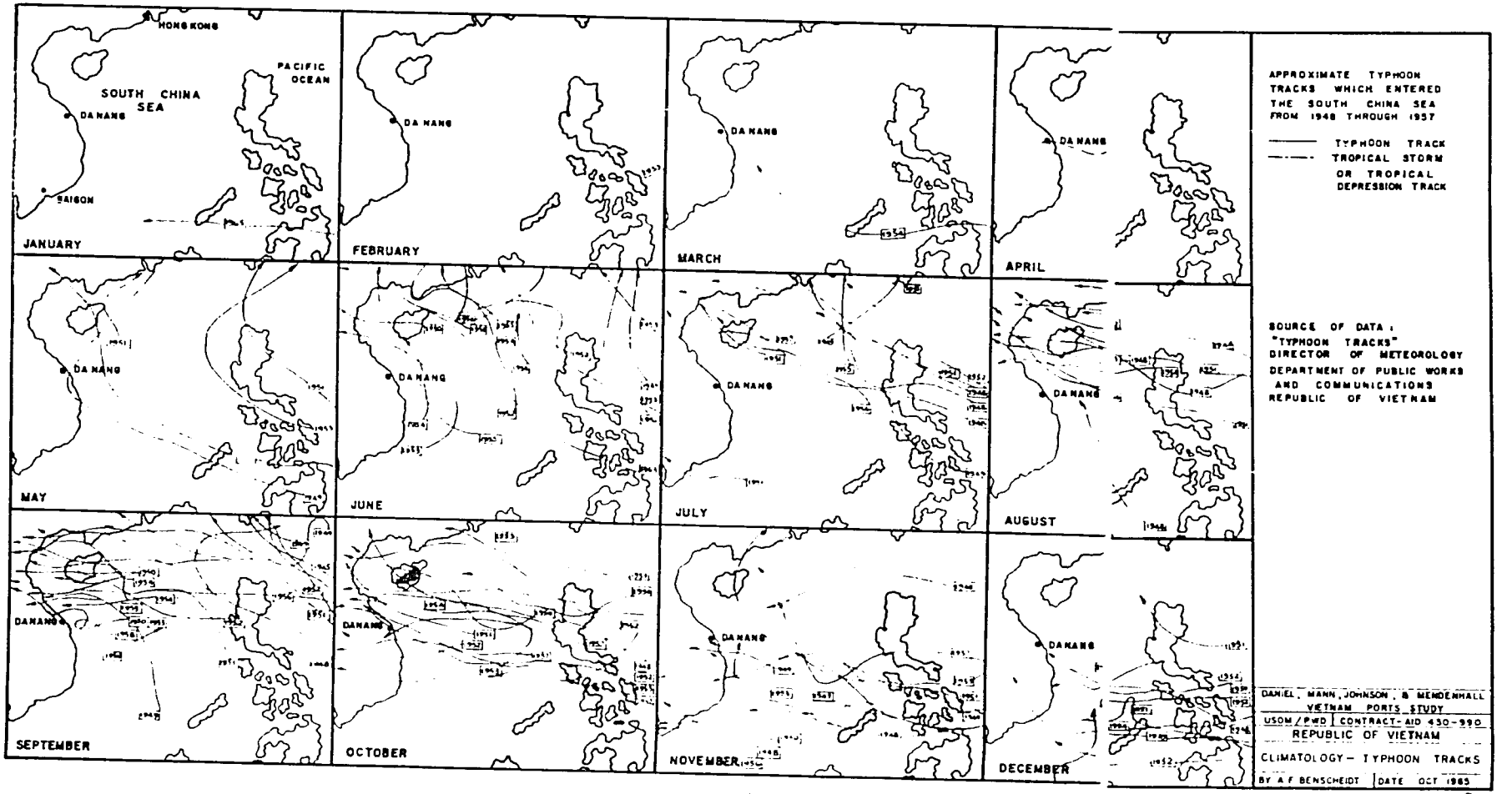
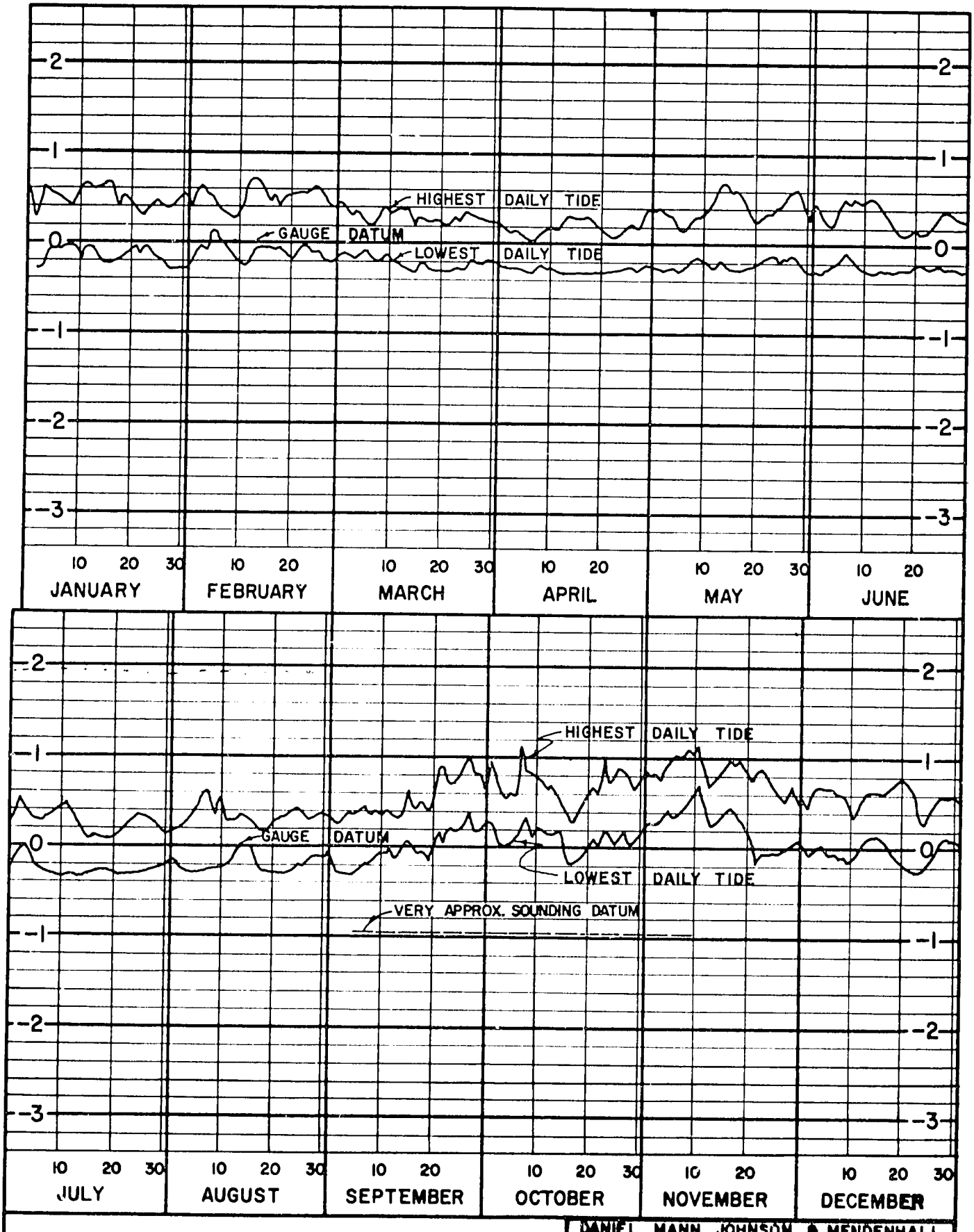


EXHIBIT 9



NOTE: ELEVATIONS IN METERS.

SOURCE: DIRECTORATE OF NAVIGATION.

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VIETNAM PORTS STUDY

USOM/PWD	CONTRACT - AID. 430-990

PORT OF DA NANG

1964 TIDE RECORD

BY: A. F. B.	DATE: NOV 1965

EXHIBIT #10

TABLE VII

Monthly Ave. Rainfall (Inches)

DA NANG: Latitude 16°02' N.
Longitude 108°11' E.
Elevation 6 Meters

Month	Average Monthly	Maximum Monthly	Maximum 24 hour
January	4.35	12.44	10.22
February	1.67	10.39	2.36
March	1.01	5.67	5.39
April	1.28	7.60	5.98
May	2.46	16.58	4.76
June	3.14	20.91	13.07
July	3.04	9.92	4.37
August	4.54	13.15	5.87
September	15.20	46.30	12.84
October	22.41	49.45	10.98
November	14.24	37.99	10.67
December	8.57	17.21	6.85
Annual	88.88		
Maximum		120.55	13.07

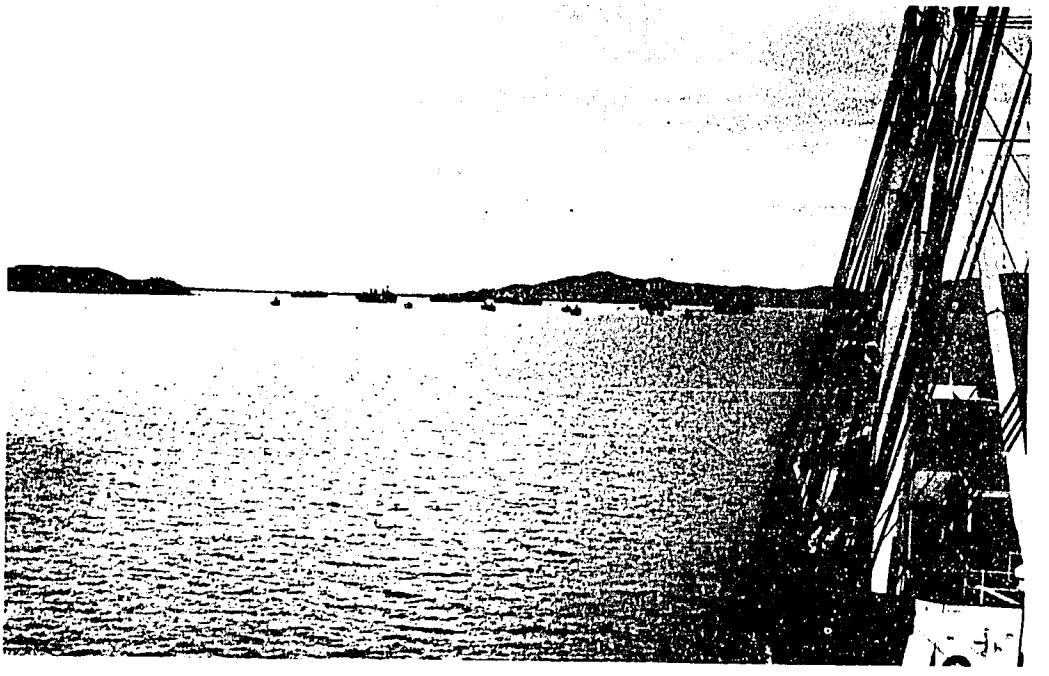


Figure 1. Entering Da Nang Harbor, June 1965.

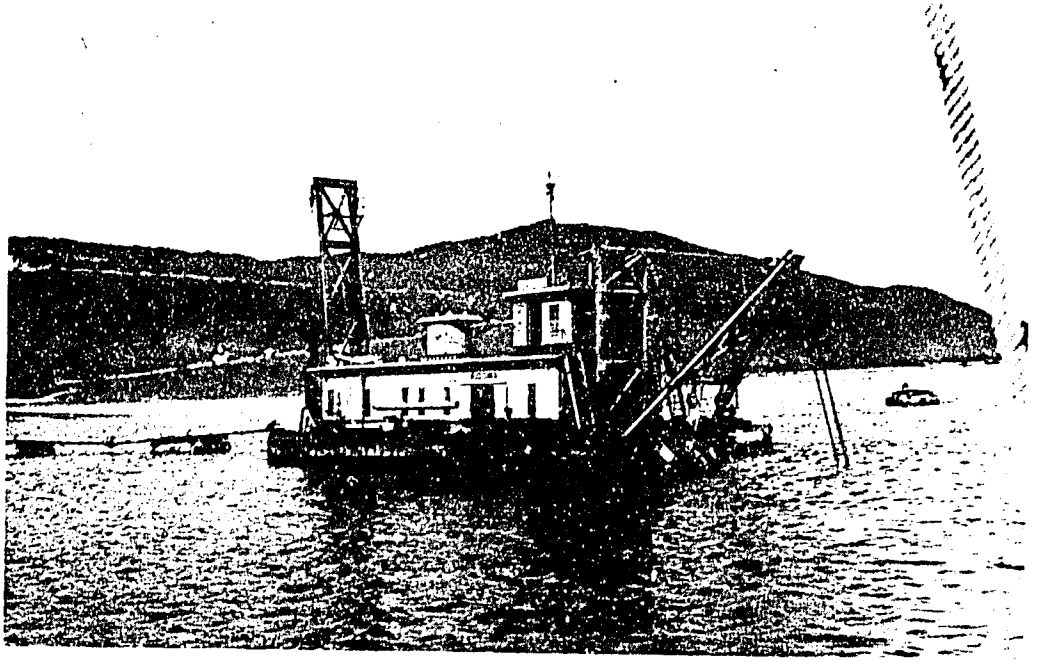


Figure 2. Dredge "Rach Gia" clearing channel.

Landside Access

Highway 1, as shown by Exhibit 11, bypasses Da Nang. For the most part, it runs across the coastal plains and is a fair road, but its use has been very much curtailed by Viet Cong activity. Mountain sections, such as on the route to Hue, are slow. Access to Da Nang is good, but the streets in Da Nang were not laid out with through highway traffic in mind. Several spans of the single bridge across the river were undermined by floods in November, 1964, whereupon several limited load temporary spans were installed to carry military traffic. One of these spans in turn was accidentally knocked out late in 1965. Plans for a new major bridge crossing to Tien Sha peninsula are an important consideration in port planning for Da Nang.

Railway access roughly parallels the highway, and contrary to most foreign charts and maps (including the January, 1966 H. O. 2520) the main line does not run through Da Nang. Since 1952, the main line has bypassed the city, as shown by Exhibit 11. Also, the spur that crossed the Da Nang River and continued out on Tien Sha peninsula has been abandoned, Figure 3.

Existing Improvements

Port facilities at Da Nang are principally those shown by Exhibit 12, and pictured on the frontispiece. Most facilities are located on the west bank of the river, on which the city is located. Figure 4 shows a coaster at a typical berth. Depth alongside is about 4 meters, and this can never be

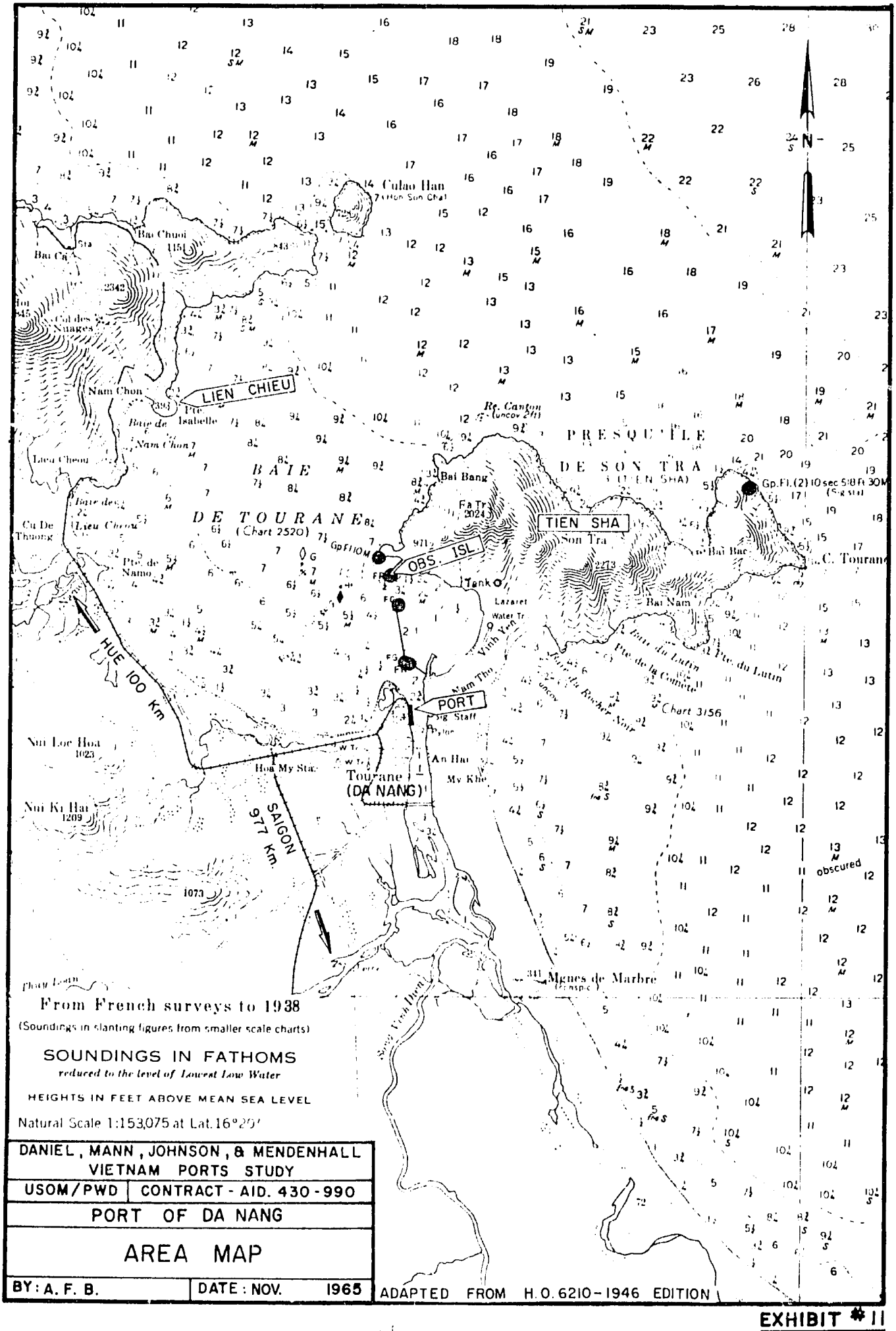
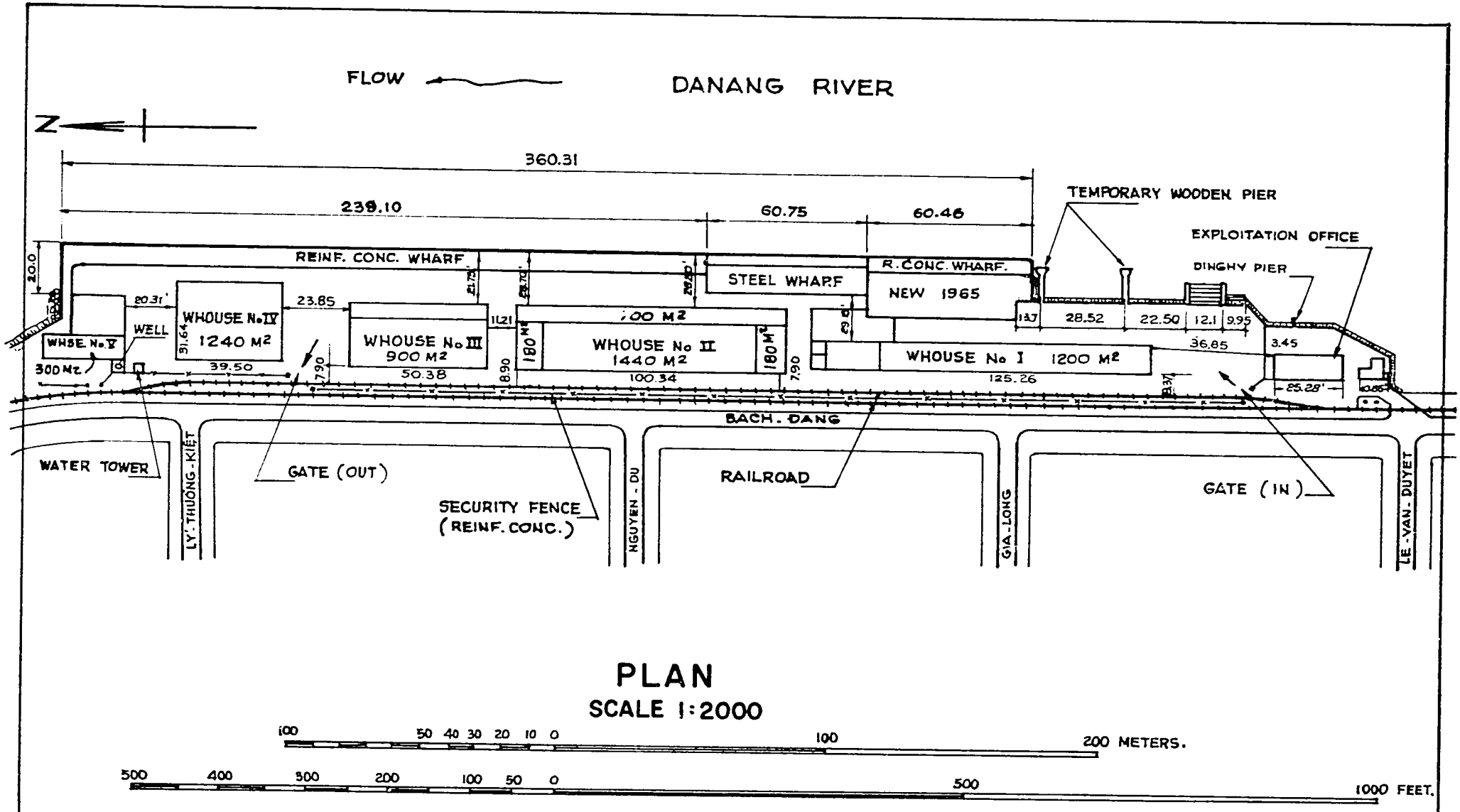

LIEN CHIEU
TIEN SHA
OBS. ISL
PORT
HUE 100 Km
SAIGON 977 Km.
Tourane (DA NANG)
BAIE DE TOURANE (Chart 2520)
PRESQU'ILE DE SON TRA (TIEN SHA)
Culao Han
Nam Chon
Bai Bang
Bai Nam
Bai Bac
C. Tourane
Nui Loc Hoa 1023
Nui Ki Hai 1209
Hon My Stac
An Hai
My Khe
Mgnes de Marbre
Chart 3156
obscured
From French surveys to 1938
(Soundings in slanting figures from smaller scale charts)
SOUNDINGS IN FATHOMS
reduced to the level of Lowest Low Water
HEIGHTS IN FEET ABOVE MEAN SEA LEVEL
Natural Scale 1:153,075 at Lat. 16°20'
DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM/PWD
CONTRACT - AID. 430 - 990
PORT OF DA NANG
AREA MAP
BY: A. F. B.
DATE: NOV. 1965
ADAPTED FROM H.O. 6210 - 1946 EDITION

EXHIBIT # 11



PLAN

SCALE 1:2000

100 50 40 30 20 10 0 100 200 METERS.

500 400 300 200 100 50 0 500 1000 FEET.

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PORT OF DA NANG	
EXISTING COASTER PORT	
BY: J. LUTTMAN-JOHNSON	DATE: APRIL, 1966

EXHIBIT # 12

EXHIBIT # 12

significantly increased because of the construction of the wharves. The lowest tide is about 0.5 meters above the sounding datum.

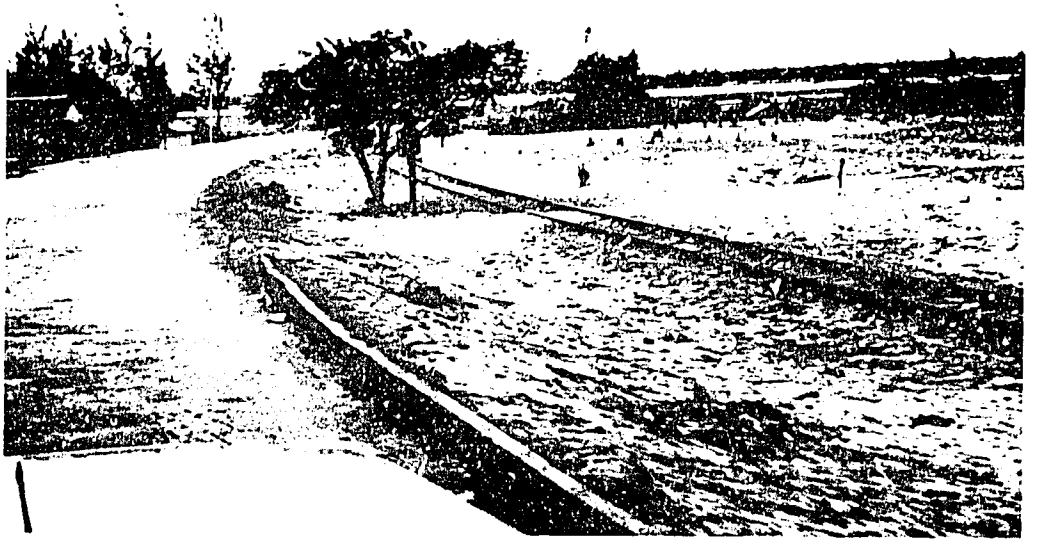


Figure 3. Tien Sha road and abandoned R. R.

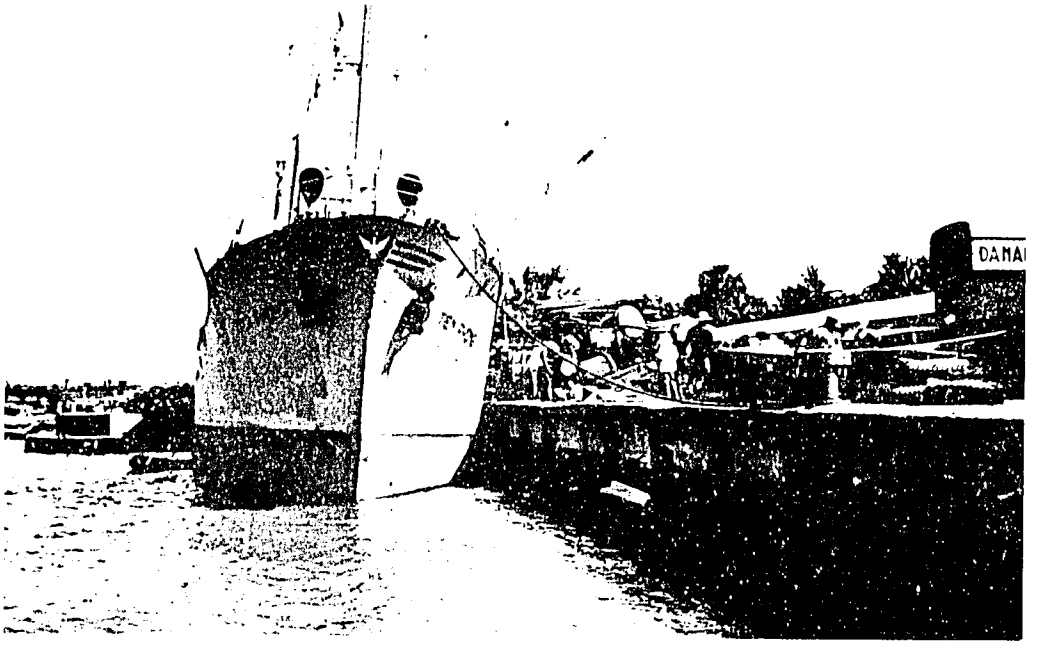


Figure 4. Coaster at berth. July, 1965.

Wharf construction on the new upstream "60.66" meter section (Exhibit 12) is shown by Figures 5 to 7 inclusive.

Construction consisted of three concrete piles per bent, capped with a substantial girder, beam and slab construction about 0.4 meters below grade, as shown by Figure 5. No batter piles, tie backs, or other horizontal restraint was built into this structure, other than the limited resistance of the piles to bending. Precast concrete sheet piles, Figure 6, were then driven along the landward side of the wharf, as shown by Figure 7. No particular care was used to close the joints in the sheet piles, however coarse stone was used for initial backfill, with upper layers graded to fine. If properly done, no fill should be lost. The whole was then brought up to grade and paved. Large horizontal pressures will be generated by this system. Unfortunately, the original retaining wall (Figure 5) was sloped. Under the new fill dead weight and load, the underlying muck will consolidate, and the resulting wedging action will further increase the horizontal loads on the outboard concrete structure. There were reports that some of the earlier construction had showed signs of distress.

Layout of the existing facilities apparently was not made with trucks in mind. Because of limited apron width, and the railroad track and solid wall back of the transit sheds, traffic during regular working hours is routed on a one-way basis between in and out gates over a third of a kilometer apart. Vietnamese practice allows the inherently efficient practice of permitting

Port of Da Nang
Wharf Construction

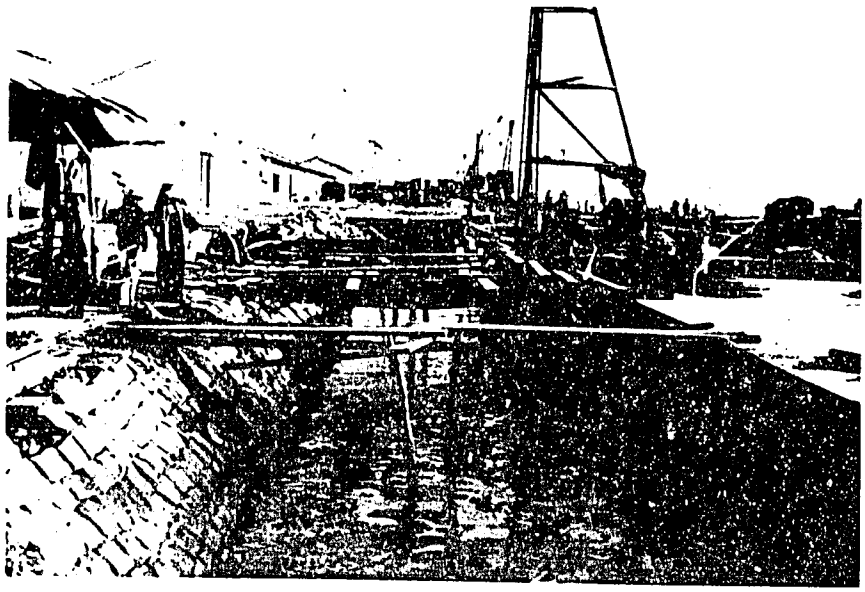


Figure 5.

Freestanding deck completed.

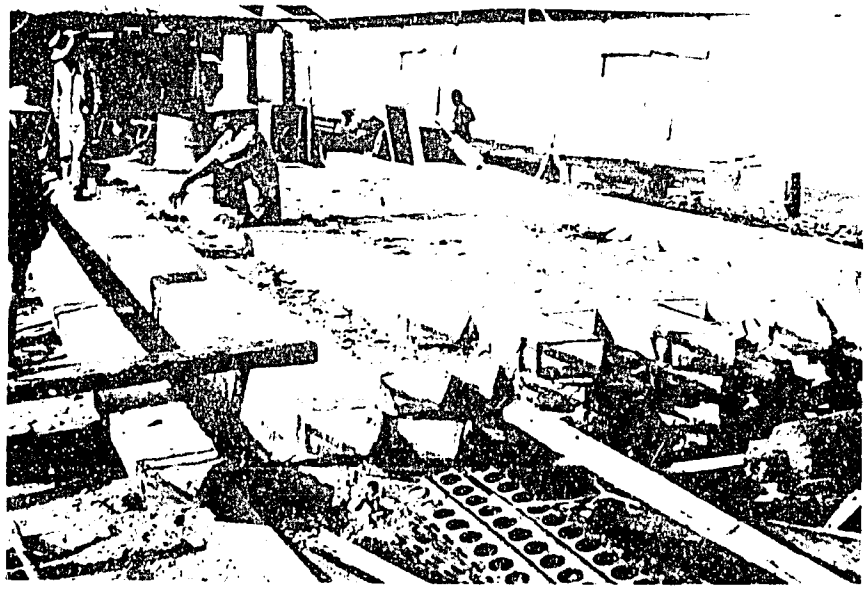


Figure 6.

Casting of concrete sheet piles.

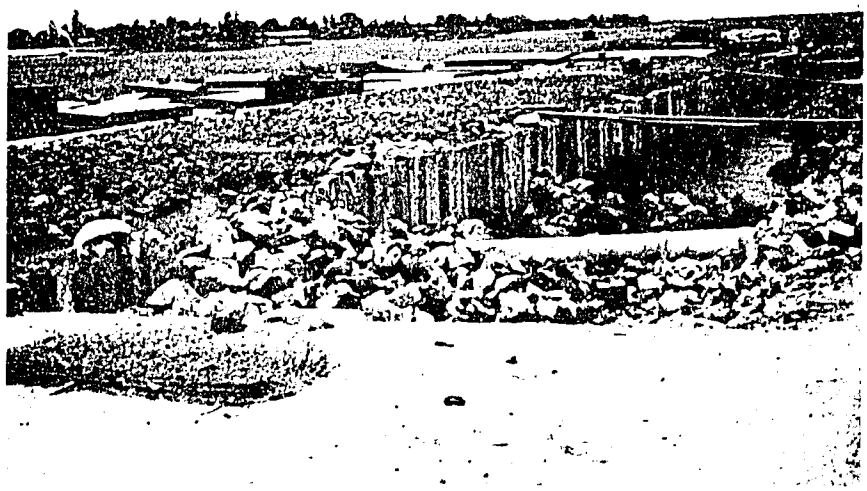


Figure 7.

Sheet pile wall and rock backfill.

trucks to take cargo under the hook, when that is practicable. When any cargo is permitted to rest on the apron, clearing the hook by truck becomes seriously impeded. Trucks working the landward side of the transit sheds also must work in an "alley" between the sheds and the track. The layout is not good for modern landside traffic, but undoubtedly grew up over a period of years.

Greater activity on the railroad would also bring problems because there is no crossover in the 400 meter siding.

Transit sheds, Figures 8 and 9, are typically long narrow buildings with little light, interior columns, and often a sill at the infrequent doors. Wall construction is usually of clay block, but sometimes corrugated metal is used. The varied transit sheds again show the sporadic development of the port.

Port Equipment

(1) Tugs

(a) 1 each 250 h.p. Diesel Tug (Vitabo)
(b) 1 each 250 h.p. Diesel Tug (Port of Da Nang)
(c) 1 each 150 h.p. Diesel Tug (Sovita)
(d) 1 each 125 h.p. Diesel Tug (Port of Da Nang)

(2) Lighterage (SOVITA and VITABO)

(a) 17 each 150 Ton Hatch Type Barges
(b) 1 each 180 Ton Flat Top Barge
(c) 1 each 100 Ton Hatch Type Barge
(d) 1 each 50 Ton Hatch Type Barge
(e) 5 miscellaneous barges

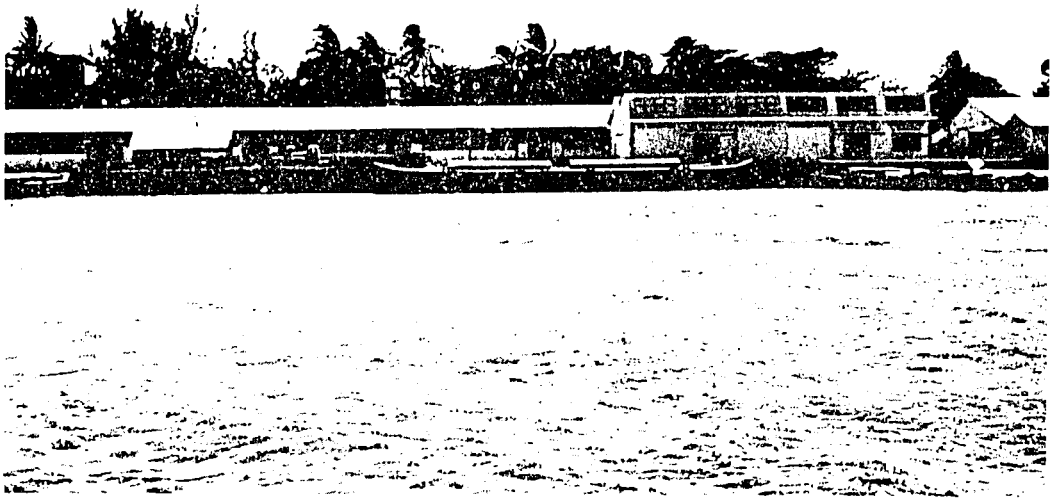


Figure 8. Transit sheds. (Warehouse # 1)

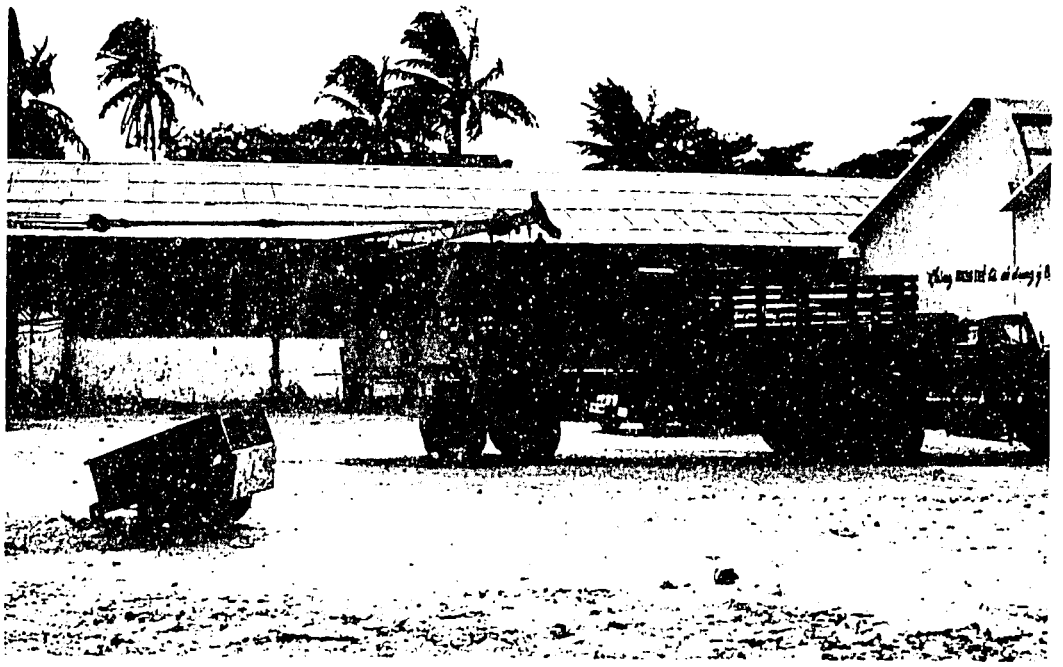


Figure 9. Detail. Site of planned prefabricated warehouse.

(3) Cranes

(a) ARVN 10th Terminal Service Company:

(1) 2 each 5 ton crawler mounted
(2) 1 each 20 ton truck mounted
(3) 1 each 10 ton truck mounted

(b) Port of Da Nang

(1) 2 quick way 3 1/2 ton
(2) 1 Bay City 5 ton
(3) 1 American 5 ton

(4) Dredging - Port of Da Nang

(a) 1 steam, barge mounted, clamshell 1500 Cu. meter/day (Old)
(b) 2 bottom dump barges
(c) 1 pontoon barge 10 x 20 m.

(5) The above might be considered a normal complement of equipment. Undoubtedly additional equipment has been provided in recent months.

IV. EXISTING PORT ADMINISTRATION

Da Nang, as one of Viet-Nam's two autonomous ports, is "an autonomous agency having the characteristics of a public enterprise." The significance of autonomy is further described in the Basic Information Volume.

Management

The Port of Da Nang operates under a decree of August 22, 1960, whereby a Port Commission of 11 members was designated as follows:

Minister of Public Works	President
Mayor of Da Nang	Vice President
One Delegate, Shipmasters (Maritime)	Member
One Delegate, Shipmasters	Member
One Delegate, Agricultural Branch	Member
One Delegate, Industrial Branch	Member
Two Delegates, Commercial Branch (Import & Export)	Members
One Delegate, Personnel of the Port	Member
One Delegate, the Finance Service	Member
One Secretary General of Public Works Ministry	Member

Appointments of members, public and private, were made, but the extent to which they actually participated in management of the Port is not known.

Commission members serve without salary or allowance. Except for the specified Director and delegate of port personnel, no port employees or contractor personnel may be Commission members. The Commission establishes the general port organization, salary schedules, contract and lease forms, and must authorize equipment and construction items between one and five million piastres. Over that amount, the President must approve.

Director of the Port is appointed by decree of the President of the Republic upon recommendation of the Commission and the Minister of Public Works and Communications.

Since September of 1965, the authority and responsibility of the Director of the Port has been expanded to give him stronger control over the Port operation under a "single manager" concept promulgated by the Ministry of Public Works and Communications.

The Port of Da Nang Has three departments:

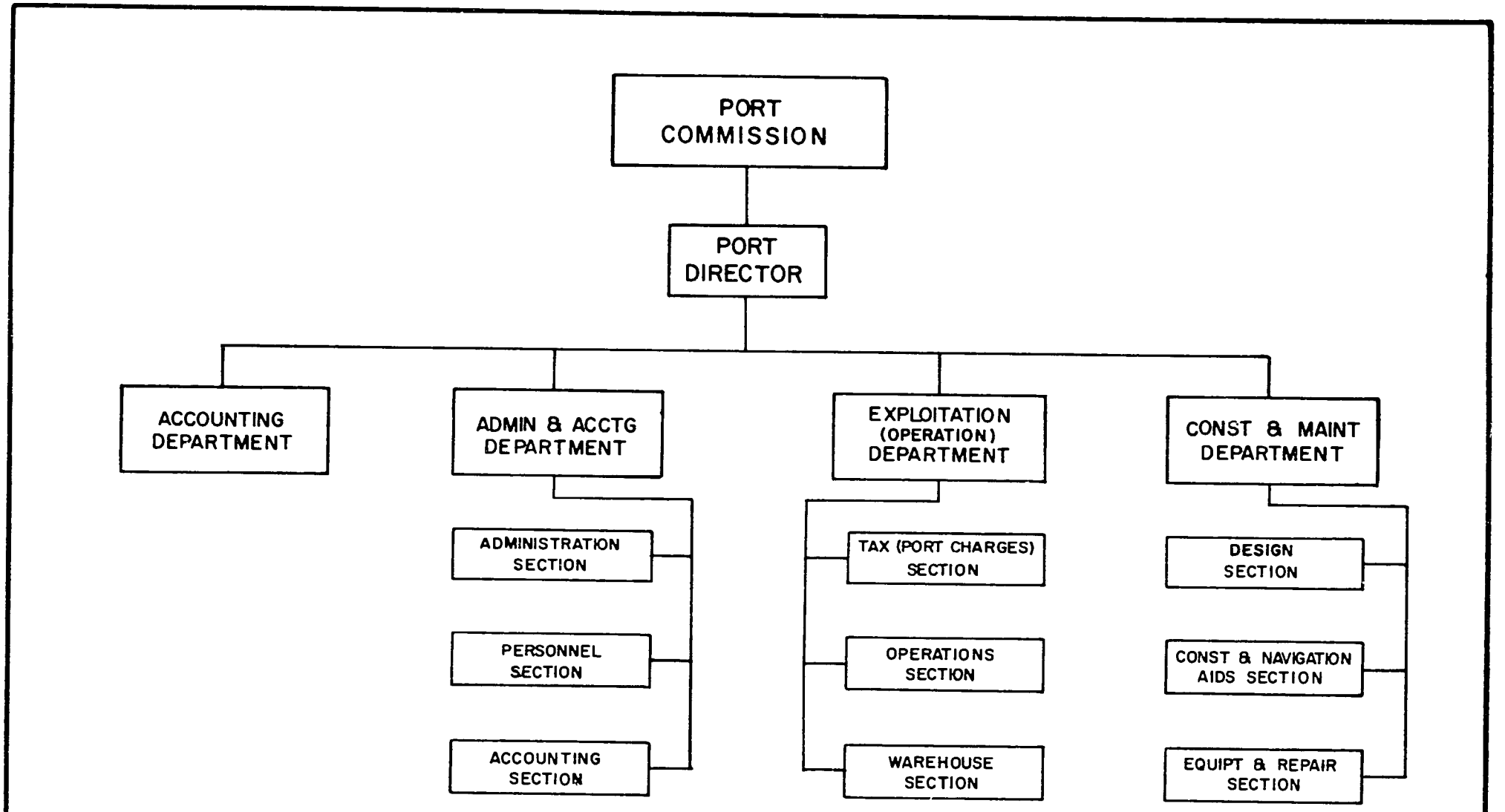
1. Works Department
2. Exploitation Department (Operations)
3. Administration and Accounting Department

Operations

Exhibit 13 shows the organization of the Port of Da Nang, which would be classed as a "non-operating" port in that stevedoring and actual terminal operations are left to others. The Port does have a man qualified as pilot.

Finances

Table VIII summarizes the Port's finances. Detailed data on the port finances was refused on the grounds that it is considered confidential.



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PORT OF DA NANG	
ORGANIZATION CHART	
BY:	DATE:

EXHIBIT * 13

TABLE VIII

PORT OF DA NANG

PORT RECEIPTS AND EXPENDITURES

1960-1964

Tabulation of Receipts from Da Nang Port

Year	Receipt	Expenditure
1960	VN$22,679,439.92	VN$21,789,534.94
1961	19,213,033.69	18,075,100.21
1962	23,735,249.17	20,148,229.63
1963	30,947,624.48	22,906,143.39
1964	37,604,446.08	21,342,991.51

Source: Port of Da Nang

Tariffs

Tariffs established by decree of 1957 were tripled and quadrupled to the following fees by the Decision of May 19, 1965:

Article 1 - Tax for renting warehouse, platform and wharf (quay) .....

Within the perimeter of the sea-port:

a) Merchandise Category A - Cereal, salted fish, salt, sugar, oil, cement, wood, steel, sheet metal, barbed wire, coal, tar, empty cases, empty bottles.

Time	Warehouse	Platform	Unit
From 1 - 2 days	VN$ 2	VN$ 1	One day &
3 - 4	4	2	One Unit
5 - 6	8	4	(ton or M^3)
7 - 10	12	6	
11 - 15	20	10	
16 - 30	40	20	
31 - 70	80	40	
Over 71	150	75	

b) Merchandise Category B - All other merchandise - Tax is to be double the preceding.

Article 2 - Outside of the perimeter of the Port.

2$00 each unit for category A within a period not over 3 days.
4$00 each unit for category B within a period not over 3 days.

It is not allowed to leave the merchandise on the platform along the river any longer than 3 days. Over 3 days, from the fourth day, there will be applied the preceding tax for the merchandise stacked on the platform of the Port.

Article 3 -

The number of days counted for renting warehouse, platform and wharf begins when the merchandise is completely put into the warehouse or on the platform and wharf. Part of a day is counted as a day. Part of a unit (ton or cubic meters) is counted as a unit. Merchandise imported directly from a foreign country shall have to pay the warehouse and platform tax from the third day only.

Other tariff fees apparently remain unchanged from various 1954 and later decrees, and principal items include:

1. Entrance fees, per net registered ton:

	VN$
Anchoring within Port limits, or alongside private dock	.75
Mooring	1.25
Alongside dock	2.00

2. Administrative fees, commodities imported within Port limits (pass issue VN$ 12, discharge VN$ 15, city budget VN$ 6, Ch. of Comm. VN$ 1, commodities receipts VN$ 10, etc.) total VN$ 63 for most commodities. Foreign military VN$ 25.

3. Same, outside Port limits VN$ 36

4. Same, exported within Port limits VN$ 37

5. Same, exported outside Port limits VN$ 30

6. Stationing (dockage) fees, per day, VN$:

Days	Alongside dock		Anchoring	
	Over 3000 NRT	Under 3000 NRT	River	Da Nang Bay
1 - 4	750	488	375	250
5 - 8	1,125	750	562	400
9 - 15	1,875	1,875	750	600
16, over	3,750	2,625	1,125	900

Barges or junks, loaded or not, any size:

Alongside dock		At buoy	
1 - 4 days	100/day	1 - 4 days	75/day
5, over	200/day	5, over	150/day

7. Warehousing as modified above.

8. Water supply - VN$ 35/Cu. M.

V. PRESENT OPERATIONS

Waterborne Cargo Systems

Cargo arrives at or departs from Da Nang by three main classes of carriers, viz., deep draft ocean-going vessels, coastal freighters drawing 3 to 5 meters, and junks or barges. Each of these handles cargo in a different manner which is discussed below:

Ocean-going vessels serving Da Nang must anchor in the harbor for cargo operations because there is not sufficient depth for them inside the river mouth. Cargo is transferred to junks, barges or military landing craft shown by Figures 10 and 11. Expensive special purpose equipment as shown in Figure 12 is pressed into service. The lighters shown by Figure 13, of which there are about 25, are the lighterage mainstay. Lighters then travel to wharves or other service areas for further handling. This costly multiple handling of the cargo is an additional expense which will help to justify port improvements.

Coastal freight ships having cargo pickups or deliveries at Da Nang can be berthed at the Port wharves if there is space available. Under present conditions, all berths are frequently occupied by other freight ships, barges, lighters or junks. If the coastal freight vessel cannot obtain a berth at the wharf, it must, as ocean-going vessels, either wait its turn or unload by lighter.

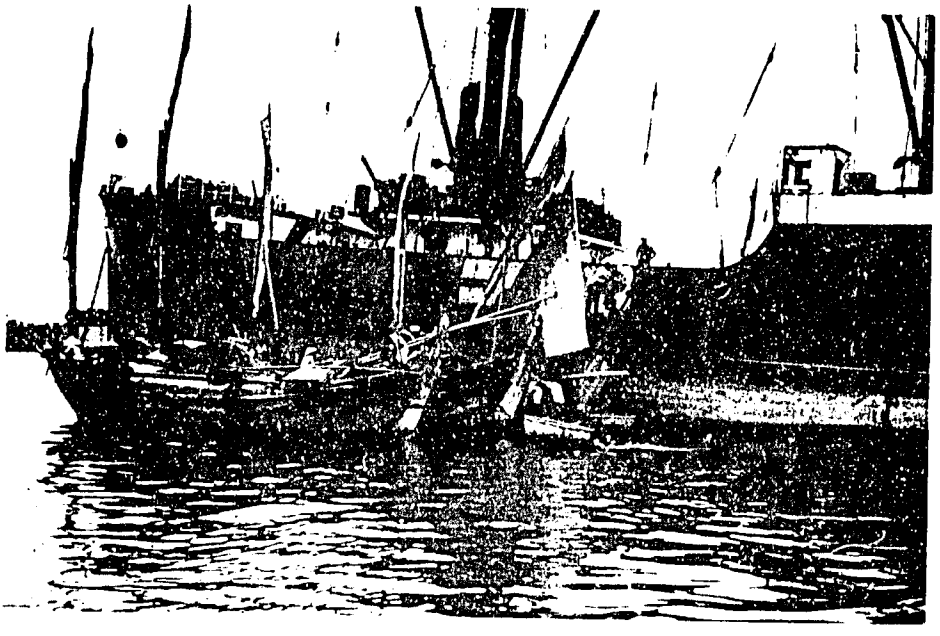


Figure 10. Lighterage by junks.

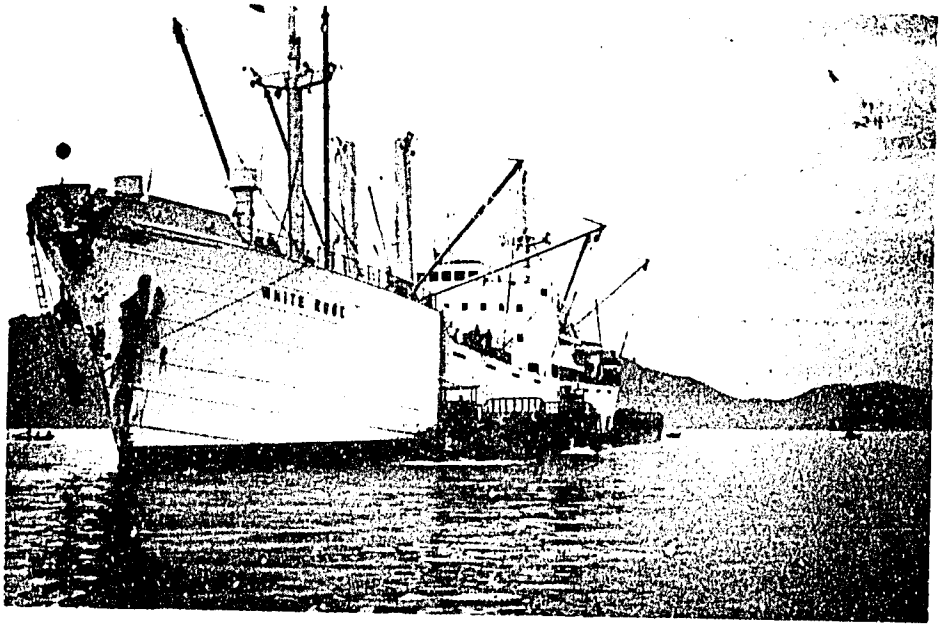


Figure 11. Lighterage by military landing craft.

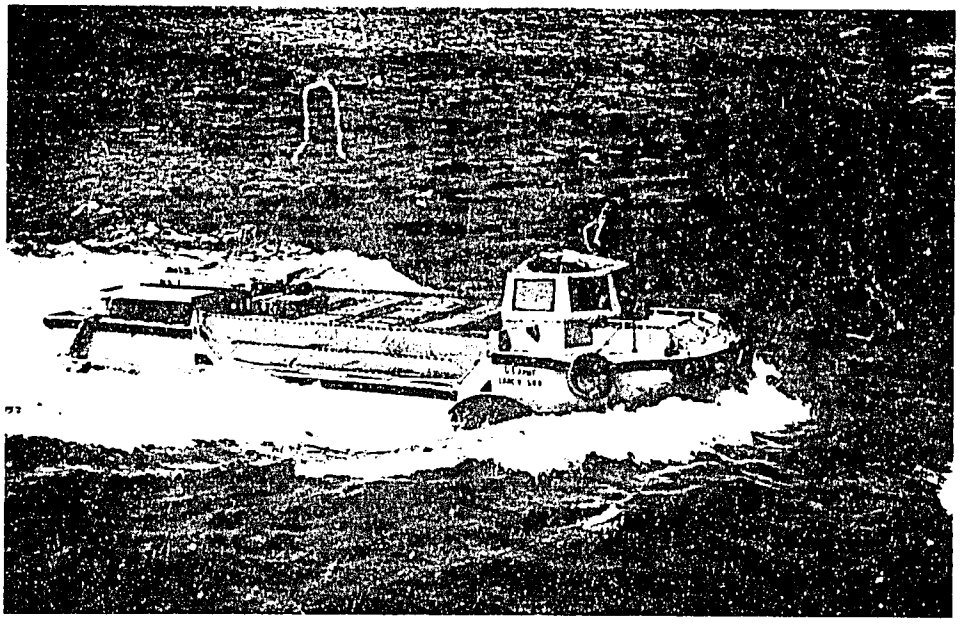


Figure 12. Amphibious craft as cargo lighter.

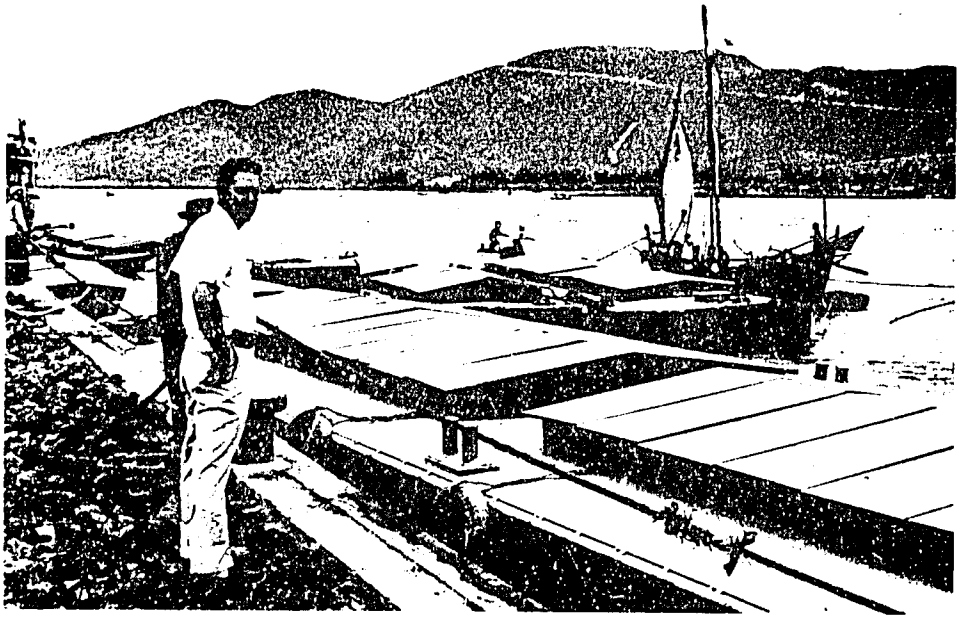


Figure 13. Da Nang harbor lighters being misused. July, 1965.

Junks to or from which cargo is to be handled also have their operation fraught by congestion. Due partially to lack of control, junks are often berthed 5 abreast adjacent to the wharf for dispatch or reception of cargo loads. The outboard junks cargo must be carried across the intervening four or more junks to its reception point. Such junk congestion also takes wharf space that might be more efficiently utilized. Given sufficient room, the junk can be beautifully handled under sail (Figure 14), but in close quarters such as shown by Figure 15, it is at a disadvantage and in the way of other equipment.

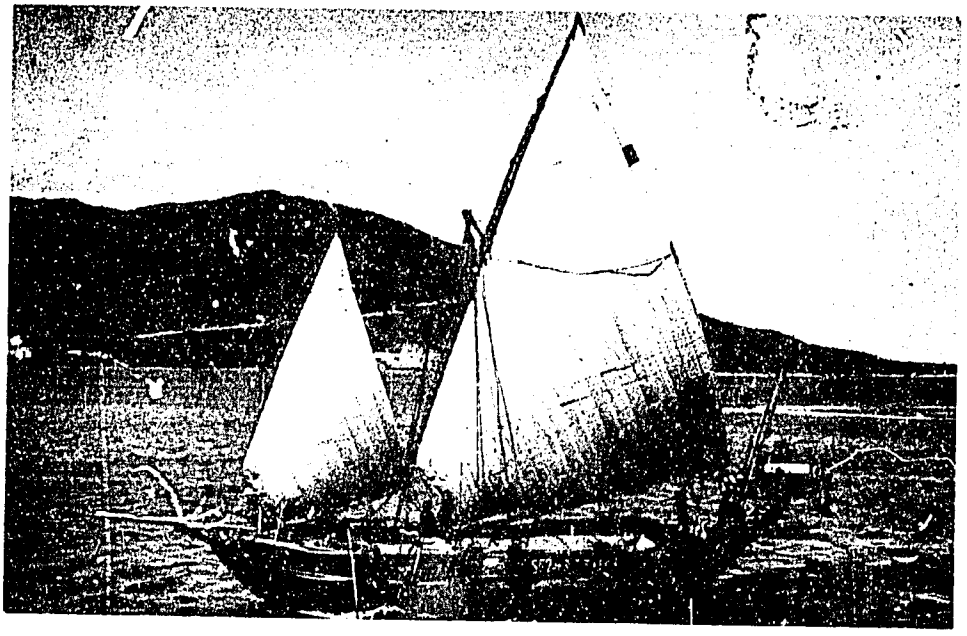


Figure 14. Junk in its element.

Figure 15.

Junk congestion
at Da Nang wharf.

Stevedoring

This function is performed by two major local concerns, plus Vietnamese and American military units.

Vietnamese methods take advantage of the fact that local longshoremen are strong, willing, and perform much work for the money paid them. Thus, Figure 16 is a common type of operation, often as not with women performing as well as men. Sometimes, as shown by Figure 17, equipment is brought into the act. A light crane can save much time when the slings are left on the lift, from the anchorage to the wharf, but too often the slings do not come back.

Figure 16. Standard stevedoring procedure - Da Nang.

Figure 17.

Beginning mechanization.

Military methods, particularly U. S., involve the use of high-cost-of-living men, so labor saving becomes necessary if not habitual. Such a lighterage operation takes on the form of Figures 12 and 18; in the latter case, apparently there was lack of coordination with a crane or a truck to move the cement on its way. It can be said in favor of the Vietnamese method that only three elements are needed - the lighter, the longshoremen, and the truck. It is also true at Da Nang, as in Saigon, that the truck operator, in furthering his own interests, often sabotages rapid cargo handling.

Figure 18. Military type cargo handling.

VI. PORT RELATED AGENCIES AND FUNCTIONS

Pilots to assist arriving or departing ships up the river at Da Nang are mandatory for vessels over 100 tons. The Port wharfinger serves also as a pilot.

Security Police maintain surveillance of cargo handling operations to prevent pilferage and acts of sabotage. These offices also inspect the credentials of all persons entering the Port of Da Nang secure area.

Customs Department. Chief Tong Phuoc Dai supervises 60 officers from his office on Doc Lap Street in Da Nang. This staff is required to exercise customs authority over the area from Quang Tri to Qui Nhon. The Da Nang Subdivision consists of one half or 30 of these officers. Customs receipts for Da Nang in 1964 totalled 5,000,000,000 $VN.

Shipyards and marine railways for the construction or repair of barges and boats are operated by S.O.V.I.T.A. The capacity or ability of this operation was observed to be adequate for the fabrication and launching of a 200 ton steel barge. (Figure 19). A small boat yard on the peninsula is capable of building junks to 20 ton capacity. There is said to be a very small dry dock. The site of one small marine railway at the upriver edge of Da Nang when last noted was being modified as an LST landing.

Inland Waterways Service of the Directorate of Navigation has had the responsibility of keeping open the 4 kilometer channel to the wharves.

This channel silted to less than three meters depth in the November, 1964 flood. The operations of this branch of the Ministry of Public Works and Communications are described in the report, "Dredging Program". Figure 2 shows the 12" suction dredge Rach Gia at work in the channel.

Maintenance dredging in the 5 years from 1959-1964 averaged about 75,000 cubic meters done with the Port clamshell and bottom dump barges. Due to the November, 1964 flood and the traffic demands for a better channel, the 1965 dredging approximated 300,000 cubic meters, done with pipe line dredges.

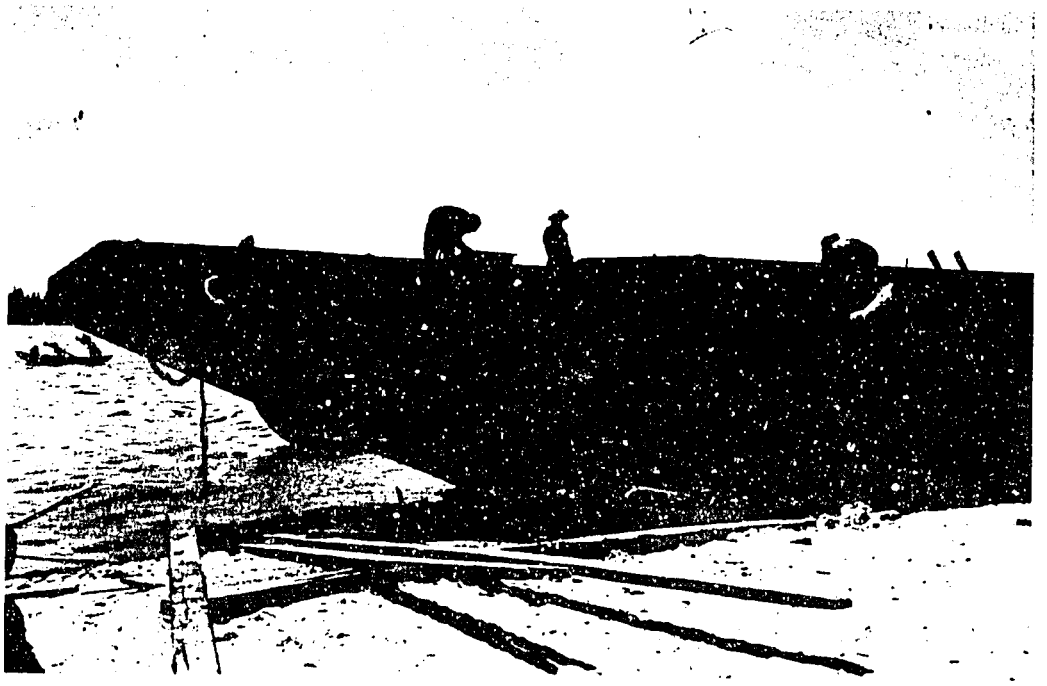


Figure 19. Steel barge fabrication "shipyard".

During part of 1965, the 12" Hoa Lan was engaged in 200,000 cubic meters of dredging for the new lighterage landing being built by the U. S. Naval Construction Regiment near the Da Nang River bridge.

Because the Directorate of Navigation personnel are frozen in limited civil service salaries, it became necessary to transfer the two dredges to the Port of Da Nang. As an autonomous agency, the Port could meet the high cost of living at Da Nang with salary increases.

Unions are apparently quite well established in Da Nang. The Confederation of Labor Unions President is Mr. Ly. The Confederation has about 28,000 workers in the Da Nang area.

Road stead workers, 360 members, is headed by Mr. Cang, and makes up 15 gangs of 24 men each for work at the outside anchorages. This means a maximum of about three vessels can be worked at one time, however the bottleneck is not often at the anchorages.

Dock workers, numbering 1200, are lead by Mr. Vi. They are made up of the several groups headed by an "elected" cai. The cai receives a little more pay than the workers.

The union leadership appears to be progressive and interested in seeing the job done, even to the point of organizing night shifts, but the members have minds of their own and are said to become unhappy when their production rate and pay is cut by poor coordination and lack of "assisting" equipment. The ship agents are often "in the middle", and dispute the availability of adequate labor. Communications failures leading to misunderstandings are at the root of many problems on the waterfront.

Stevedores are principally VITABO and SOVITA. STIC operates a fork lift rental agency.

Military cargo handling battalions one and two have been expensive but the saving feature so far as military cargo is concerned.

VITABO owns 11 lighters from 40 to 180 D. W. T., total 1500 D. W. T. Also one tug.

SOVITA owns 12 170 D. W. T. lighters, total 2040 D. W. T., and 2 tugs 150 and 180 hp. In addition, SOVITA built in 1965, at least one 150 ton lighter (Figure 21) size 5. 5 x 30 meters, depth 2. 5 meters, loaded draft 2. 0 meters.

Agents at Da Nang include Dennis Freres, represented by Mr. Fang, SOVITA, and VITABO; the latter two are also owners and operators of lighters. There are a number of purely shipping agents.

Petroleum Facilities are provided by the companies doing business in Viet-Nam. Thus, both Esso and Shell have substantial plants at Da Nang.

Shell storage facilities are shown by Figure 20. A small pier on the Da Nang side of the river, a short distance below the bridge, carries two 6" product lines. Storage capacity is about 80,000 barrels. Shell has been considering an offshore pipeline, possibly in Rocher Noir Bay.

Esso facilities are located at Lien Chieu (Exhibit 4). Esso uses two 6" offshore pipelines to receive bulk POL from tankers up to 7 meter draft. Storage capacity is about 93,000 barrels. (See Figures 32 and 33).

Military forces have established significant POL facilities, and some thought has been given to offshore pipelines.

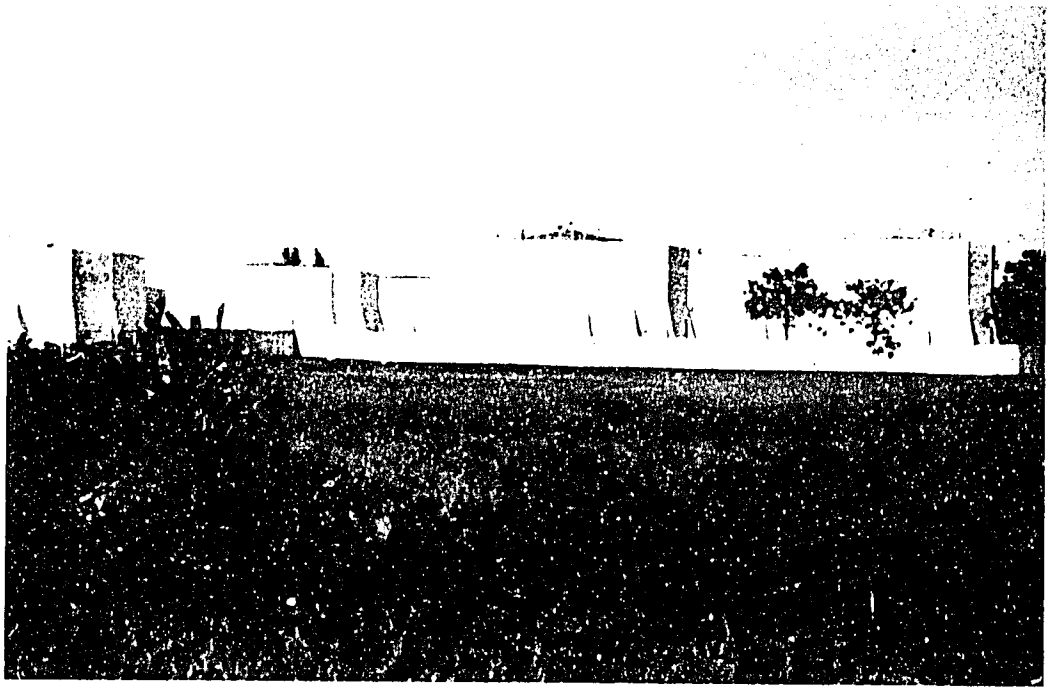


Figure 20. Splinter protected Shell tanks, Da Nang.

VII. OPERATIONS IMPROVEMENT

Lighterage

Vessels unloading at the deep water anchorage was the primary bottleneck in the Port of Da Nang during 1965. This required that a series of events be synchronized; the slowest link determines the speed of the hook. In the chain there is the hatch gang, the hook, the lighter crew (assuming that the lighter is there), the lighter gang at the wharf, the stevedores, and finally the truck. More often than any other element, the truck was not there.

The truck, unlike in the United States, is permitted in Viet-Nam to take cargo directly from the hook. This is inherently efficient; if the cargo must be dropped on wharf, another handling, and the condition shown in Figure 20, is the result. Lack of interest on the part of the trucker often results from a consignee who engages him for the lowest price per ton. Knowing that he can only lose by having a truck waiting for the cargo to arrive, he sees to it that the cargo is waiting for him when he arrives.

Stevedoring. An occasional and sometimes almost chronic lack of enterprise on the part of stevedores was also a factor during the first half of 1965. Methods in vogue (Figure 16) were wasteful of manpower, but from all accounts there was much more available. Yet, the lighters accumulated (Figure 13). These basic considerations lead to high level GVN conferences

that resulted in a stronger port organization at Da Nang, with more authority to make the cargo move. Figures 21 and 22 illustrate the impressive difference. While a clean apron does not in itself move cargo, it at least permits the moving of cargo.

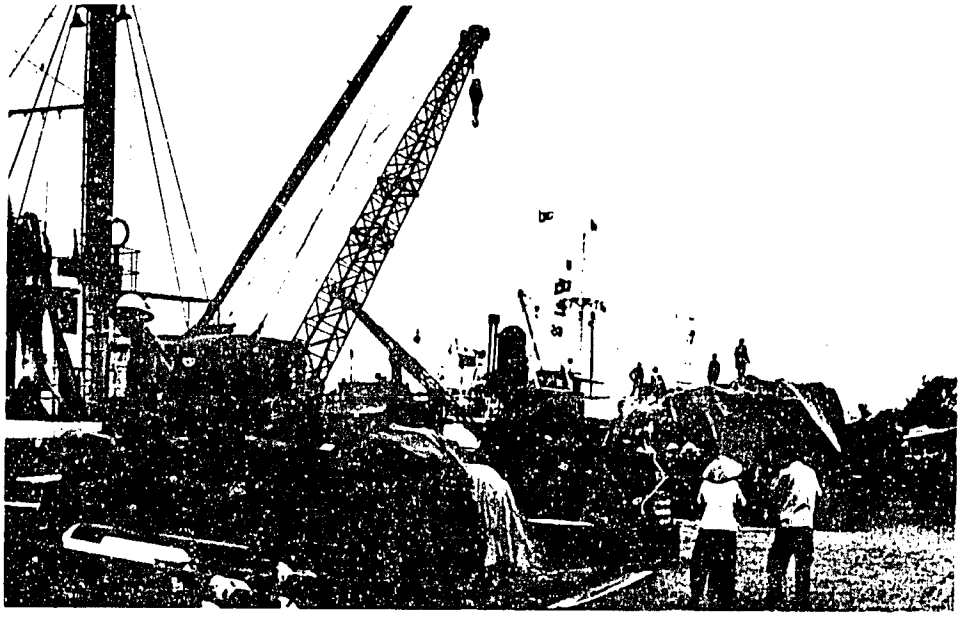


Figure 21. Before. Storage on apron. June, 1965.

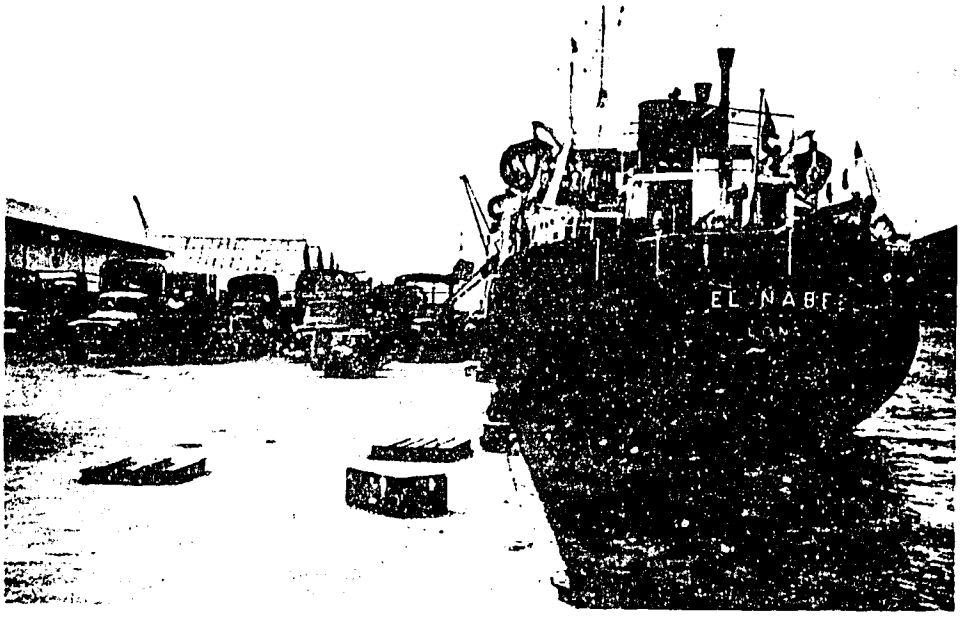


Figure 22. After. Trucks get at the cargo. August, 1965.

Enlarged facilities had been the subject of much military attention since early in 1965. Accordingly, a dredge filled sheet pile bulkheaded area has been established on the Da Nang River immediately below the bridge so that military landing craft and barges may be offloaded without adding to the traffic congestion and nuisance through the city.

The Port completed a new wharf, above described, about July, 1965.

Coordination of effort, by the Port Director, involved several elements; including establishment of liaison with ships' agents to permit better cargo planning. Enforcement of demurrage stimulated ships and cargo movement. Barriers to 24 hour operations such as the curfew were examined as to necessity.

Additional lighters were to be acquired, and the Port of Saigon was directed, around July, to send 10 lighters to Da Nang. There appeared considerable question of the need for more lighters, when all that was needed was to unload the ones already at Da Nang.

Mechanization discussion requires first definition of whether Vietnamese or U.S. Military operations are under consideration. As long as Vietnamese longshoremen need work, and will perform as economically and collectively as fast as machinery, it is folly to replace them with expensive machinery built by a machinist in Los Angeles. If labor needs an assist, or becomes comparatively expensive, elimination of some of the more burdensome

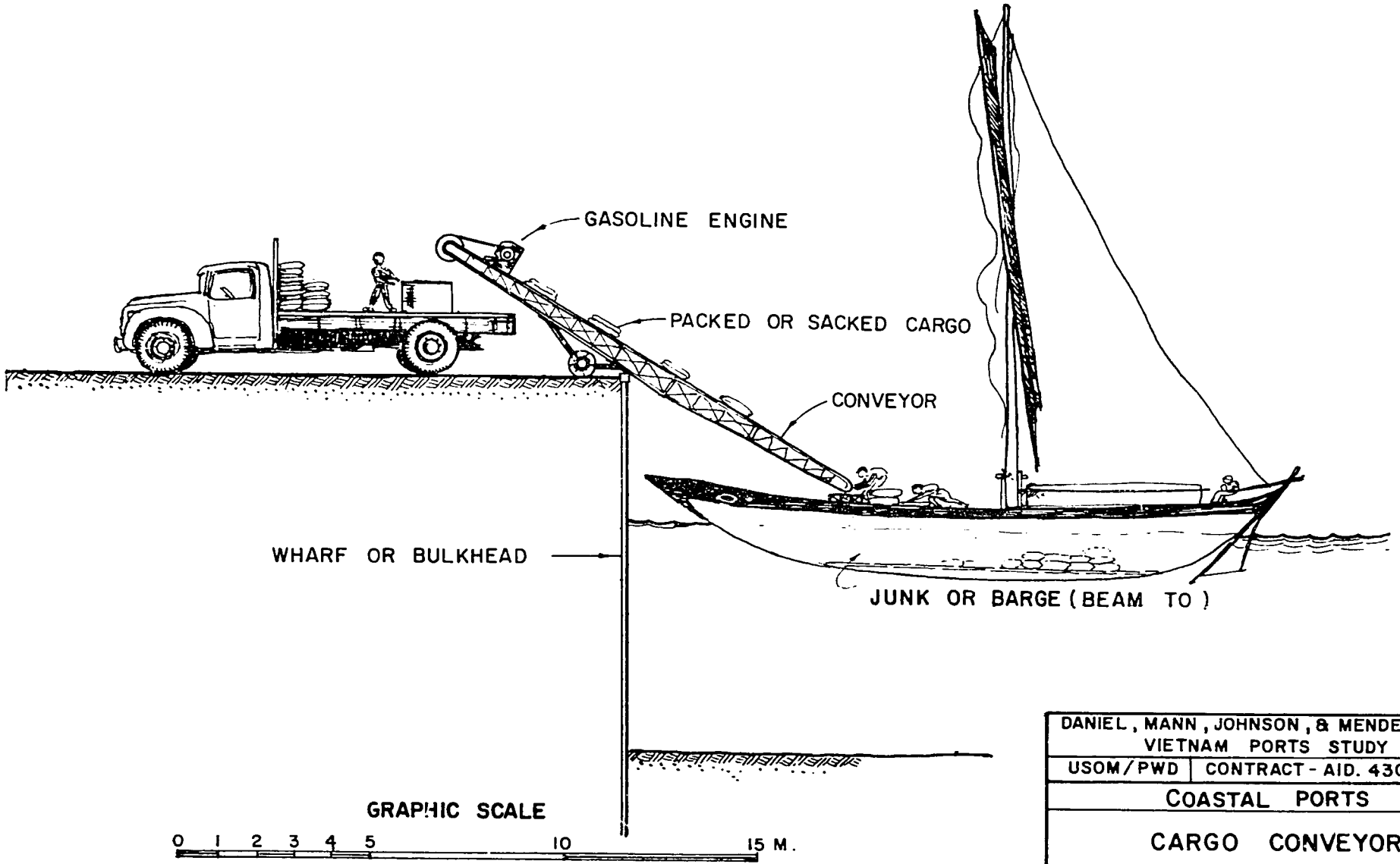
elements of longshoring should be considered. Unloading lighters often involves long totes of up to 100 kilo bags and other items that would ride well on a belt conveyor. Much of the lift operation could be done by conveyor. The conveyor principle is illustrated by Exhibit 14. The application is not new; the belt conveyor is used in some medium-cost-labor ports. About $5000 would cover a portable trial installation. Of course, this should be done prudently to avoid deterioration of the usually cooperative longshoremens' attitude.

Coaster Operations

The Port of Da Nang was built for coasters, and serves them reasonably well in normal unhurried times. The principal problems under present conditions are those relating to clearing the hook - again a matter of "getting the cargo away from there". At present, coaster shipments tend to be intra-country, and more mixed than deep sea movements, except when rice is shipped from Saigon. The latter can efficiently move direct to local warehousing. Other cargo must often be moved through transit sheds, but tends first to be dumped on the wharf (Figure 21). This should always be avoided, and dock tractors and trucks should immediately receive and remove such cargo to transit sheds.

Dredging

Dredging operations are now under the Director of the Port, and the greater



DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
COASTAL PORTS	
CARGO CONVEYOR	
BY: A.F.B.	DATE: NOV. 1965

EXHIBIT #14

latitude allowed him in salary inducements has undoubtedly stabilized the operations. However, the equipment remains the same, and throughout 1965 there was evidence that an excessively short discharge line was permitting solids to recirculate through the channel. Figure 23 illustrates that situation; discharge is on the northern extremity of the main breakwater. The effective disposal of spoil requires adequate pipeline length, and should be given more attention.

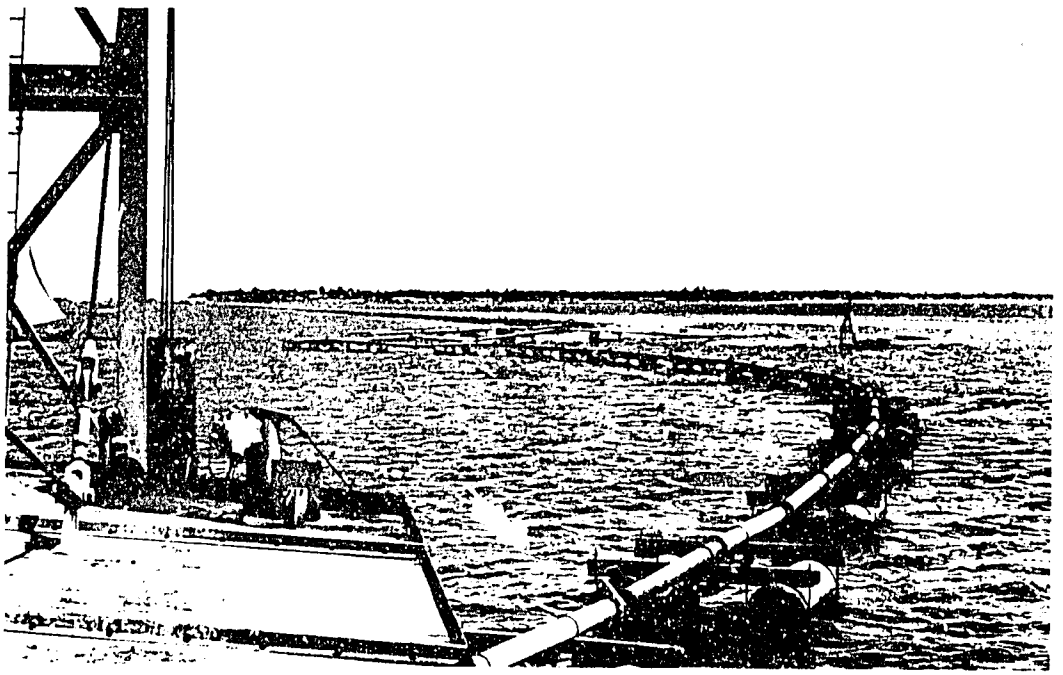


Figure 23. Dredge in north end of entrance channel. Looking south.

VIII. FACILITIES EVALUATION

Condition of wharves, transit sheds, storage areas and equipment at the Port of Da Nang is fair. They have, of course, been put to hard use for a number of years. The cleanup in August and September was a long step toward better preservation and greater efficiency. Much of the Port's lack of fresh paint and clean decks may be attributed to the hard constant use of the past several years.

One of the most serious questions at the Port is that of structural integrity of the wharves, under the present work loads. The possibility of fill pressures pushing the wharves seaward was noted on page 48. Bridging of the fill area with concrete has been suggested but "dead men" with tie rods might be a cheaper solution, and structurally better than adding a half span of dead and live load to the existing structure.

Timber fenders on the face of wharves are considered expendable; if properly proportioned each crushed timber means that a vessel was saved some damaged plate or a frame. Many such timber fenders apparently have served their purpose and should be replaced.

Wharf lighting should be improved for efficiency, safety, security, and pilferage control during the regular night work to be expected.

Channel maintenance probably will not regularly be the problem it was in 1965, but the situation will become progressively worse as the river "delta" moves seaward.

Adequacy. The Port of Da Nang could be maintained with addition of berths as needed, to handle only coastal freighter traffic. Following cessation of military hostilities, several facilities will accrue to the Port that can be used to handle junk and barge traffic. With these taken care of elsewhere, there may be enough wharf space for the coastal freighters for a long time.

IX. PROPOSED DEVELOPMENT

Certainly no port in Viet-Nam has received as much planning attention as has Da Nang. Starting with the French Lt. De Richery in about 1800, a number of the more recent studies are listed at the beginning of this report. At the present time, military planning introduces some new uncertainties; it is never possible to predict what will come of such plans, and then what facilities might be bequeathed to the civilian economy. As a part of this study an interim report was issued on the Port of Da Nang and later a supplement Scheme VII; these two reports are incorporated herein.

Otherwise, probably nothing has influenced port thinking at Da Nang more than the November, 1964 floods that undermined several spans of the Da Nang River bridge and deposited hundreds of thousands of cubic meters of silt in the dredged channel, and much more in deeper water.

Another fact of the past several years has been the substantial increase in tonnage moved through the Port. After 1955, (Exhibit 5) tonnage settled down to roughly 220,000 tons, increasing about 10,000 tons each year to 1962. It then jumped to over 400,000 and 1965 appeared to be headed for at least 600,000 tons.

While the 600,000 ton value is inflated by military cargo, deferred civilian needs and the industrial development now building for An Hoa, would quickly take up the slack. After that will come orderly growth and population increase.

The Problem

Da Nang's waterborne trade in the past has been of two basic types, reflected by Table IX. Most of the tonnage in "normal" times is carried in Vietnamese ships, mostly the Government's fleet of about 7 coasters of about 700 ton capacity that constantly ply the run from Saigon to Da Nang with stops at the larger ports in between. These account for roughly half of the tonnage into Da Nang. French ships account for about one-sixth, and "American and others" about one-third. Clearly half of the tonnage, therefore, was deep draft; little foreign tonnage would be brought in vessels of 4 to 5 meter draft.

The coastal trade is analyzed in some detail in the report on the Port of Can Tho, and it appears that rice from the delta region will remain a relatively constant factor in northbound trade, even as population increases. The Vietnamese diet is becoming more diversified, and the Central Provinces in particular seem to rely more on a variety of locally grown foods.

The import tonnage build-up will be more in the industrial lines that would come in ocean freighters either direct or via Saigon or some other deep water port.

Outbound or export shipments, when they can be re-established, will consist of cinnamon, glass products, cordage, and timber products. Much of the An Hoa production of 90,000 tons of urea and ammonium sulphate will go

TABLE IX
PORT OF DA NANG
EXPORT - IMPORT (IN AND OUT) TONNAGE

	1960	1961	1962	1963	1964	1965 (5 Mo.)
Vietnamese Ships						
Export	6,646	3,986	3,327	4,583	13,076	849
Import	149,628	144,241	169,169	168,176	128,862	8,714
Total	156,274	148,227	172,496	172,759	141,938	9,563
French Ships						
Export	5,409	5,318	3,607	3,897	4,918	440
Import	38,322	48,218	47,362	64,798	57,030	3,286
Total	43,731	53,536	50,969	68,695	61,948	3,726
American and Others						
Export	2,407	295	5	127		481
Import	69,518	55,164	71,874	160,452	189,477	37,631
Total	71,925	55,459	71,879	160,579	189,477	38,112
Export	14,452	9,599	6,939	8,607	17,994	1,770
Import	257,468	247,623	288,405	393,426	375,369	49,631
GRAND TOTAL	271,920	257,222	295,344	402,033	393,362	51,401

toward the delta.

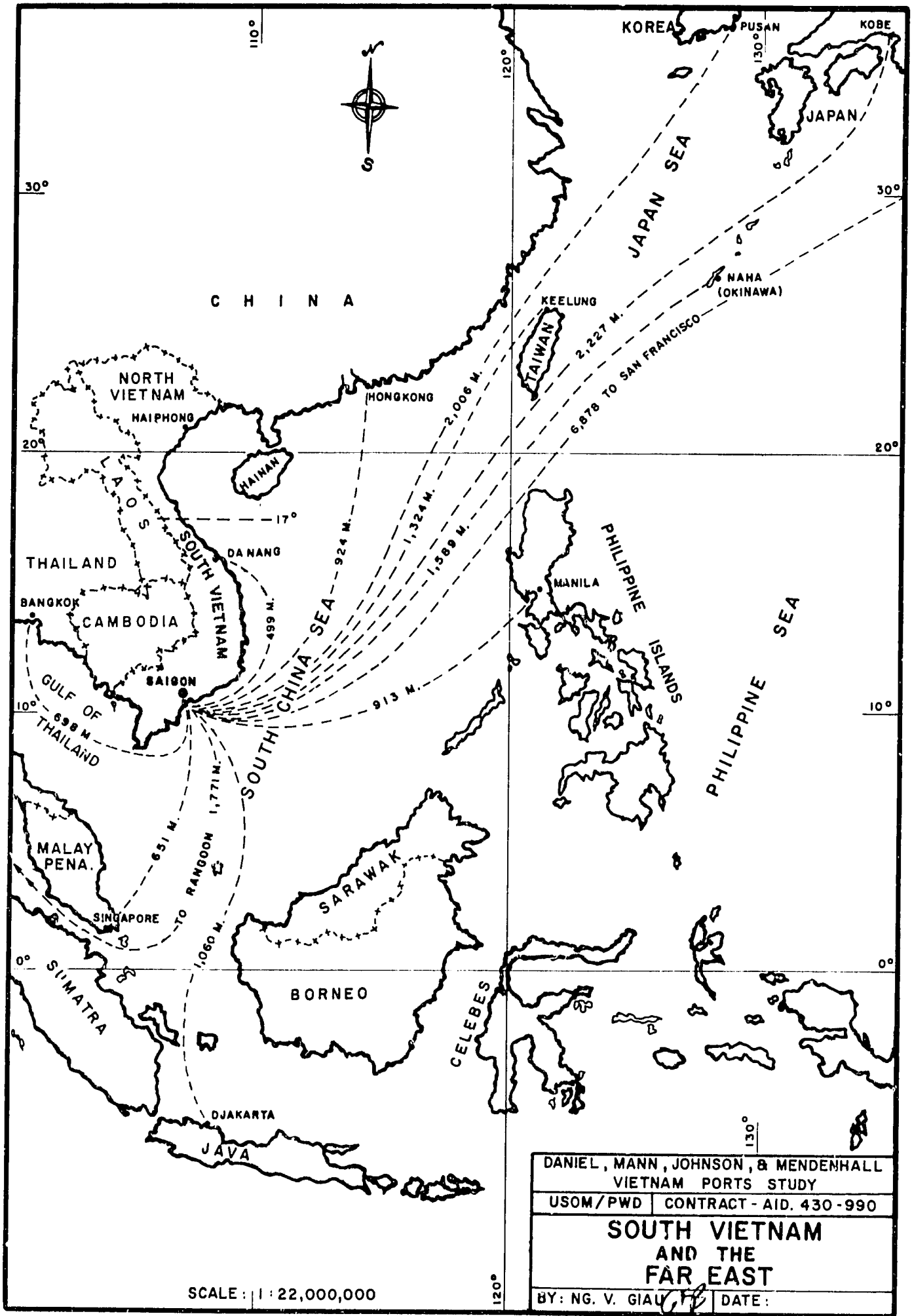
Finally, there is the certainty that the land-locked country of Laos will need the Port of Da Nang as its principal avenue to world trade. Exhibit 15 brings out that Da Nang, while not directly on world trade routes, is much better positioned than the thriving Port of Thailand, at Bangkok, which takes a vessel at least two days off its course. It shows the strategic location of Da Nang in relation to Laos.

Exhibit 16 shows the substantial population, at least 2 million, in Da Nang's hinterland. The Port of Hue report indicates that Hue would do better to rely upon the Port of Da Nang. The future of a Port development in Quang Ngai Province may depend upon the Mo Duc iron ore development.

Facilities Site

Many solutions have been proposed for the port problem set forth above. For the reasons earlier stated, the situation now is somewhat clearer. For instance, the river has shown what a problem it can be. On the other hand, the military cargo loads and problems tend to cloud the fact that this study is of basically peacetime harbor needs.

The confusion of military with future peacetime requirements often created minor problems during this study, and a clear distinction is essential, both as to tonnage requirements and handling methods. However, in the earlier stages of the study of the Port of Da Nang in particular it was hoped by some


KOREA
PUSAN
KOBE
JAPAN
JAPAN SEA
110°
120°
130°
30°
20°
10°
0°
N
S
CHINA
KEELUNG
TAIWAN
NAHA
(OKINAWA)
2,227 M.
6,878 TO SAN FRANCISCO
NORTH
VIETNAM
HAIPHONG
HONGKONG
2,006 M.
1,324 M.
1,589 M.
924 M.
HAINAN
17°
LAOS
SOUTH VIETNAM
DA NANG
THAILAND
BANGKOK
CAMBODIA
SAIGON
699 M.
913 M.
698 M.
GULF OF
THAILAND
SOUTH CHINA SEA
PHILIPPINE
ISLANDS
MANILA
PHILIPPINE SEA
MALAY
PENA.
651 M.
SINGAPORE
TO RANGOON
1,771 M.
1,060 M.
SARAWAK
BORNEO
SUMATRA
CELEBES
DJAKARTA
JAVA
SCALE : 1 : 22,000,000
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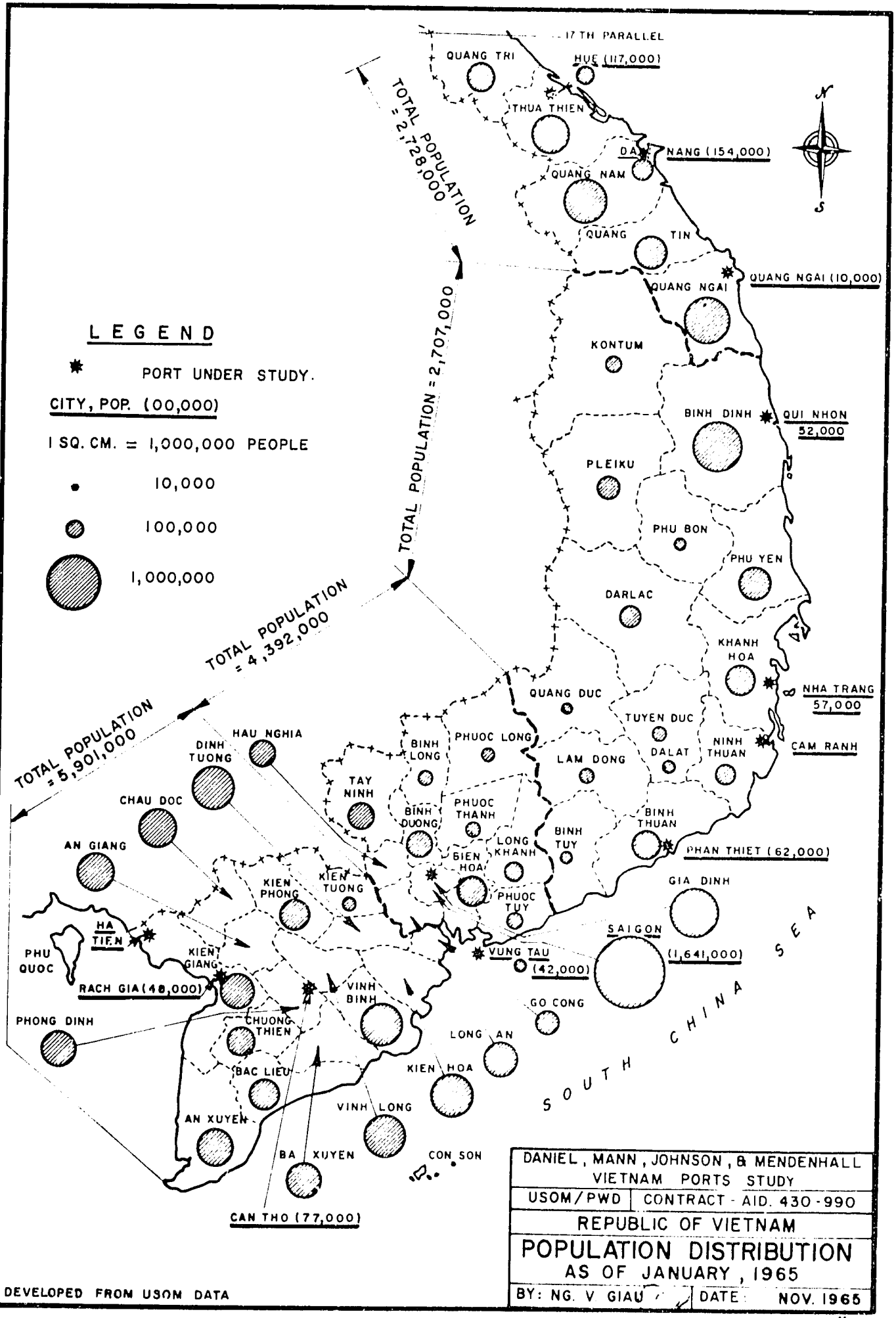
SOUTH VIETNAM
AND THE
FAR EAST
BY: NG. V. GIAU
DATE :

EXHIBIT # 15


17TH PARALLEL
QUANG TRI
HUE (117,000)
THUA THIEN
DA NANG (154,000)
QUANG NAM
QUANG TIN
QUANG NGAI (10,000)
QUANG NGAI
KONTUM
BINH DINH
QUI NHON 52,000
PLEIKU
PHU BON
PHU YEN
DARLAC
KHANH HOA
NHA TRANG 57,000
CAM RANH
QUANG DUC
TUYEN DUC
DALAT
NINH THUAN
LAM DONG
PHUOC LONG
BINH LONG
TAY NINH
BINH DUONG
PHUOC THANH
BIEN HOA
LONG KHANH
BINH TUY
BINH THUAN
PHAN THIET (62,000)
GIA DINH
SAIGON (1,641,000)
VUNG TAU (42,000)
PHUOC TUY
GO CONG
LONG AN
KIEN HOA
VINH LONG
AN XUYEN
BA XUYEN
CON SON
CAN THO (77,000)
BAC LIEU
CHUONG THIEN
VINH BINH
RACH GIA (48,000)
KIEN GIANG
PHU QUOC
HA TIEN
PHONG DINH
KIEN PHONG
KIEN TUONG
AN GIANG
CHAU DOC
DINH TUONG
HAU NGHIA
TOTAL POPULATION = 2,728,000
TOTAL POPULATION = 2,707,000
TOTAL POPULATION = 4,392,000
TOTAL POPULATION = 5,901,000
SOUTH CHINA SEA
LEGEND
PORT UNDER STUDY.
CITY, POP. (00,000)
1 SQ. CM. = 1,000,000 PEOPLE
10,000
100,000
1,000,000
DEVELOPED FROM USOM DATA
DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY
USOM/PWD
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REPUBLIC OF VIETNAM
POPULATION DISTRIBUTION
AS OF JANUARY, 1965
BY: NG. V GIAU
DATE: NOV. 1965

EXHIBIT # 16

that a common solution to military and civil needs might be found at Da Nang. For that reason, the various possibilities were examined and developed in more than the usual detail for a study of this kind.

Thus, seven distinct schemes of improvement have been considered for the Port of Da Nang. The proposed military development north of Observatory Island is described as "Scheme O".

Identification	Location	Purpose
Scheme I	Rocher Noir Bay	Commercial Terminal
Scheme II	East Side, Tien Sha Peninsula	Commercial Terminal
Scheme III	Mouth of Da Nang River	Commercial Terminal
Scheme IV	Namo Point	Commercial Terminal
Scheme V	Lieuchou Bay	Commercial Terminal
Scheme VI	East of Observatory Island	Emergency Pier
Scheme VII	South Side Tourane Bay	Military, then Commercial
Scheme O	North of Observatory Island	Military

The location and extent of the above is illustrated on Exhibit 17. *

Alternate Plans. The various plans briefed above were not all devised to serve the same purpose. During the early months of this study, it was obvious that cargo facilities at Da Nang could not effectively carry their commercial load plus the expected military load. Studies were made, therefore, toward a plan that would serve the military purposes, but then phase into a commercial port. Schemes I, IIa, IIb, and III first came out of that approach.

Further study, better definition of the military problem, and apparent urgency

* Exhibit 17 is duplicated in Exhibit 33, for reference.

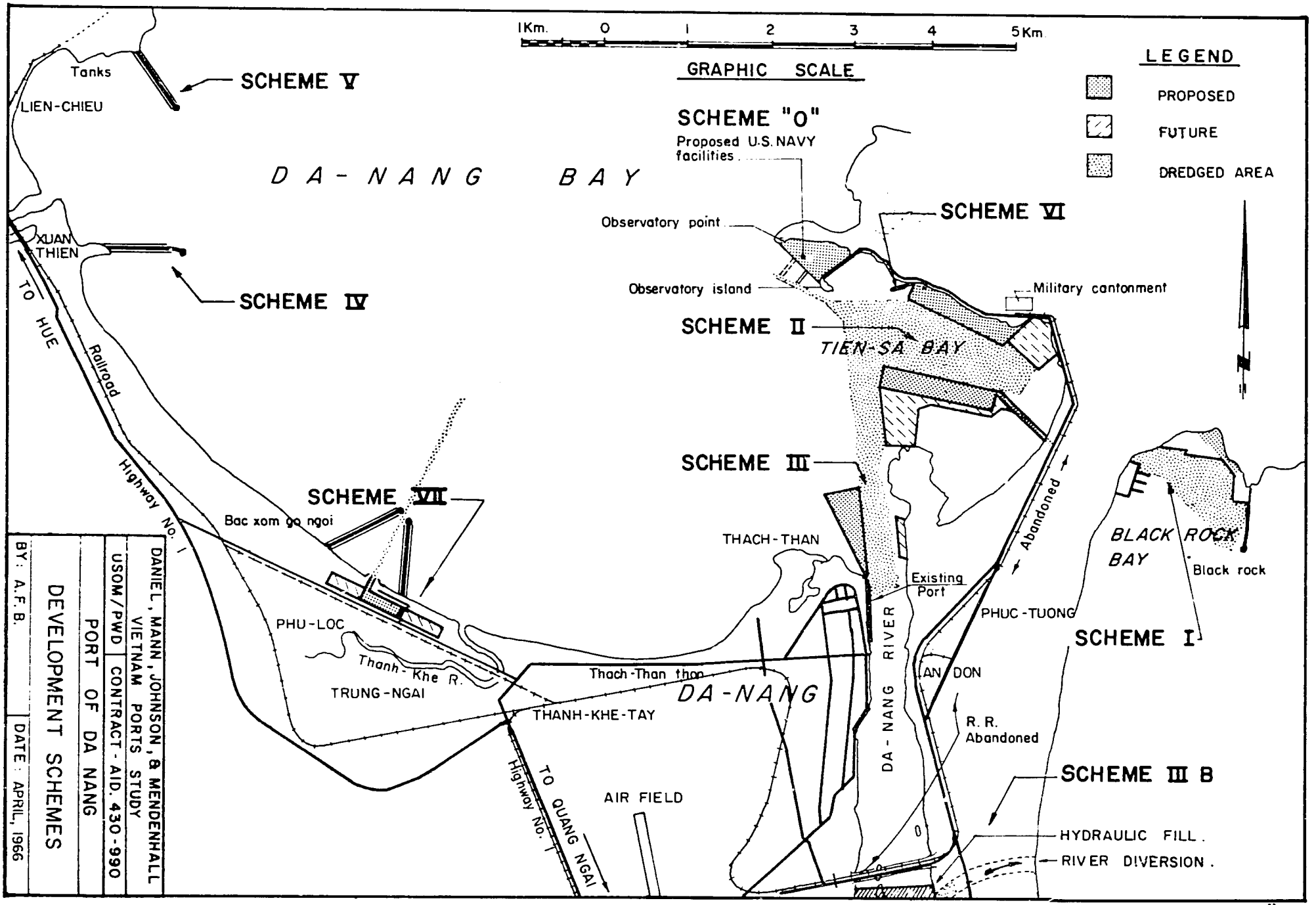


EXHIBIT # 17

EXHIBIT # 17

lead to Schemes IV and V.

Scheme VII was developed last. It appeared to have promise as a quick solution to the military problem, and yet would phase smoothly into a standard cargo wharf. Taking advantage of the terrain and the soil conditions, it would have permitted an early construction start, and early completion, with minimum wait for materials from the United States. This plan would have started operations with the "house falls" method of cargo handling, and thus could have been placed in operation without waiting for wharves to be built.

Approach. Each plan listed above will be examined individually with drawings, estimates, and discussion as appropriate. Considerations leading to selection of the best plan and economic feasibility of that plan will then follow. The commercial terminal facilities are all evaluated tentatively on the basis of a three ocean freighter berth first phase. Usually a second phase of two more berths follows.

The various plans had been made largely on the basis of existing site information, supplemented by superficial examination at the site. It was intended to do a few actual soil borings, but the logistics problems at Da Nang limited the work to a series of jet probings in Rocher Noir Bay. This type of preliminary work must be supplemented by detailed site investigations at the selected site. Thus, at Rocher Noir, the contours of the underlying rock would be extremely important to final siting, and particularly the type

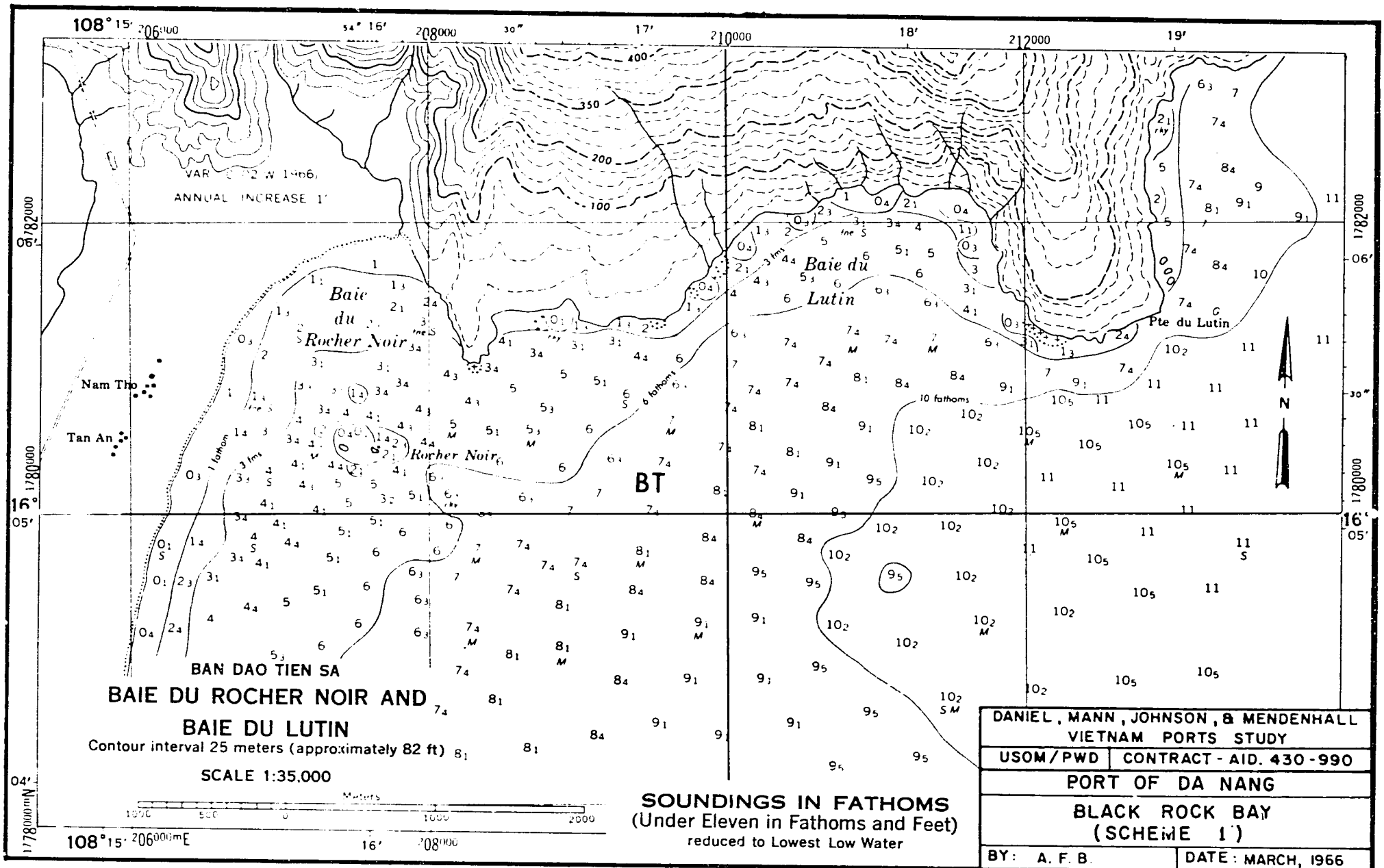
of wharf selected. (The Basic Information Volume illustrates several types of wharf sections, and their applications to special soil conditions.) At Schemes II and III, soil borings and analyses would be very important. At Scheme VII, construction and hydrographic conditions would determine final orientation, and position of the facility, i.e., whether built completely on-shore, or pushed further seaward.

Scheme I

This site is located in Rocher Noir Bay (Black Rock Bay), Exhibit 18, on the East side of the Tien Sha peninsula, and northeast of the present Port of Da Nang. Figures 24 and 25 show the site in May of 1965.

This particular area has been studied in considerable detail by both Japanese and French engineers and was recommended by them for a new commercial port. It has good potential for port development. As Exhibit 19 shows, dredging required would be about sufficient to provide the fill necessary for the development shown by Exhibit 20.

The outlined port terminal at the Rocher Noir Bay site would basically follow the same idea, as to general location, as the Japanese and French schemes, but with a different layout of facilities. Breakwater construction would be needed substantially as indicated by the other studies. There is excellent material available very close to this site for extensive breakwater construction. There is also a good supply of fresh water immediately adjacent to the port site.



BAN DAO TIEN SA

BAIE DU ROCHER NOIR AND BAIE DU LUTIN

Contour interval 25 meters (approximately 82 ft)

SCALE 1:35.000

SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)
reduced to Lowest Low Water

DANIEL, MANN, JOHNSON, & MENDENHALL
VIETNAM PORTS STUDY

USOM/PWD	CONTRACT - AID. 430-990

PORT OF DA NANG

BLACK ROCK BAY
(SCHEME 1)

BY: A. F. B.	DATE: MARCH, 1966

EXHIBIT # 18

EXHIBIT # 18

The site offers a high degree of natural sheltering to the waves produced by the Northeast Monsoon. Little shelter exists for waves coming in directly from the East.

Several diffraction studies of breakwater orientations were made and also preliminary breakwater design, based on a significant wave height of 15 feet and 10 second period. For design of the breakwater a design wave = 1.55 H was used. Maximum armour of 10 ton weight should be adequate in final design by adjustment of slopes. A typical breakwater cross-section is shown in Exhibit 31. Dock facilities within the harbor were so located to assure wave heights less than 2 to 3 feet under the most severe storm conditions.

In a final stage investigation of this site more study should be directed to the problem of avoiding inner harbor wave reflections and to the possibility of minimizing storm surge.

Estimated percentage of time of occurrence of significant wave heights and average periods at the Rocher Noir site are given in Table VI. It is believed the littoral transport is relatively small at Rocher Noir Bay and entrance maintenance dredging should be infrequent.

There remains some question about sub-surface conditions at Rocher Noir Bay. It was found logistically impracticable to complete borings in the bay area, but jet probings were made by DMJM and by UDT (Underwater Demolition Team) personnel. Rock was not encountered down to about -10

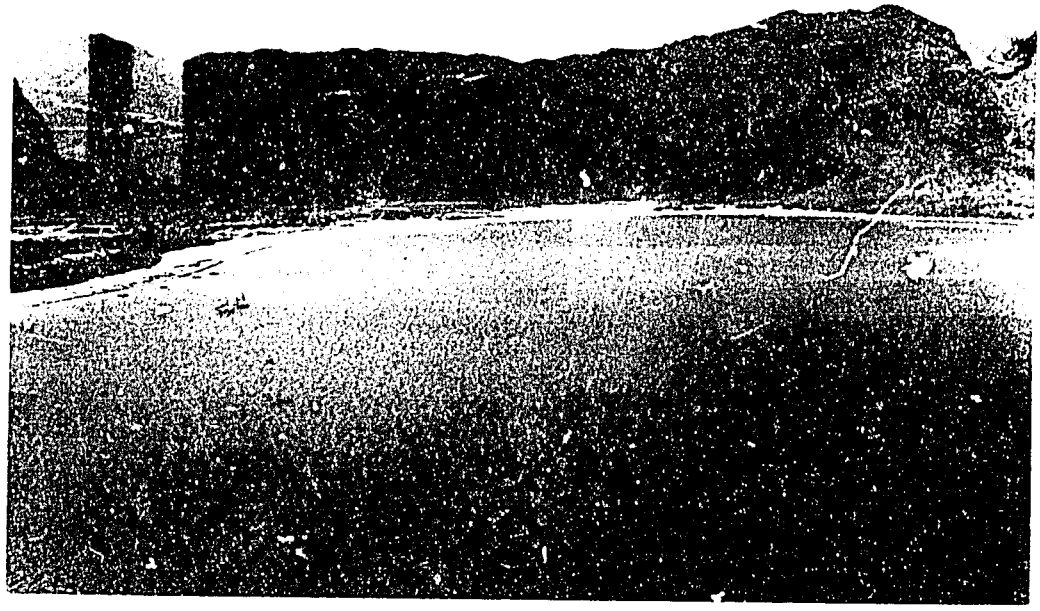


Figure 24. Black Rock Bay. Looking north.

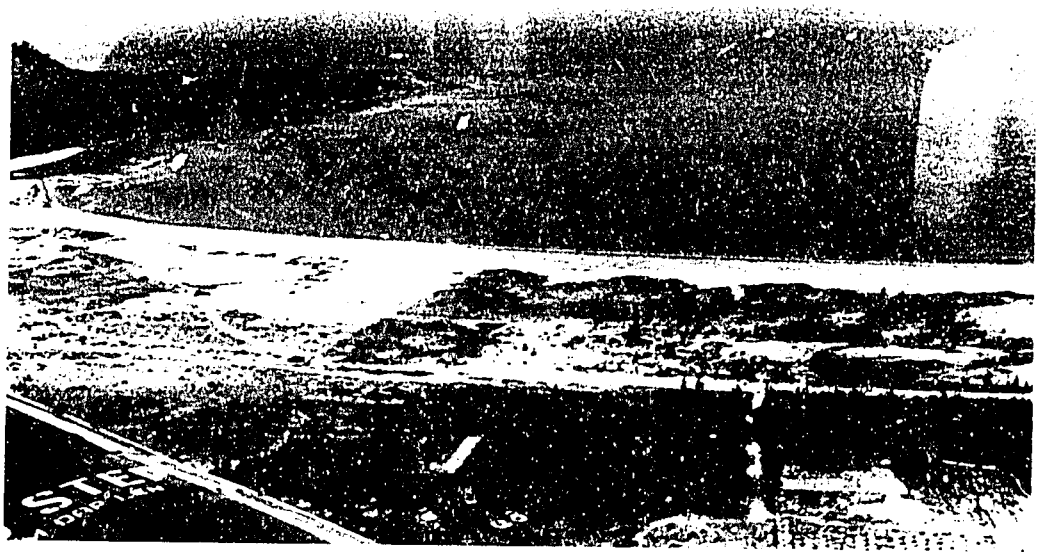


Figure 25. Black Rock Bay. Looking S. E. Cu Lao Cham I sland in distance.

or 11 meters, except where it was to be expected. Thus, dredging conditions appeared favorable. Foundations conditions remain to be verified; it appeared unlikely that incompetent material would be encountered, but a varied rock profile would present construction problems.

The greatest handicap of the Rocher Noir site is its remoteness from inland transportation. As Exhibit 17 shows, the main coastal railroad and highway lies about 10 kilometers inland across the Da Nang River. The only existing bridge across the river, Figure 26, no longer carries a railroad track. It was severely damaged by the November, 1964 floods and the temporary spans later suffered in a truck accident. The bridge problem will be solved; much thought already is being given to a new bridge across

Figure 26. Bridge from Da Nang to Tien Sha Peninsula.

the river, downstream where the river is narrower, to lead into the heart of the city. The frontispiece photograph suggests the problems this would present to through truck or rail traffic.

A port development at Da Nang certainly should have direct railroad access. A separate railroad bridge would cost millions, and a combined bridge would be a perpetual aggravation, hazard and expense. The urban development plan for Da Nang does little to the existing downtown section, but expands on the peninsula for a new commercial center and along the south shore of Da Nang Bay. Some thought has been given to a "residence area" on the northerly slopes of Tien Sha; the June, 1965 Ministry review "Project for Economic Development of Central Viet-Nam" so indicates.

In the cost estimate that follows, no allowance is made for a new bridge across the Da Nang River; it is assumed that such a bridge will be provided in any case. The "small boat basin" shown on Exhibit 20 is estimated at $525,000 but is not included in any of the phase estimates.

SCHEME I
PORT OF DANANG
ROCHER NOIR (BLACK ROCK BAY)
CONSTRUCTION COST ESTIMATES

I T E M S	PHASE I	PHASE II	PHASE III	TOTAL
Dredging	1,967,000.	689,000.		2,656,000.
Fill and Riprap	426,000.	-	—	426,000.
Wharf	3,468,000.	2,312,000.	3,661,000.	9,441,000.
A.C. Pavement	460,000.	677,000.	121,000.	1,258,000.
Transit Sheds	1,652,000.	826,000.	1,652,000.	4,130,000.
Warehouses	1,180,000.	2,360,000.	—	3,540,000.
Misc. Buildings	467,000.	346,000.	—	813,000.
Security Fence & Gates	43,000.	5,000.	—	48,000.
Road, Trestle & Drainage	565,000.	3,000.	1,000.	569,000.
Railroad	1,491,000.	292,000.	—	1,783,000.
Breakwater	3,403,000.	—	—	3,403,000.
Utilities	406,000.	598,000.	107,000.	1,111,000.
TOTAL.....	$15,528,000.	$8,108,000.	$5,542,000.	$29,178,000.

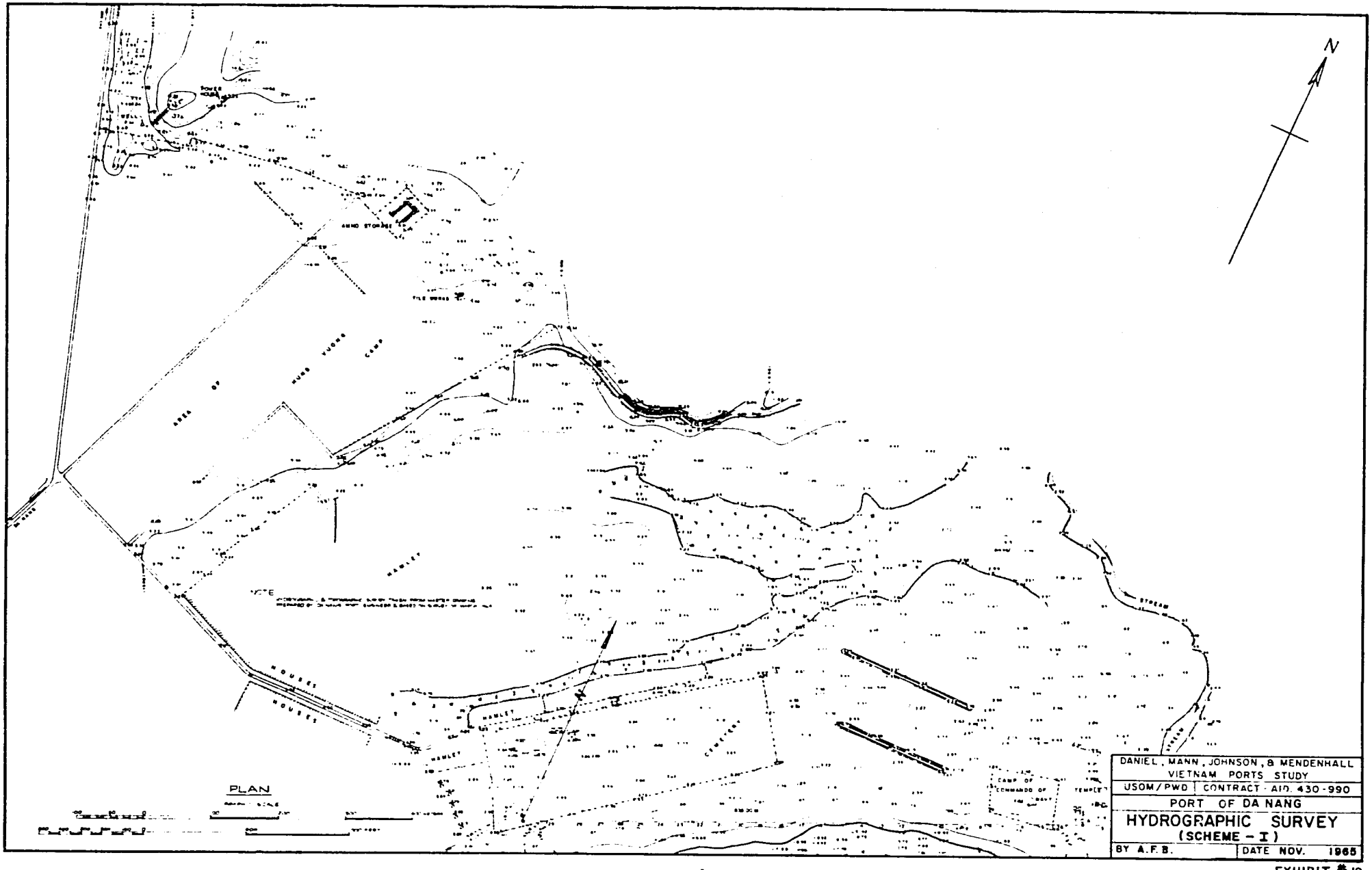
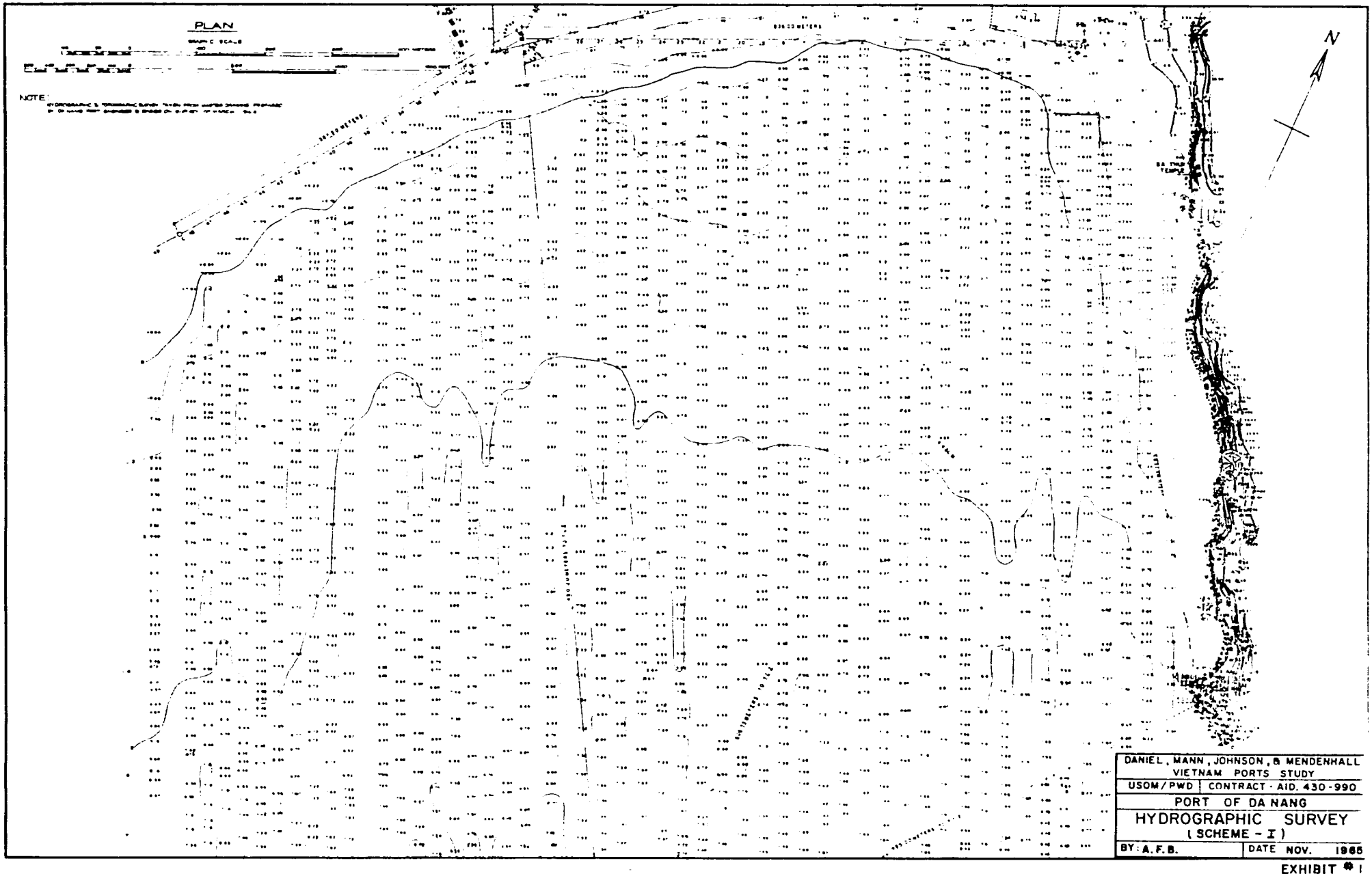


EXHIBIT # 19-



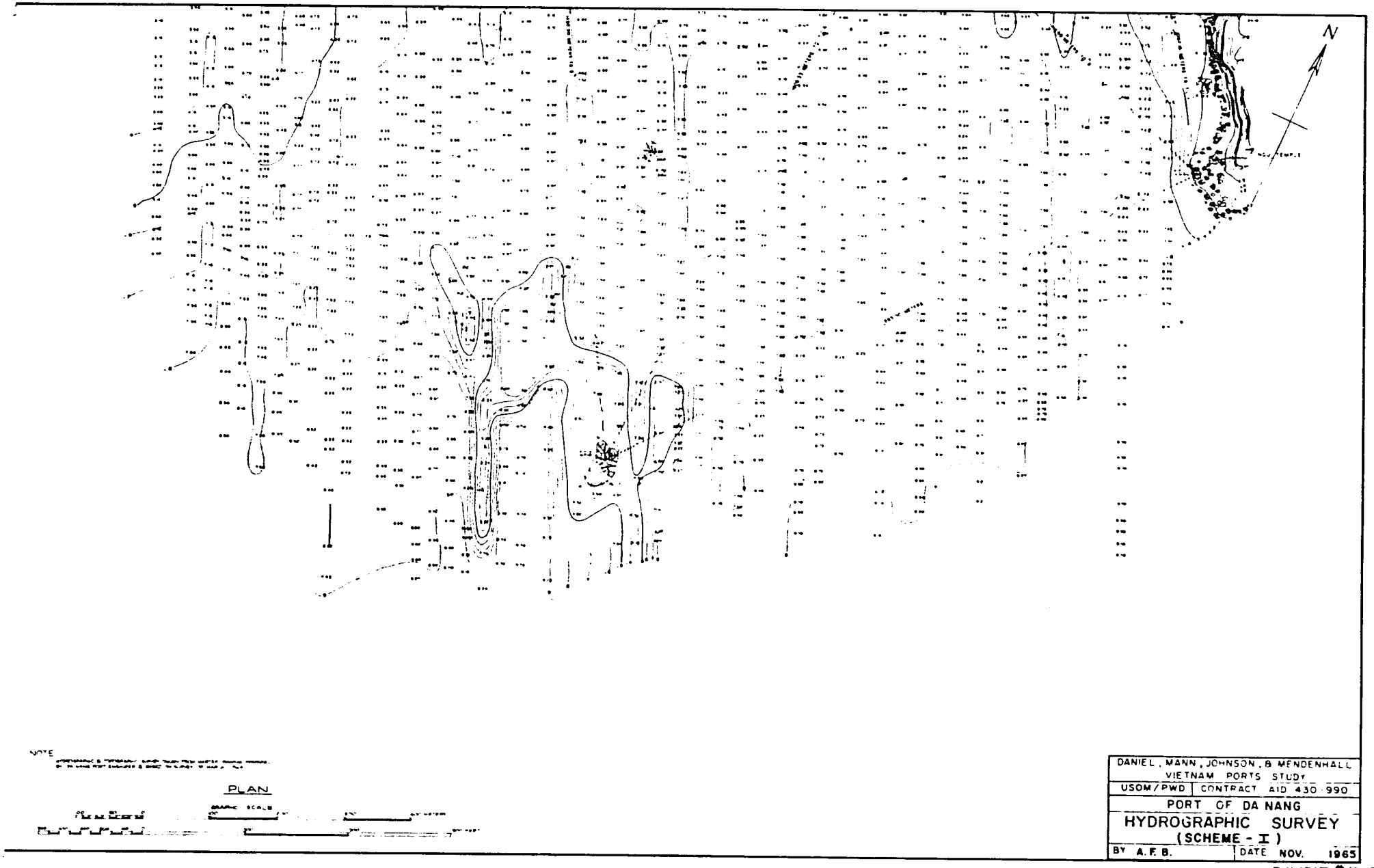


EXHIBIT # 19-C

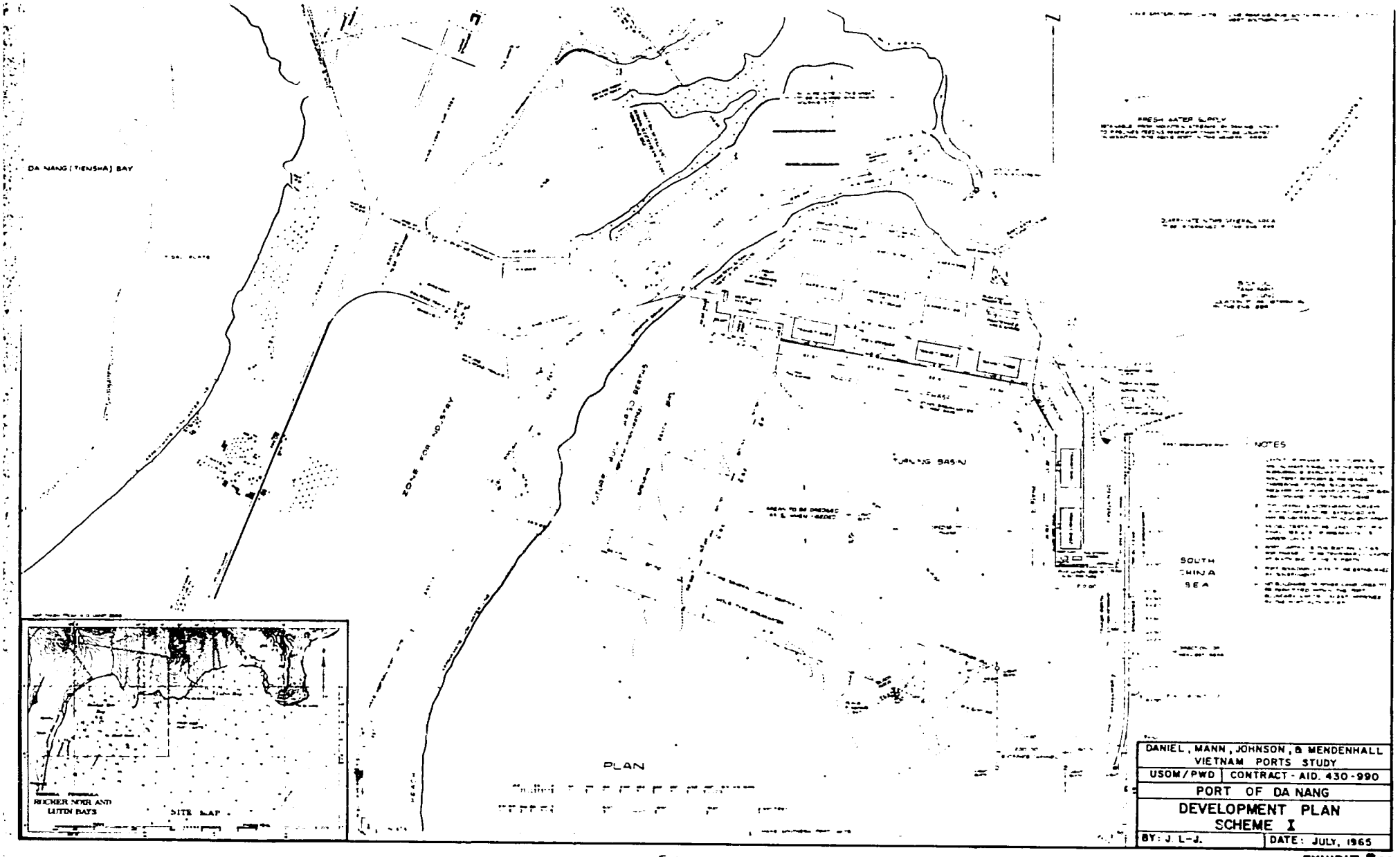


EXHIBIT #20

Scheme II

This site is located in the inner bay on the east side of the Da Nang River opposite the northern end of the north-south breakwater and seaward from the present Da Nang docks in the general area of Figures 27 and 28. Existing conditions are shown approximately by Exhibit 21. The site would involve rather extensive bulkhead construction and hydraulic fill work.

The development could be built on either side of a dredged basin as shown by Exhibit 22. Recent charts and visual indications such as Figure 29 show that the river is pushing its delta further to sea. Unless the river is diverted to the northwest, it would regularly drop silt in the entrance channel and basin.

Scheme II would, however, requires a lesser amount of dredging, both for the initial construction and for maintenance after it has been built, than would be the case for Scheme III. There would be no breakwater construction involved in this location.

The principal objection to this site is much the same as for Scheme I, insofar as land transportation is concerned, as well as the bridge crossing of the Da Nang River.

It does have an offsetting cost element in that part of the hydraulic fill would be in excess of the actual port requirements and the sale of this excess land could be used partially to offset the construction cost of the project. However, test borings and thorough subsoil investigation will be necessary.

This scheme is considered as a separate study, but the bulk cargo facilities noted under Scheme III could be relocated down the river toward the sea and considered as part of this improvement.

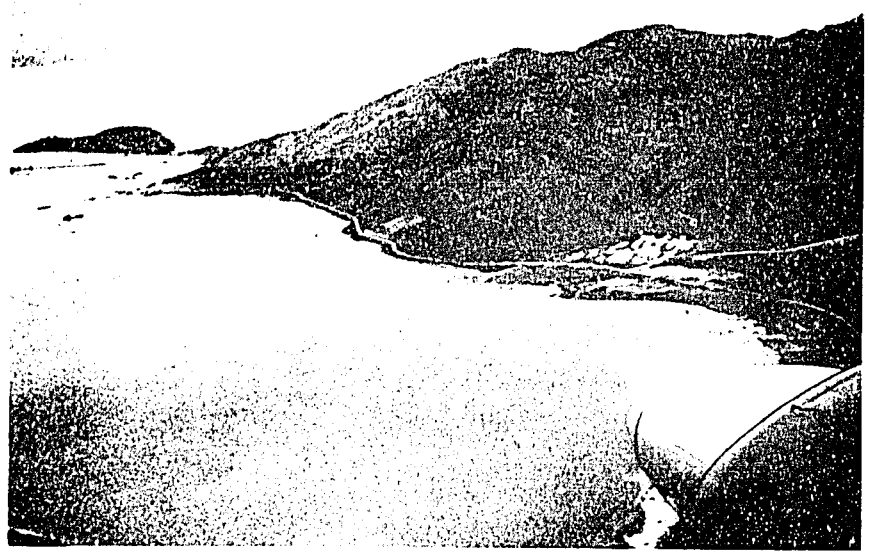
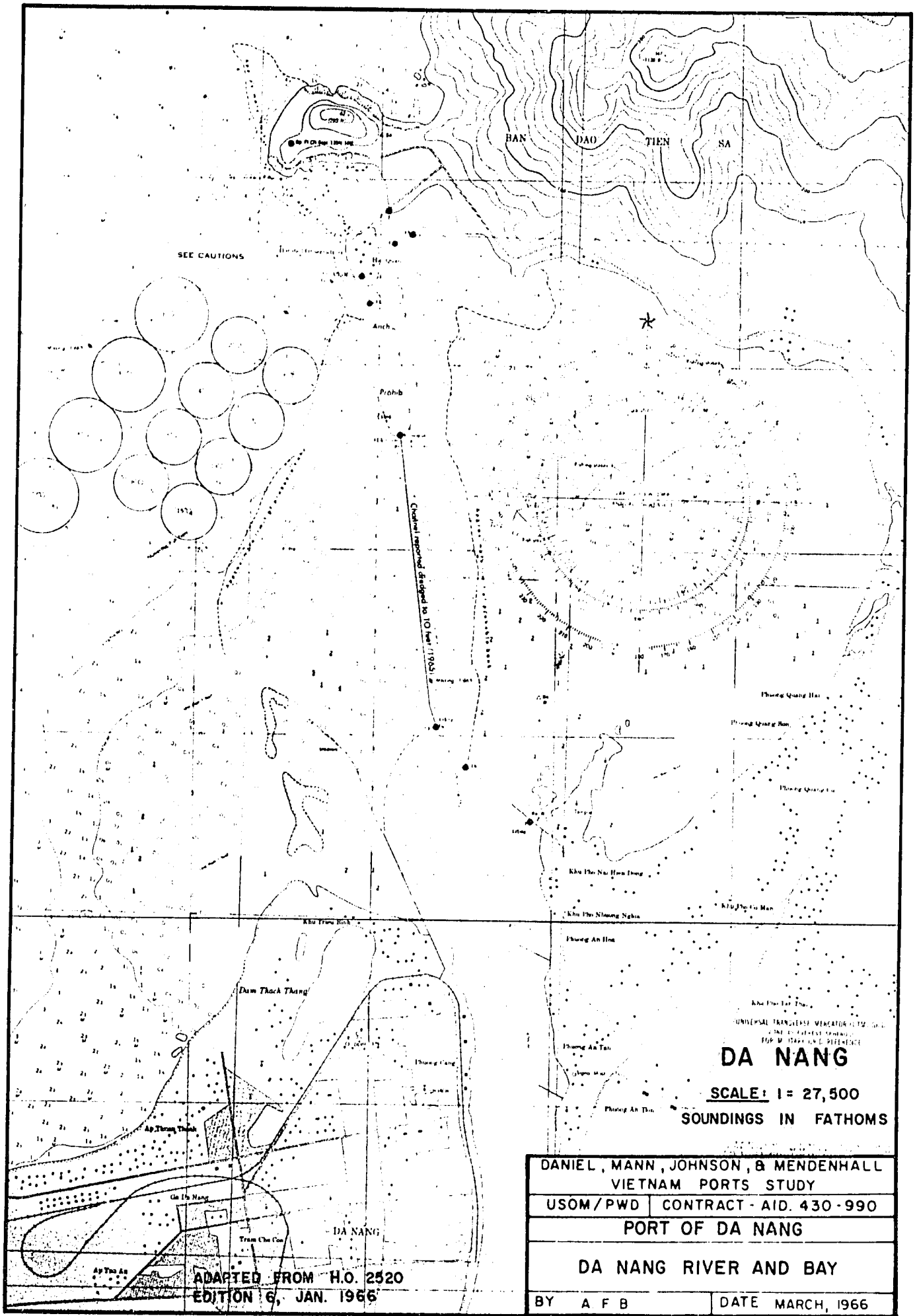


Figure 27. Scheme II site. Looking N. W. Observatory Island in background.

Figure 28. Looking across narrow peninsula toward Da Nang Bay and Scheme II improvement site.



DA NANG

SCALE: 1 = 27,500

SOUNDINGS IN FATHOMS

ADAPTED FROM H.O. 2520
EDITION 6, JAN. 1966

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
PORT OF DA NANG	
DA NANG RIVER AND BAY	
BY A F B	DATE MARCH, 1966

EXHIBIT #21

SCHEME II

TIEN SHA BAY DEVELOPMENT

PORT OF DA NANG

CONSTRUCTION COST ESTIMATES

I T E M S	PHASE I	PHASE II	PHASE III	TOTAL
Dredging	6,207,000.	——	——	6,207,000.
Fill & Riprap	384,000.	——	——	384,000.
Wharf	3,468,000.	2,312,000.	3,721,000.	9,501,000.
A.C. Pavement	1,015,000.	502,000.	615,000.	2,132,000.
Transit Sheds	1,652,000.	826,000.	1,615,000.	4,093,000.
Warehouse	2,360,000.	1,180,000.	2,360,000.	5,900,000.
Misc. Buildings	467,000.	346,000.	——	813,000.
Security Fence & Gates	33,000.	14,000.	10,000.	57,000.
Railroad Ext.	1,072,000.	284,000.	259,000.	1,615,000.
Road Widening & Improvement	138,000.	——	——	138,000.
Utilities	905,000.	448,000.	551,000.	1,905,000.
TOTAL.....	$17,701,000.	$5,912,000.	$9,131,000.	$32,745,000.

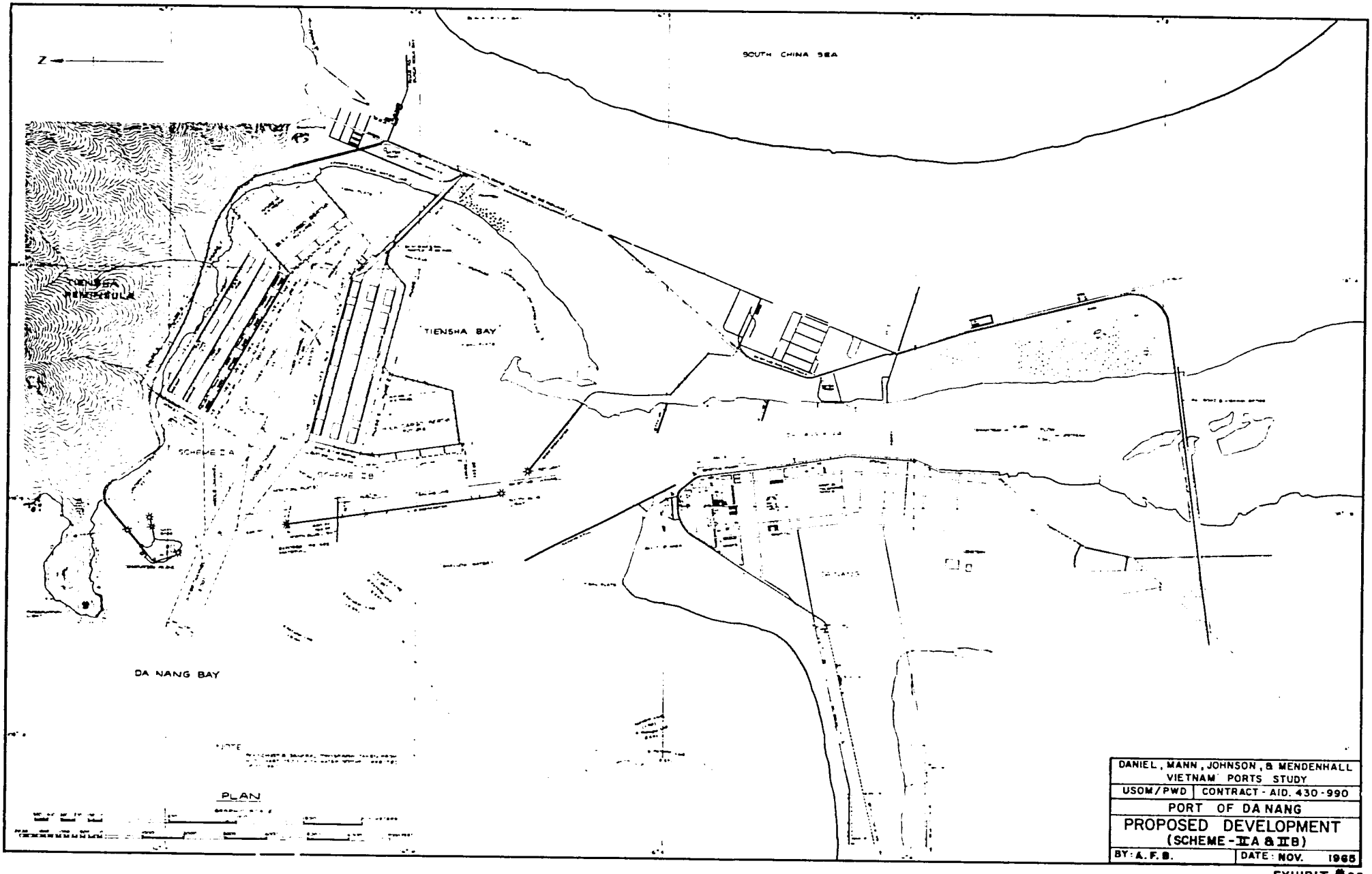


EXHIBIT #22

Scheme III

Scheme III would lie in the upper center of Figure 29, as shown.

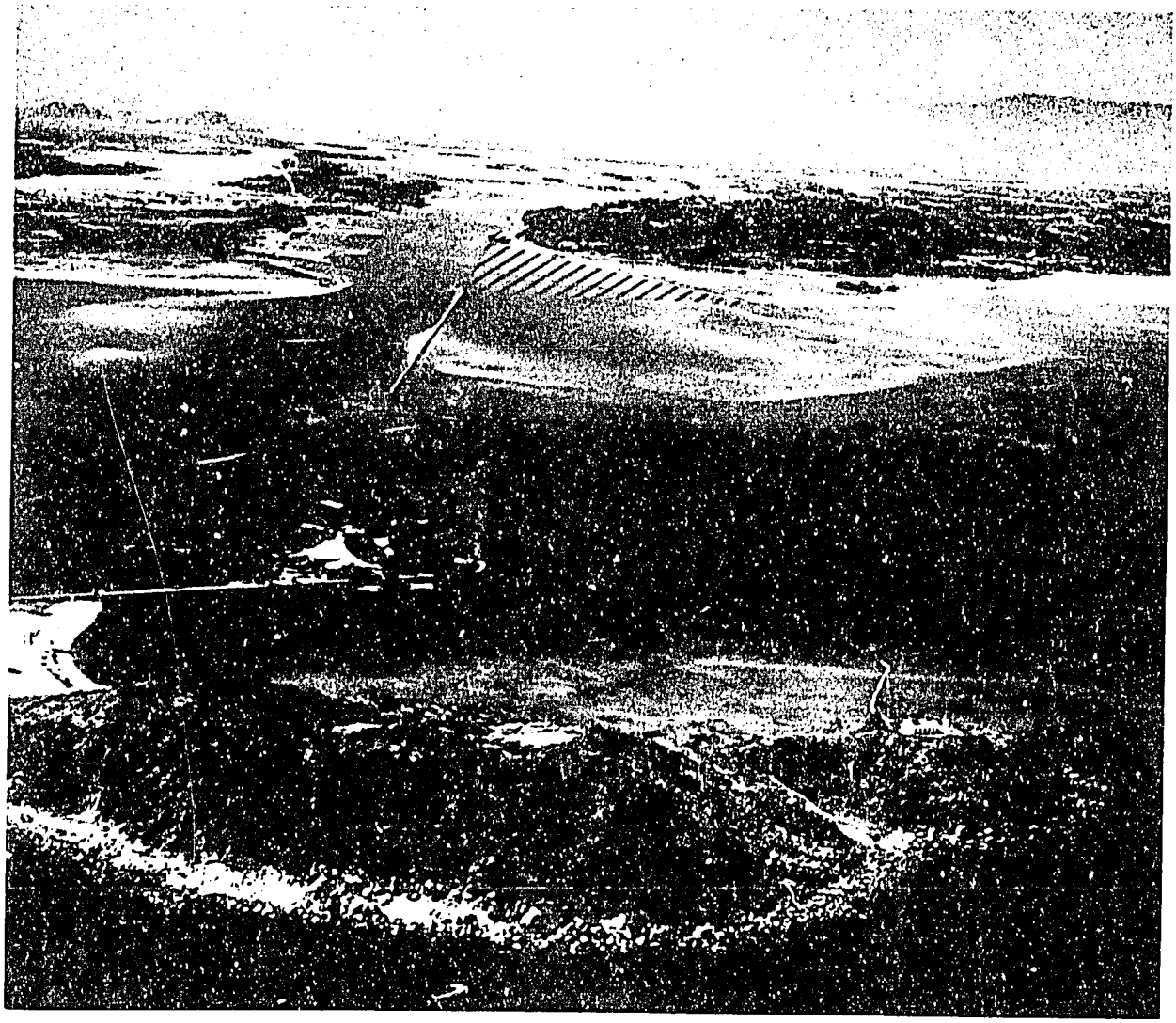


Figure 29 Obs. Point, Da Nang River, looking South. About 1964

Were it not for the hazards of occasional serious river floods and the depositing of extensive silt in the navigation channels, (and possibly putting the port out of action temporarily for deep draft vessels), this would be a most interesting site; its principal advantages as follows:

a. Is is located adjacent to existing port facilities and present port operations.

b. Rail and highway connections to this area could be constructed from the present systems, without the need of a railroad bridge.

c. All port utilities, such as water and electricity, etc., could be extended from the city provided the supply is adequate. (There is some doubt of adequacy at present.)

d. Minimum of dike construction is required to hold the dredge material during pumping operations as there is an existing dike (seawall) running completely across the back of the site.

Some of the principal disadvantages of this site are as follows:

a. Heavy silting due to severe floods could place the port temporarily out of action for deep draft vessels.

b. This site will require greater dredging of navigation channels, as compared to some of the other sites, and this would heavily burden the Phase I construction.

The difficulty of maintaining an 11 meter channel 4 kilometers long is indicated by the sand build-up in two years between Figures 29 and 30.

Figure 30. Da Nang channel. Looking south. July, 1965. Dredge in channel.

c. Continual maintenance dredging will be required to maintain the specified draft along the face of the wharf and the navigation channels.

d. The development would tend to add to the general traffic congestion in the city.

At this location, it would be possible to construct up to 7 berths of 182 meters each for ships of up to 30 foot (9 meter) draft. This site probably is best adapted to sheet pile or cellular bulkhead construction, but that observation is subject to thorough soil investigation. The type of construction is relatively easy once the material has been purchased and is on the site.

Bulk cargo would be handled at a separate facility on the East bank of the river, with construction undertaken as and when required.

A variation of Scheme III has been proposed. This would involve dredging a new outlet channel for the Da Nang River across the peninsula into the South China Sea, as sketched on Exhibit 33. The material from this cut could be used to build an embankment across the river, thus isolating Scheme II or Scheme III port development from the river floods and major silting. It would be an expensive undertaking, but could be used to provide a land crossing over the Da Nang River in lieu of the existing highway bridge. The river diversion would isolate the peninsula communities south of the proposed channel (Exhibit 11). It would probably change the fishing industry in the Da Nang River, and thereby affect a good many people; whether beneficially or adversely would need to be determined. The additional silt deposit would build up the ocean beaches but that would be little problem.

The continuing military construction on the peninsula may also limit the feasible locations for such a diversion. The diversion plan should be very seriously studied before, or if, it is undertaken.

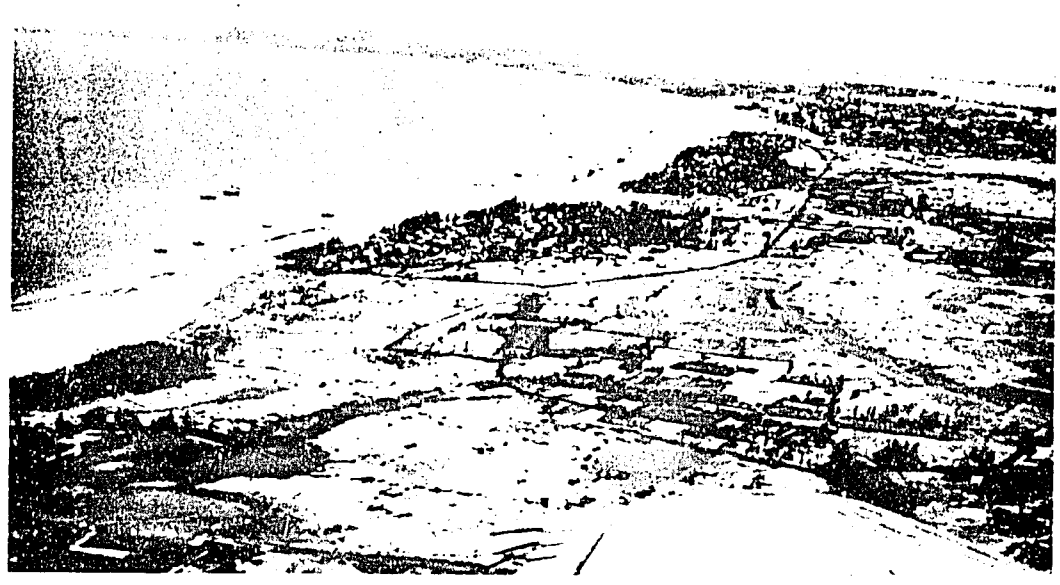


Figure 31. Scheme III. Da Nang River diversion across peninsula. Looking south from Rocher Noir Bay. Da Nang River roughly parallels coast.

SCHEME III

(DA NANG RIVER)

PORT OF DA NANG

CONSTRUCTION COST ESTIMATES

i T E M S	PHASE I	PHASE II	PHASE III	TOTAL
Dredging	4, 325, 000.	—	—	4, 325, 000.
Fill & Riprap	296, 000.	—	28, 000.	324, 000.
Wharf	3, 942, 000.	2, 312, 000.	3, 151, 000.	9, 405, 000.
A. C. Pavement	322, 000.	442, 000.	626, 000.	1, 390, 000.
Transit Sheds	1, 652, 000.	826, 000.	1, 652, 000.	4, 130, 000.
Misc. Buildings	272, 000.	—	78, 000.	350, 000.
Security Fence & Gate	20, 000.	13, 000.	15, 000.	48, 000.
Railroad	237, 000.	279, 000.	284, 000.	800, 000.
Utilities	278, 000.	396, 000.	555, 000.	1, 229, 000.
Warehouses	—	1, 180, 000.	2, 360, 000.	3, 540, 000.
Jetty	—	—	218, 000.	218, 000.
TOTAL.....	$11, 344, 000.	$5, 448, 000.	$8, 967, 000.	$25, 759, 000.

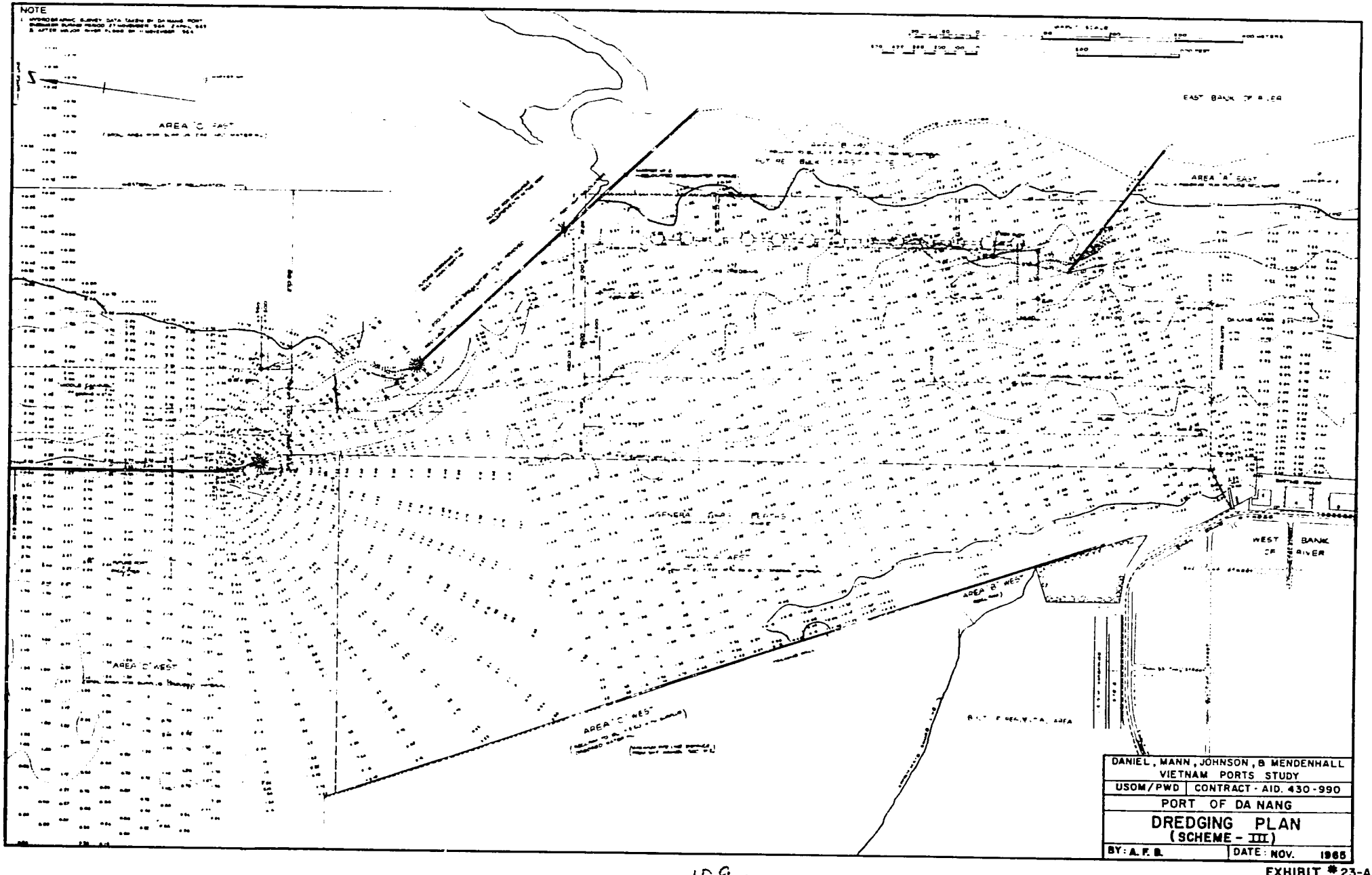


EXHIBIT #23-A

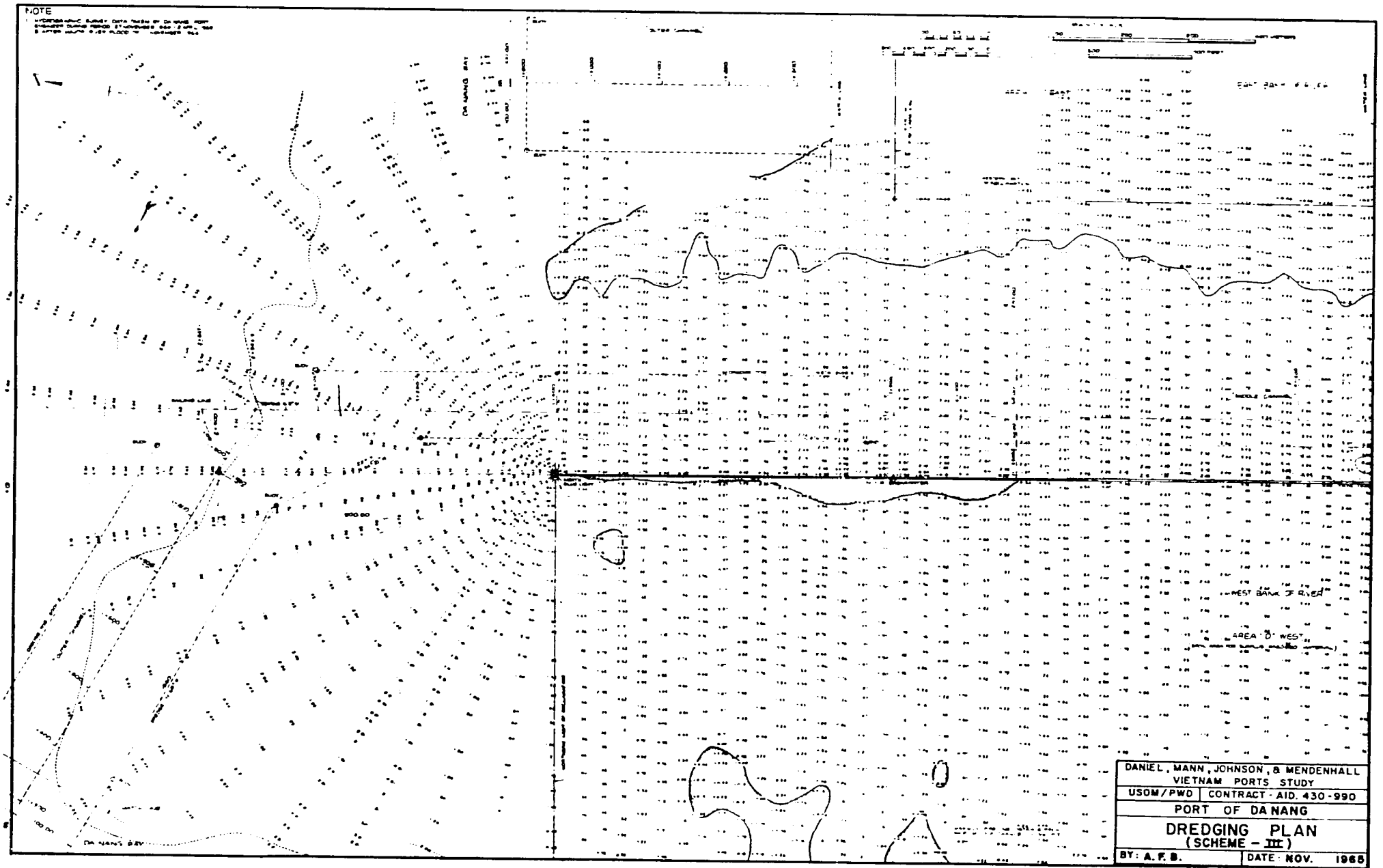


EXHIBIT #23-B

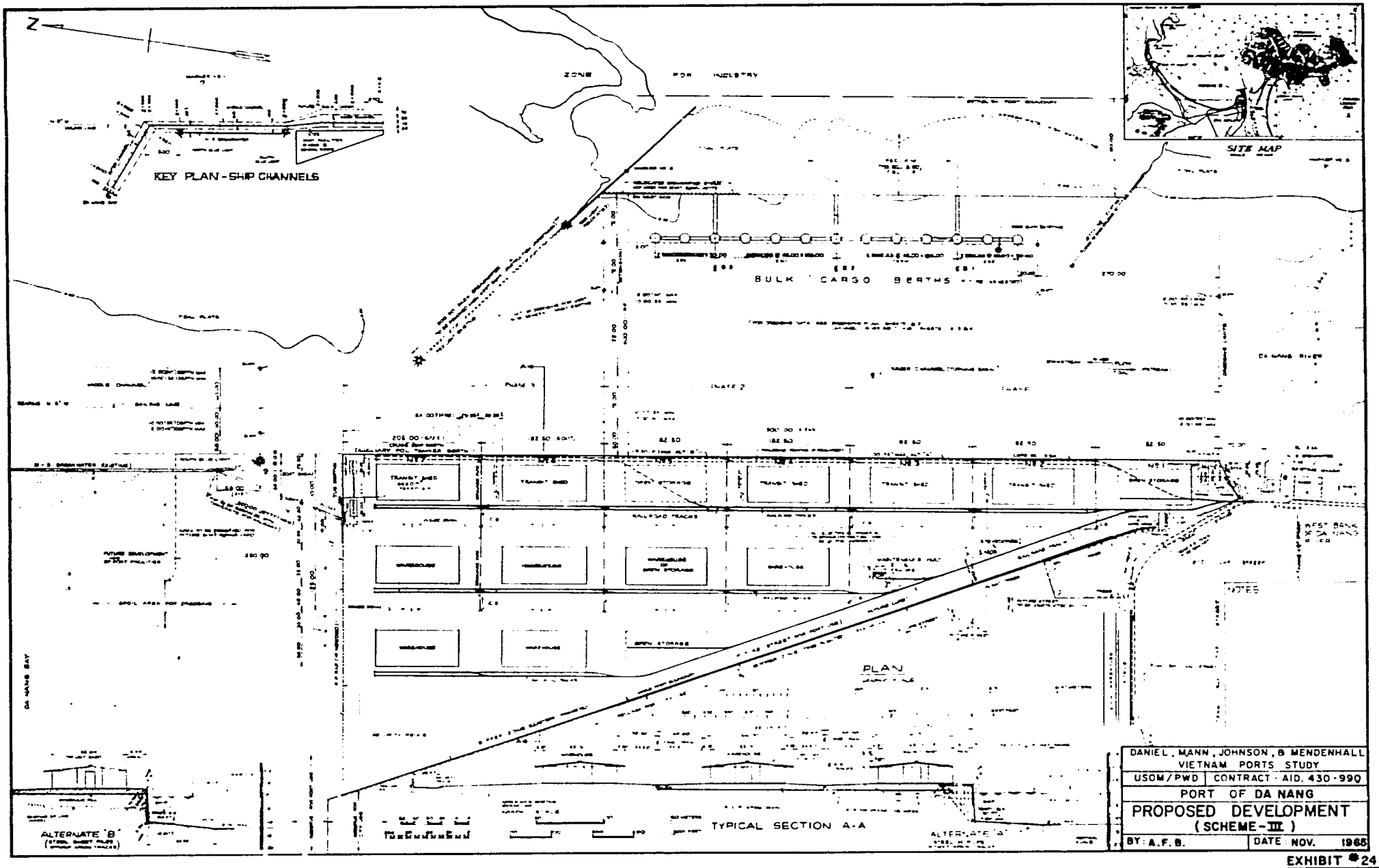


EXHIBIT #24

Scheme IV

This plan at Xuan Thien, off Nam O point (Exhibit 26), was not fully developed in the initial studies, partly because it was unacceptable to the military for security reasons. The site is shown by Figure 32. It would be developed much like Scheme VII below, with a pair of converging jetties or breakwaters to about six meter depth to still the swells, and with an 11 meter channel on out to deep water. So near the mouth of the Ca De Song, this arrangement might present some special littoral drift problems.

Another possibility (sketched on Exhibit 33, last page of this volume) would involve the construction of a breakwater to deep water area offshore to provide protection from the Northeast Monsoon winds and swells. A single leg breakwater would need to dogleg down-coast to prevent undue wave diffraction effects around the end, and breakwaters in deep water increase in cost nearly as the square of the height.

The principal disadvantage of Nam O point is its isolation from Da Nang. This would also present a problem in transportation of dock workers to and from the area. There is a general lack of utilities for ship service and port operations. Haul of goods in and out of Da Nang would be nine kilometers further than from Scheme VII, with no compensating advantages.

While Nam O presents no apparent advantages over Scheme VII (also on the bay, but nearer Da Nang), until more complete data is assembled, the entire

coast from Nam O to Da Nang should be considered as a potential site for Scheme VII.

Figure 32. Nam O Point. October 20, 1965
Scale Approx. 1:8500

Scheme V

The site at Lien Chieu Bay area was selected by Esso for a petroleum receiving and storage plant, which is served through an off-shore tanker line. The plant, Figure 33, lies against the base of the mountain.

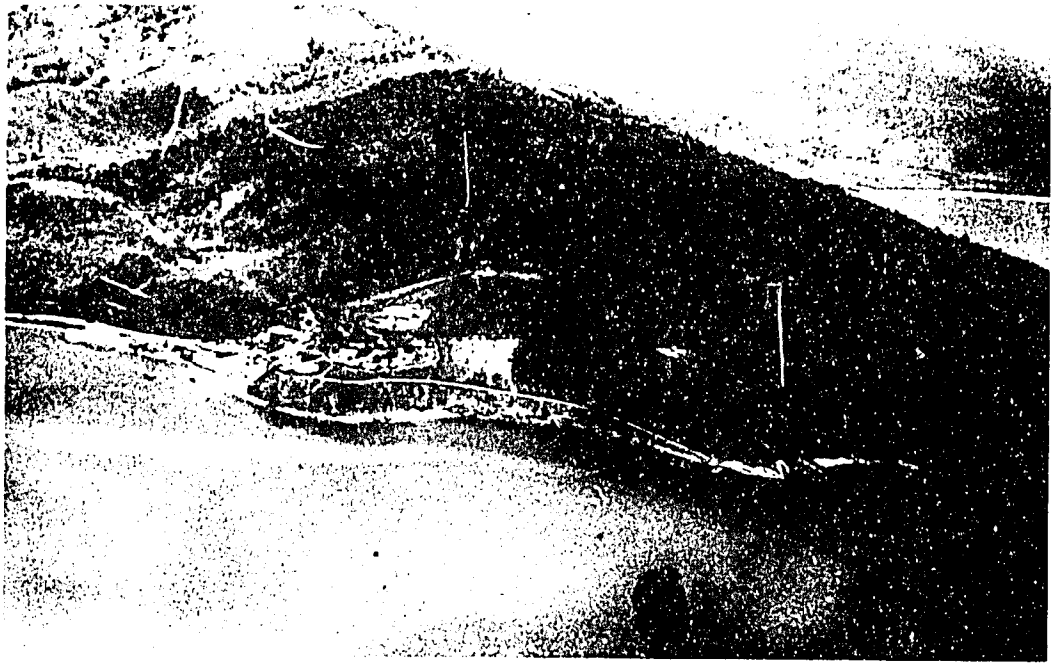


Figure 33. Esso storage and distributing plant, Lien Chieu Bay.

The site was not acceptable for a military-civil project because of security considerations (the Esso plant was later seriously damaged in a Viet Cong sneak attack), but it should not be overlooked as a future port location. Development could be along the same lines as Scheme I at Rocher Noir, but with minor complications such as a small stream discharging into the cove, a small settlement, a large number of graves, and the railroad just back of the beach line, all evident on Figure 34. (The graves are the circular

Figure 34. Lien Chieu Bay.
Approx scale:

spots inland of the railroad.) The lack of utilities would also add to the initial cost. The 18 kilometer distance to a substantial labor supply at Da Nang would be a continuing operating problem. For all time to come, all traffic with Da Nang and with An Hoa would pay for an extra 12 kilometers of truck or rail backhaul, as compared to Scheme VII.

Next up-coast, Nam Chon Bay, affords almost the same swell protection as Rocher Noir from the Northeast, with the added feature of complete absence of long period surge from the South and Southeast. As Exhibit 26 shows, the headlands of Tien Sha peninsula leave only about 45 degrees of exposure at Nam Chon Bay, and that sector is readily covered by a breakwater.

Deep water lies close inshore at the rocky headland of Point Isabella, and again at Lien Chieu Point, and at two outcroppings in the cove. The

Figure 35. Nam Chon Bay. Looking north.

maximum distance between the 10 meter depth and the beach line is only 700 meters. Whether the sandy beach hides more rock would have to be known before feasibility of a harbor development at Nam Chon could be decided.

Railway access to the site would be easy, according to observations and charts, but the highway to Hue already has started its climb toward the pass. Two kilometers of expensive construction would be required.

Compensating for the above construction disadvantages, the site would entail very little dredging.

The breakwater would be no less expensive than the first leg at Rocher Noir, but with much more assurance of effectiveness under all weather and sea conditions.

Operationally, Nam Chon has the same disadvantages as Lien Chieu Bay, plus another 5 kilometers distance from Da Nang, a total of over 20 kilometers.

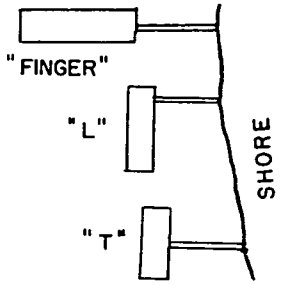
Scheme VI (Emergency Pier)

This scheme was proposed as an emergency pier to serve two ocean going ships simultaneously as shown by Exhibit 25. One site considered was in the Naval Base area of Tien Sha peninsula. The idea was premised upon information that stripped down ship hulls were available in Japan.

Four "Liberty" ship hulls, after they have been cut down to near the waterline for scrap purposes would be reconstructed as large floating pontoons.

The site would involve a minimum amount of channel dredging from deep water and, provided the various parts of the construction items can be brought to the site in fairly short order, the pier could be placed in operation much sooner than any of the other larger and more permanent schemes. The stake pile anchorage system, with heavy chain mooring lines, has the advantage of "giving" with movement, and gradually taking up as the mooring chain changes from catenary toward taut position.

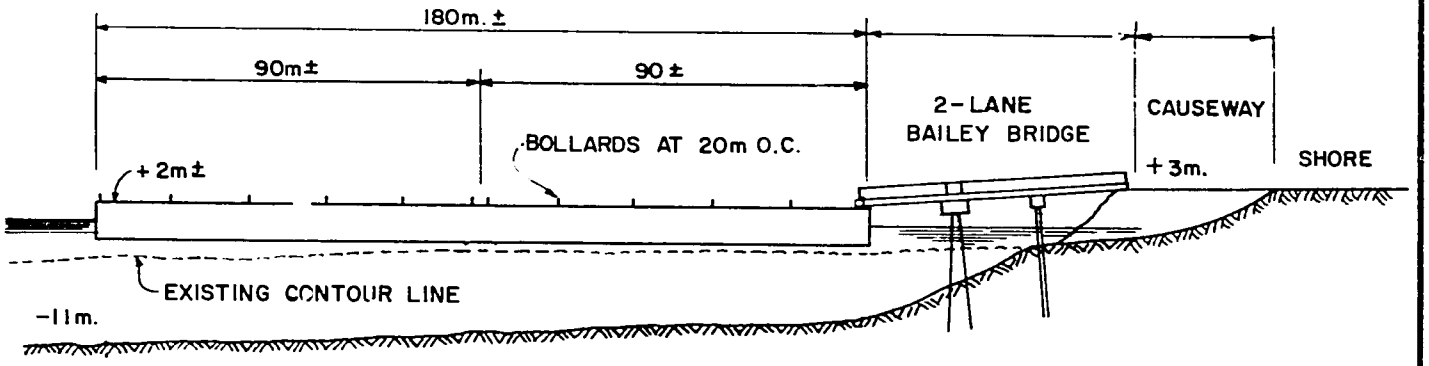
Military cargo would have to be transported by truck over the existing peninsula route highway and over the bridge across the Da Nang River to reach the main military base on the west side of the river.



TYPICAL LAYOUT

N. T. S.

(VARIES TO SUIT LOCATION)



SECTION THRU "A"

SCALES: HOR. 1" = 150' VERT. 1" = 50'

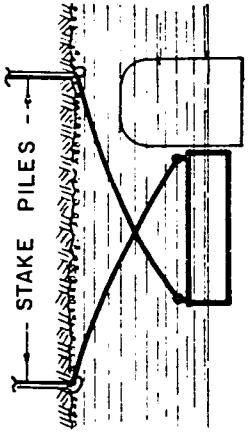
FLOATING PIER:

"LIBERTY" SHIPS (4) FROM SCRAP YARDS CUT DOWN TO ABOVE WATER LINE. SQUARE-OFF FORE AND AFT, ADD DECK, ETC., AND TOW TO SITE.

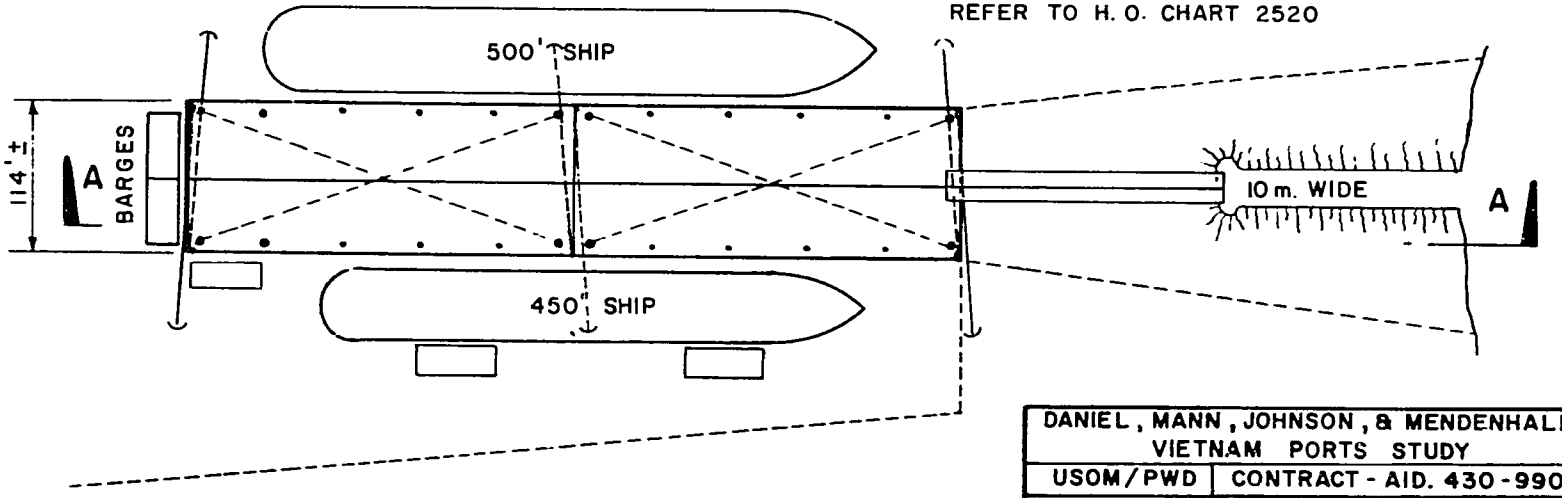
DREDGING PROBABLY IN VERY SOFT BLUE CLAY SILT, SAND OR COMBINATION THEREOF.

TIDAL RANGE: LLW = 0.67' (0.20 M.)
HHW = 5.25' (1.60 M.)

REFER TO H. O. CHART 2520



END ELEV.



PLAN

SCALE: 1" = 150'

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
PORT OF DA NANG	
EMERGENCY PIER (SCHEME-6)	
BY: J. L-J. A.F.B.	DATE: Oct. ,1965.

EXHIBIT # 25

Scheme O (Observatory Point)

Development of this military cargo facility is understood to still be in progress. It is understood that the facility will consist of two piers extending southwesterly into Da Nang Bay from a bulkhead constructed across the shallow bay separating Observatory Point from Observatory Island, shown in Figure 29. Dredging spoils, developed in deepening ship berthing areas adjacent to the proposed piers would be used to fill the rocky shoal area between the two promontories.

At one time, plans for the facility included a partial steel sheet pile bulkhead, with tie rods to deadmen, with two piers perpendicular thereto. Piers were to be about 20 meters by 180 meters, with concrete deck on steel H piles concrete encased in the tidal zone. Estimated cost is not known. The boulders observed so near the site were investigated and found apparently not to interfere.

Advantages claimed for Scheme O are:

1. Security through isolation from public areas.
2. Government ownership of required property.
3. Convenience of access from the sea.
4. Proximity to existing military and naval stations.

As a military or commercial cargo facility, the proposed piers also have disadvantages, generally the same as those of Rocher Noir Bay. The distance to Da Nang is even greater (about 15 kilometers). Of course, a larger part of the military traffic would not go through Da Nang, nor is any destined to

be shipped inland via Highway 1 or the railroad. The piers, if completed, certainly will be a deterring factor in consideration of new facilities for the Port of Da Nang. While narrow piers are poorly suited for cargo handling, these conceivably could revert to the Port. However, Observatory Island has long been a military reservation, so it is appropriate for the purpose of this study to tentatively assume exclusive military use of Scheme O.

Scheme VII (Military)

This, when known as Scheme X, was proposed to give the military forces a cargo facility at the earliest possible date, using the "house falls" system for putting cargo ashore with fair efficiency while waiting for wharves to be built. It appeared that the facility could be planned and sited so it would phase directly into an efficient commercial port development. The location selected and shown by Exhibit 26 happened to be adaptable to a construction plan that would be immune to the monsoon season and, as will be outlined later, it also has much in its favor as a Port of Da Nang.

Construction of the plan shown by Exhibit 27 could have started at the beginning of the 1965-66 monsoon season by building the basin inshore, even at the expense of additional excavation. Da Nang Bay, from about October to February, becomes too rough to permit suction dredges to operate. It was proposed to move the dredge Rach Gia, and up to two additional dredges, into the small Phu Loc River entrance, Figure 36, and there to "hole up" to work for the duration of the monsoon. The basin would be at the location of Figures 36 and 37. Toward the end of the monsoon season, the basin would be ready to be opened to the sea, and the dredges would then concentrate on the relatively small quantity of first stage access channel dredging. Also, by that time, the "house falls" installations could be ready to receive ships. The first 50 meter channel would have been widened to 100 meters by the onset of the next monsoon season, a year after starting.

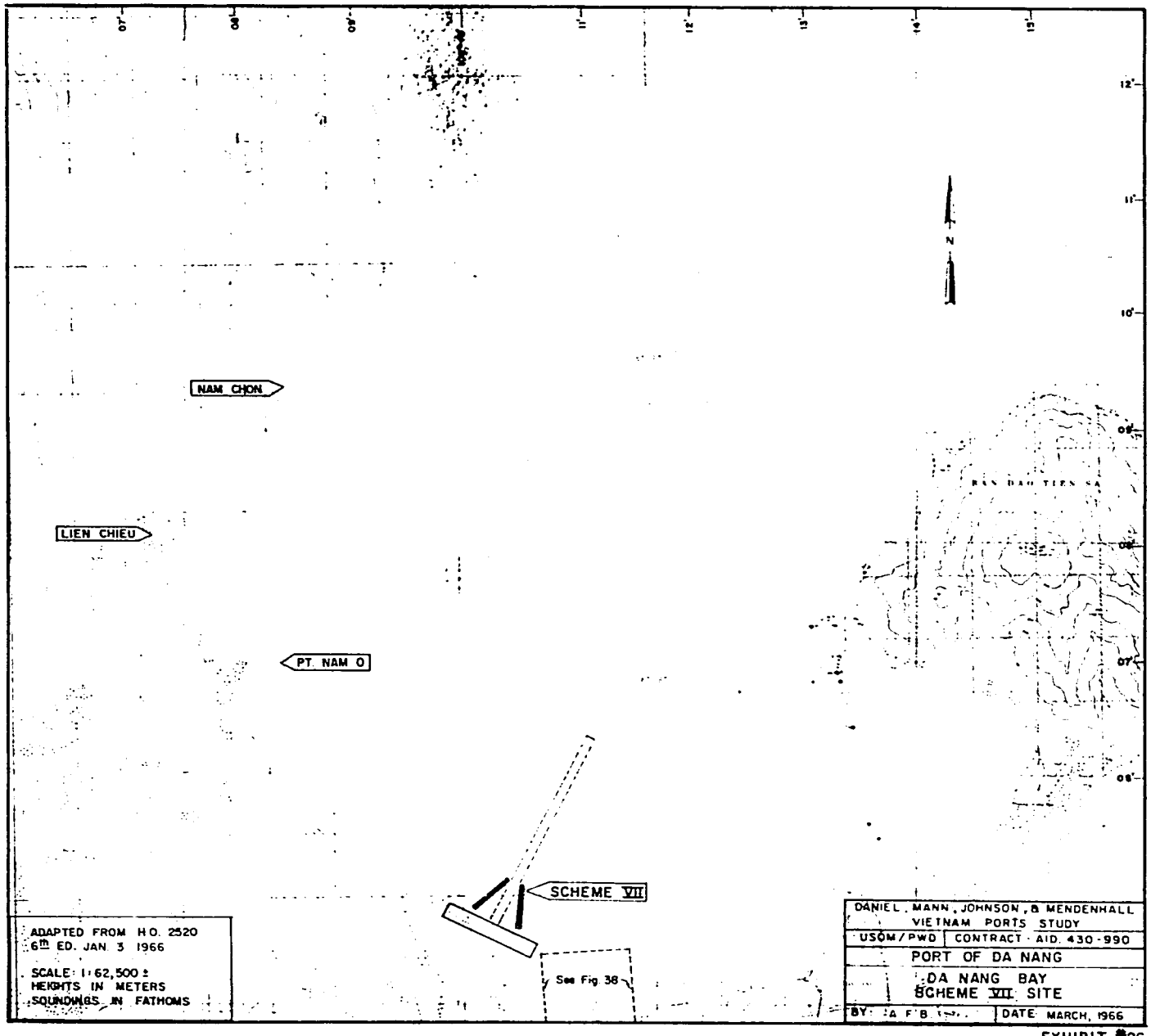


EXHIBIT #26

Rock work also was planned to proceed as much as possible during the monsoon season, placing jetty rock when conditions permitted, and slope revetment at the dredged berths at other times. During the interval to the next monsoon season, the jetty work could proceed full speed, and during that period, partial completion would suffice for the port to be in operation. Some quarrying of fair quality rock already has been done about 5 kilometers from the proposed site.

The House Fall system is illustrated by Exhibit 30. Exhibit 27 shows how it compares with the standard ship's gear-to-wharf method. It is described in more detail in the Cargo Handling volume, but briefly it is nothing more than a "cargo beam", "gin pole", or other secure substitute for the outboard cargo boom in the standard ship's gear. The ship's standard boom is designed to reach out over a wharf that is within about 8 meters of the side of the ship. The house fall, as still used to some extent on the East Coast of the United States, originally was often used to drop the load on an upper floor mezzanine of a transit shed, sometimes beyond the reach of a ship's boom. Now it is more often used as an extra hook in a long hatch.

There is a limit to how far the house fall can be worked from the side of a vessel. If the earth can be shaped to stand vertically from -11 meters to above high tide, there is no problem; this, with the assistance of concrete and steel, is the modern deep water wharf. If there is not time to build the wharf, or if the need is temporary, and the earth will stand on a moderate

Figure 36. Panorama to west. Thanh Khe (Phu Loc) stream mouth, Nam O Point.

Figure 37. Panorama to the east, toward Da Nang.

slope like 1.5 to 1, or as steep as 1 to 1, the house fall becomes a workable substitute for the ship's boom. The Scheme VII site gave every promise of suitable soil.

Basin development is governed by the need to turn vessels around and otherwise maneuver them with tug assistance, and by the hydraulic aspects of the basin and the entrance channel. The minimum requirements are about the same whether for military or commercial cargo vessels. For long range permanent use, it is feasible to spend extra money on a more than minimum basin. Thus, the changeover from the house fall to standard wharves could have been accomplished in a number of ways; the only problem was one of adapting to needs of the ultimate basin.
As is apparent from Exhibit 27, the conversion from the house fall system to a standard wharf consists simply of removing the cargo beam and supports and the temporary bresting dolphin (or these could be simply wide floating camels), and superimposing the wharf.

Scheme VII (Commercial Port)

At this time, the military appear to be continuing with the Observatory Point plan as previously described, so Scheme VII will be considered on its own merits as a potential Port of Da Nang. The basic concept would remain the same, but construction urgency probably would not be such as to warrant any temporary expedient such as the house falls. The construction cycle would stress economy more than speed; this might dictate shifting of the basin more to seaward. However, when a harbor is "scabbed" onto the coast line, the more complicated relationship between the rock work, dredging, and fill work often makes the "obvious" the more expensive. Comparative preliminary estimates in connection with Scheme X indicated that could be the case. For the purpose of this study, Scheme VII, located about as shown on Exhibit 26, will suffice. The relative position of the two jetties should be carefully considered, although a very similar small harbor configuration on the California coast is doing well. Wave and surge estimates and diffraction-refraction analyses should be made.

Site for the proposed facility is in an area of shallow sand flats and low upland sand dunes, as shown by Figures 36 and 37.

Advantages of the location are:

1. Nearness to city utilities and labor supply.
2. Elimination of congestion and bridges for access to Da Nang.
3. Extensive expansion possibilities.
4. Reduced construction time requirement.

5. Relatively unobstructed site, apparently much of it public domain (Figures 36 and 37).
6. Close to main coastal railroad and Highway 1 (Exhibit 33).

Toward Da Nang from the proposed Scheme VII site, the land area covered by Figure 38 is occupied largely by abodes of the type shown in Figure 39.

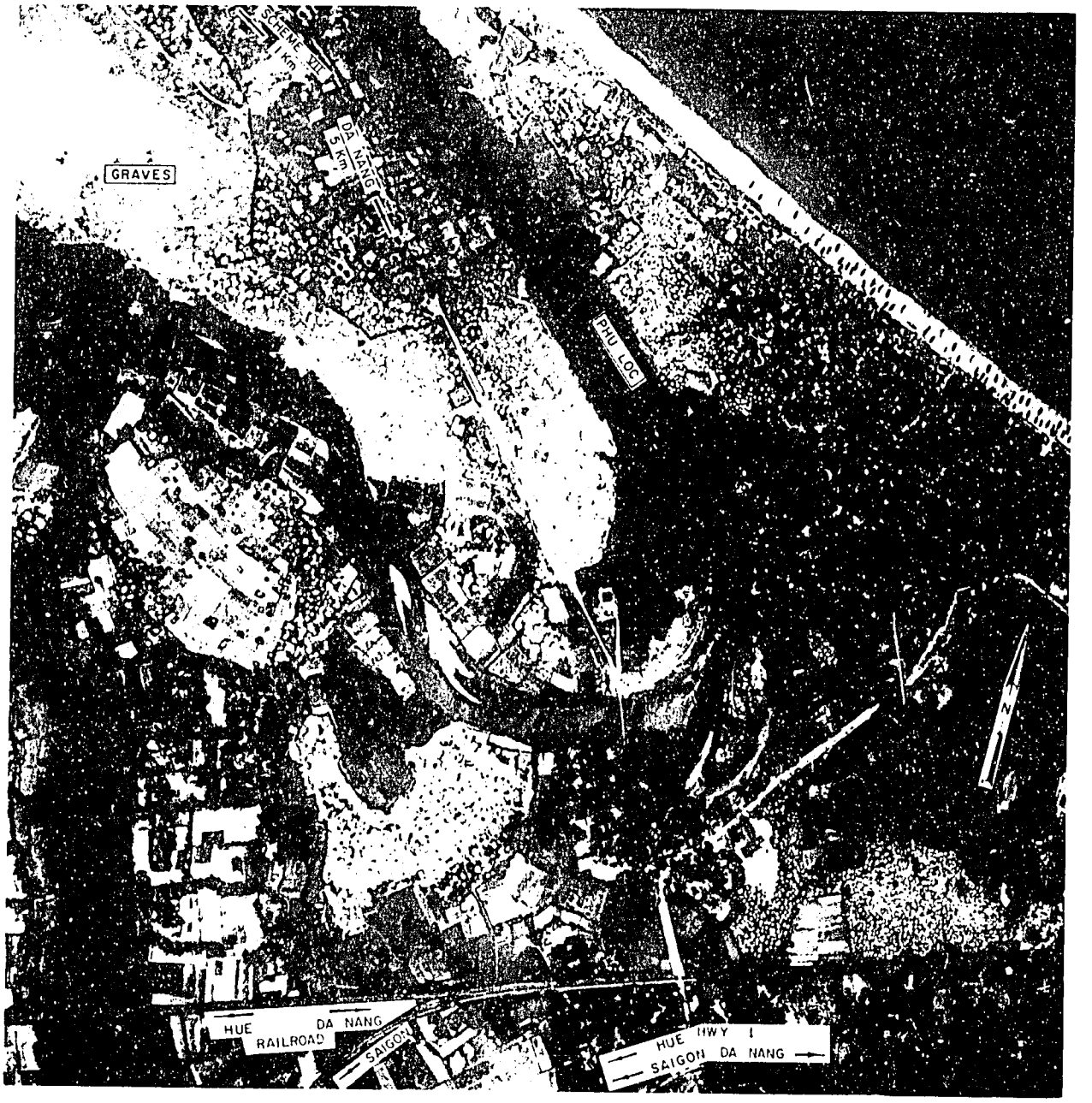


Figure 38. Area S. W. of Scheme VII site.
Scale 1:8500 See Exhibit 26 for location.

There are many graves in this area, but with a few exceptions, these can be avoided. Some access road widening along an existing right of way toward Da Nang would be required. Inland, the terrain is comparatively undeveloped as Figure 40 shows.

Figure 39. Community development between Scheme VII site and Da Nang.

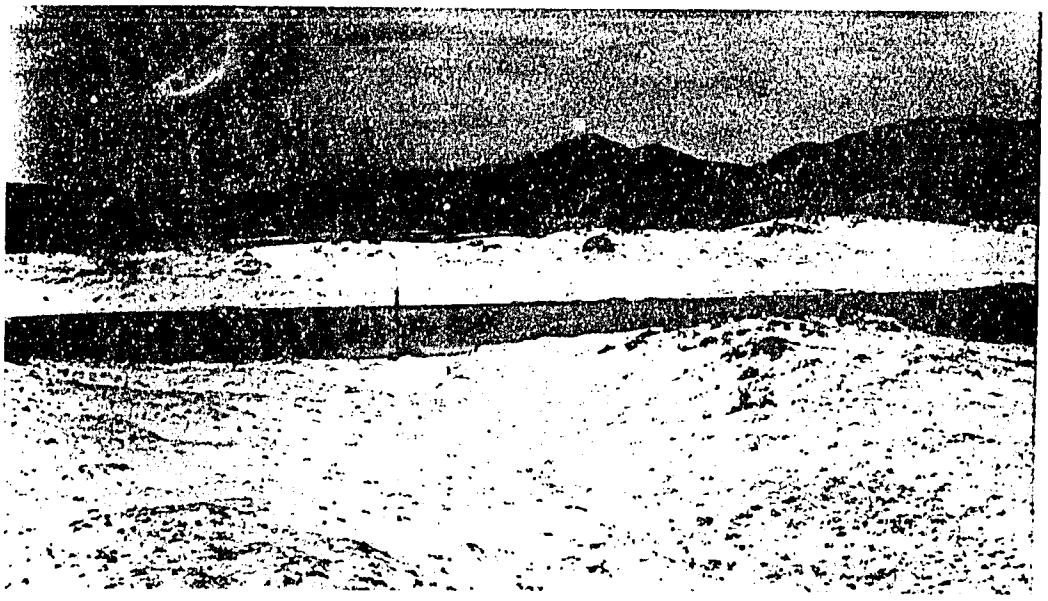


Figure 40. Inland of Scheme VII site. Phu Loc stream.

The best site for the future Port of Da Nang must first of all be one that promises a favorable benefit-cost ratio, measured basically in terms of transportation savings and other tangible benefits to Viet-Nam. It should be a site compatible with the future growth of the municipality of Da Nang.

Scheme VII has a formidable array of favorable factors as follows:

1. Convenience to labor supply.
2. Convenience of railroad access.
3. Convenience of highway access.
4. Convenience of ship access.
5. Negligible maintenance dredging required.
6. Low probable property cost.
7. Relatively available Da Nang City utilities.
8. No removal of extensive existing construction required.
9. Simplicity of security because of isolation.
10. Site available for expansion.
11. Nearness to probable future industrial development area.
12. Minimum traverse of congested urban development for cargo bound to or from terminal.
13. Lower construction cost because of favorable topographic and hydrographic features of site.
14. Structural adequacy of foundation for construction.
15. No costly crossing over Da Nang River required.
16. Arriving and departing ships need not traverse channels congested by small boats.

Location for the future terminal within the area concerned can best be determined immediately prior to construction of facilities. The sand dunes that have occupied the general area for centuries have, no doubt, pre-consolidated the underlying strata. Thus, though the soils are very probably favorable, a number of borings should be made. The following conditions may be determinants at the time when construction is planned and may affect to some degree the exact site to be developed:

a. Location of future airport clearance zone boundaries.
b. Growth of Da Nang residential areas.
c. Relative cost of construction materials or dredging.
d. Development of future industrial areas.
e. Location of future National Highway improvements.
f. Construction time schedule (urgency of accomplishment).

Item "f" in the preceding table (urgency of accomplishment) will be of concern in determining the relative north-south positioning of the facility, as above mentioned. Position shown for the terminal is that which can be accomplished at any season of the year, because dredges could work within the landlocked basin during annual Monsoon storms.

Dredging spoil developed in excavation of the cargo basin should be wasted, inshore of the high water line on low value property lying immediately northwesterly of the terminal site, or on beaches near the terminal. In that connection, a further study of littoral drift should be made.

Construction cost of the recommended port terminal will not be greatly affected by slight changes in location position or orientation within the area concerned.

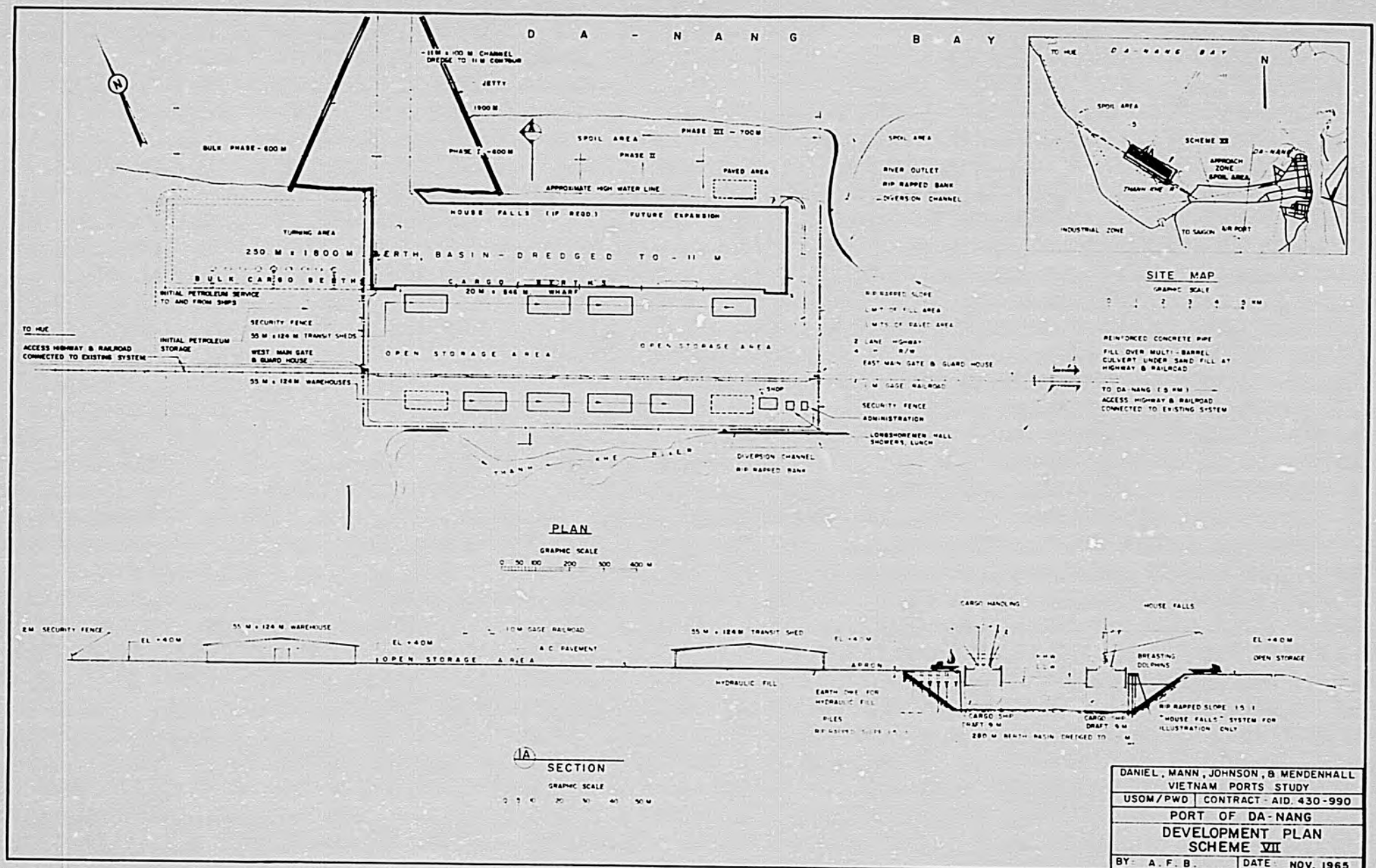
SCHEME VII

DA NANG BAY DEVELOPMENT

PORT OF DA NANG

CONSTRUCTION COST ESTIMATES

I T E M S	PHASE I	PHASE II	PHASE III	TOTAL
Dredging (11 M):				
Channel	1,003,000.	___	___	1,003,000.
Basin	913,000.	747,000.	___	1,660,000.
Breakwater:				
Armor	441,000.	___	___	441,000.
Class "A" Rock	352,000.	___	___	352,000.
Class "Q" Rock	214,000.	___	___	214,000.
Riprap & Filter	388,000.	224,000.	___	612,000.
Wharf	3,330,000.	2,220,000.	3,330,000.	8,880,000.
Transit Sheds	1,652,000.	826,000.	1,652,000.	4,130,000.
Warehouses	1,180,000.	2,360,000.	___	3,540,000.
Misc. Buildings	467,000.	___	___	467,000.
Road (2 Lane & R/W)	797,000.	___	173,000.	970,000.
Railroad	564,000.	___	97,000.	661,000.
A.C. Pavement	768,000.	557,000.	152,000.	1,477,000.
Security Fence	50,000.	___	___	50,000.
Utilities & Equip.	691,000.	213,000.	96,000.	1,000,000.
TOTAL. . .	$12,810,000.	$7,147,000.	$5,500,000.	$25,457,000.



DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
PORT OF DA-NANG	
DEVELOPMENT PLAN SCHEME VII	
BY A.F.B.	DATE NOV. 1965

EXHIBIT #27

Proposed Facilities

Ship access to the proposed port terminal will be of paramount concern. To facilitate entry to the terminal area or berthing basin, it is recommended that the entrance channel be excavated initially to have a depth of 11 meters below datum, which appears to be about 0.5 meters below L. L. W. This must be verified. Ships could pass in a channel of 100 meter width, but major ships need not and should not do so.

Highway access for trucks and other vehicles bound to or from the port can be conveniently accomplished from nearby National Highway No. 1. Initially, a two lane paved highway, 7 meters in width, should be built to provide access to the terminal area from the easterly or Da Nang side. At such time as the bulk cargo facility is to be constructed, it may be expedient to open another highway connection at the northwesterly end of the terminal area. When congestion occurs frequently, or when vehicular traffic count approaches 3,000 vehicles per day, additional width or lanes should be provided to carry the load. Traffic of such intensity (in excess of 3,000 vehicles per day) may also warrant grade separations at railroad crossings and at points of interchange with other important highways.

Railroad access. Delivery of cargo to or by railroad can be an important traffic factor for the Port of Da Nang. The recommended facility site

(Scheme VII) has easy access to the north and southbound railroad. The port terminal, because of its convenient location, can also receive and store cargo for consolidation into carload lots.

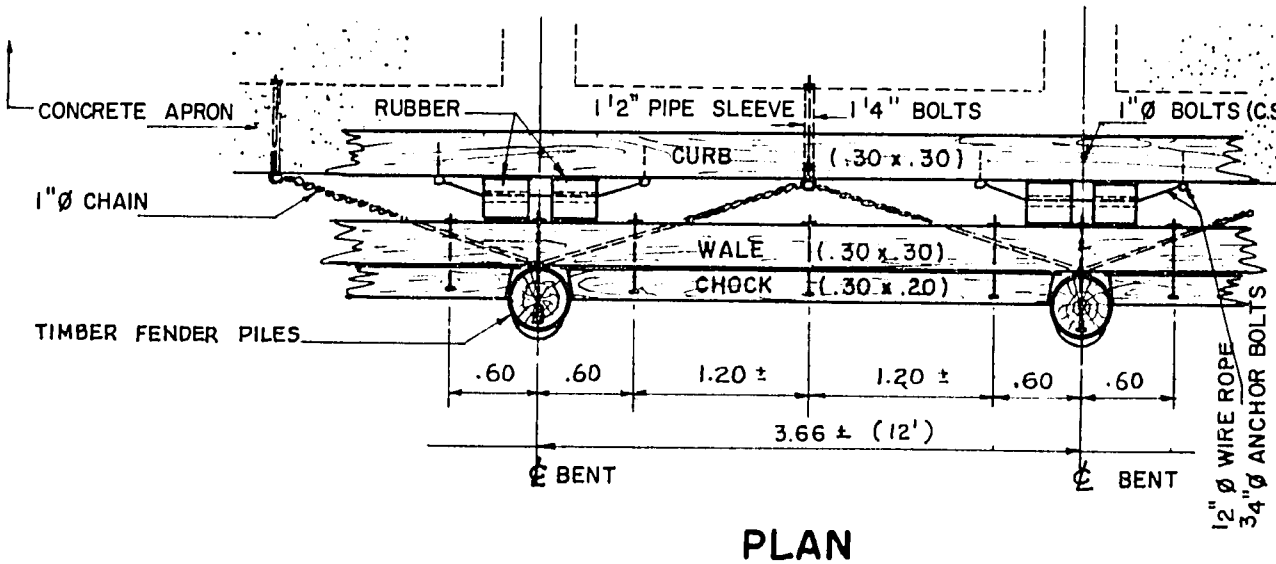
Cargo wharves are proposed to be of reinforced concrete with prestressed concrete piles. The design recommended can also be accomplished with H piles, as shown on Exhibit 28, depending upon availability. The philosophy of flexible fenders of a type such as illustrated by Exhibit 29 is that it is easier on ships, and therefore popular with shipowners, but it may also simplify wharf design in easing impact loads.

Wharf deck design should be for 600 pounds per square foot, or concentrated loads such as cranes (as noted below), railroads, trucks or fork lifts, with adequate allowance for horizontal loads induced by ship impact or warping winches. Such details are matters for final construction designs.

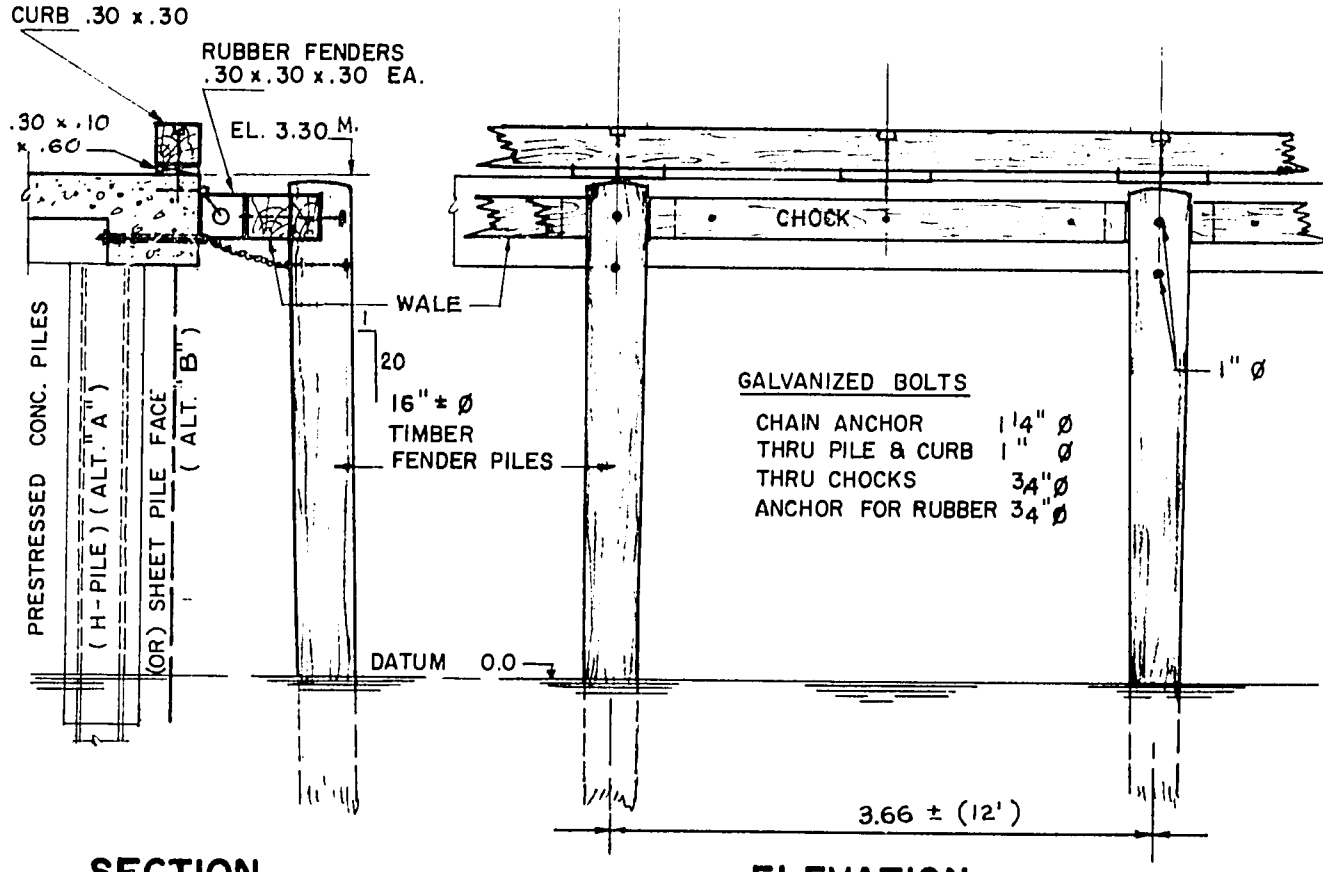
"House falls" operations sites, to augment the port's cargo handling potential, probably will not be required unless urgent demands must be met. The type of facility and its method of operation are illustrated by Exhibit 30.

Cargo handling equipment imposing heavy wharf loads may be indicated in the future. A more detailed examination and evaluation of cargo handling problems in Viet-Nam is included in the volume, "Cargo Handling".

Eventually, the Port of Da Nang may need to efficiently handle heavier lifts requiring a modern gantry crane. If considered in the design, this load can



PLAN



SECTION

ELEVATION

SCALE = 1 : 50

3.0 2.0 1.0 .5 0 1.0 2.0 3.0 METERS.

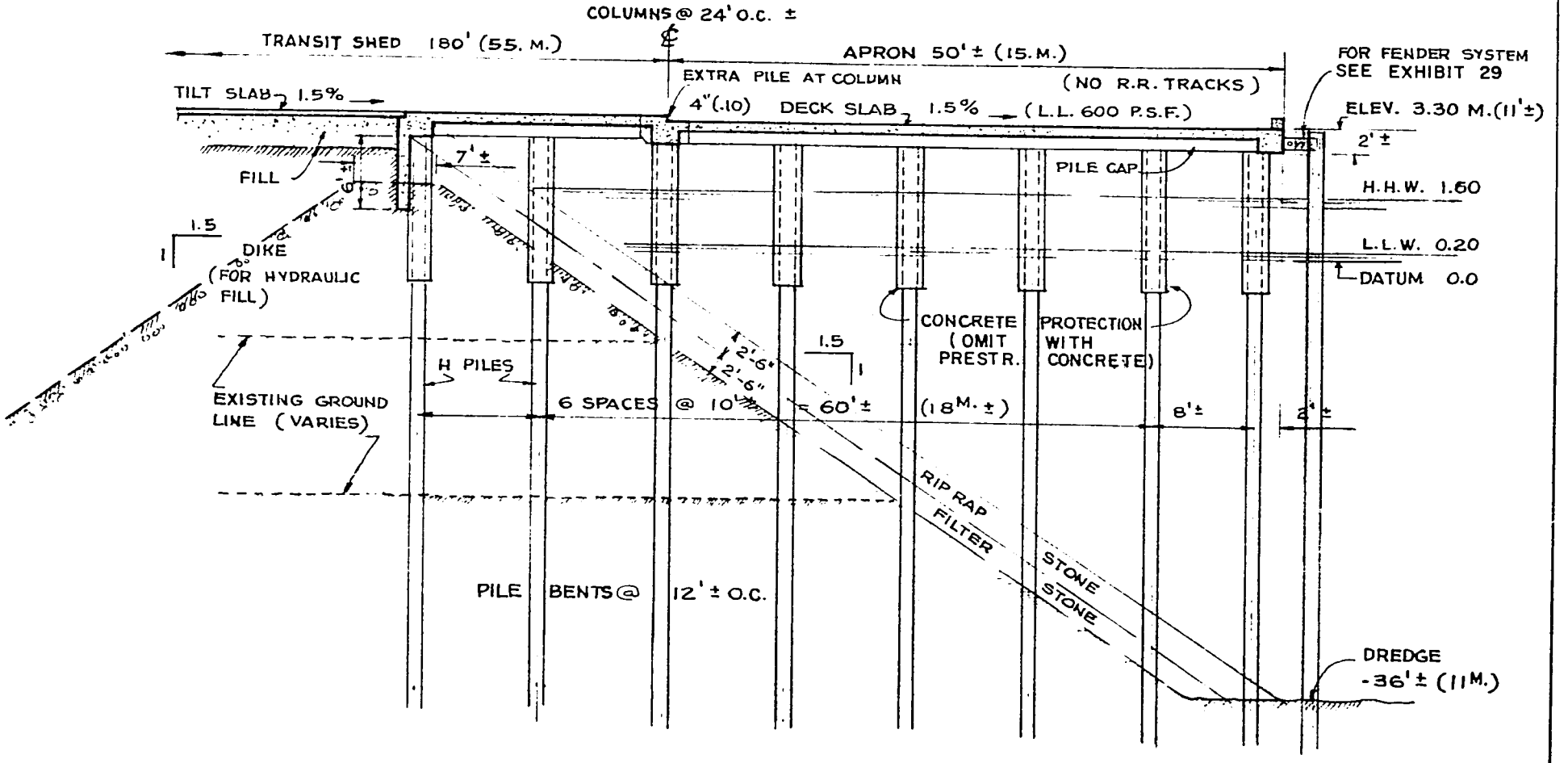
10 5 4 3 2 1 0 5 10 FEET.

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT-AID 430-990
PORT OF DA NANG	
TYPICAL FENDER SYSTEM	
BY: A. F. B. & J. L-J.	DATE: NOV. 1965

EXHIBIT #28

NOTE:

IF MARGINAL RAILROAD TRACKS AND/OR WHARF CRANES REQUIRED, THEN A DIFFERENT DESIGN IS NECESSARY. PRESTRESSED CONC. PILES MAY BE USED.



TYPICAL CROSS SECTION

SCALE 1 : 150

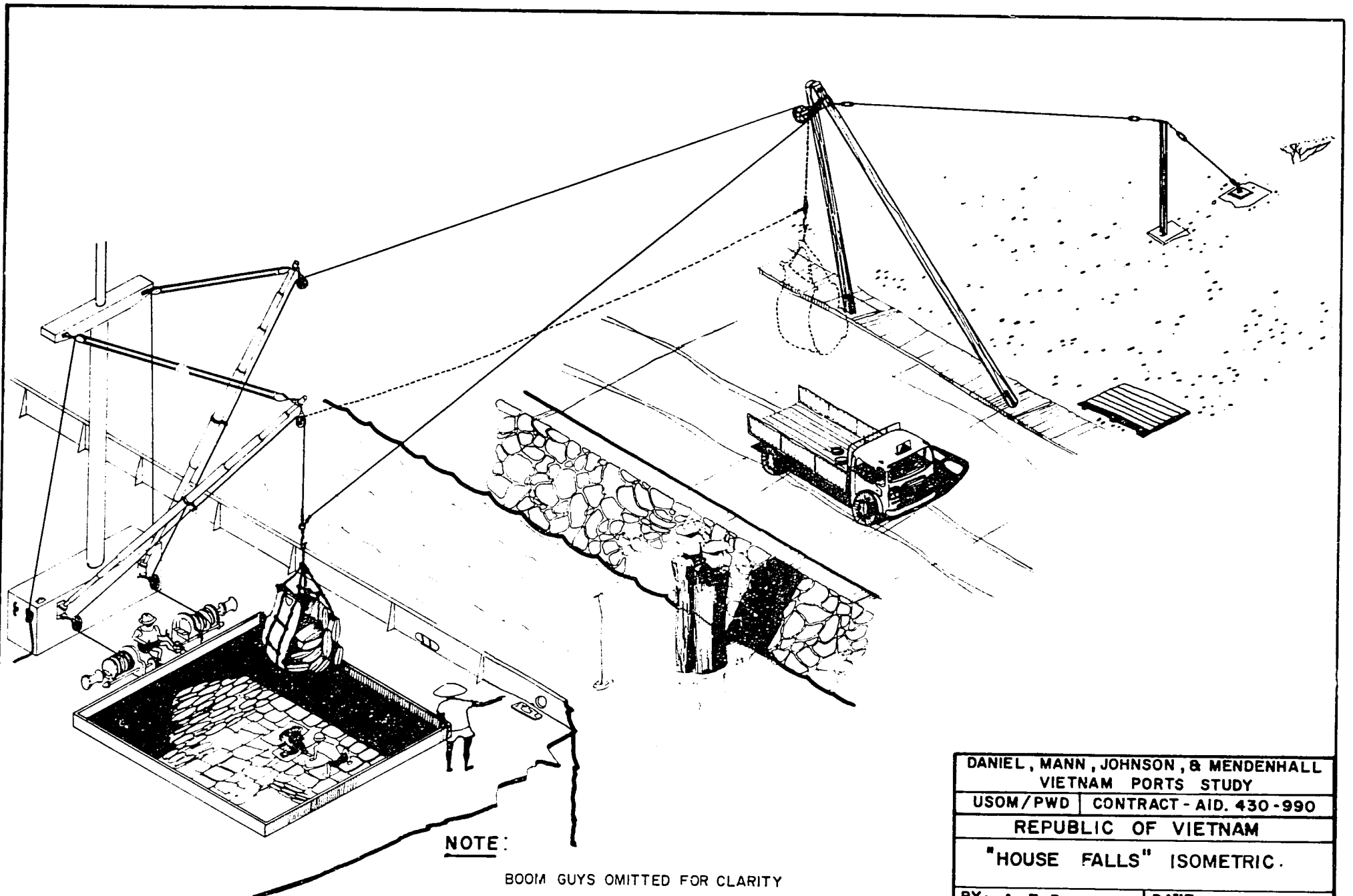
5 4 3 2 1 0 5 10 METERS.

20 15 10 5 0 10 20 30 FEET.

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/ PWD	CONTRACT - AID 430-990
PORT OF DA NANG	
PILE SUPPORTED WHARF	
BY: A. F. B.	DATE : NOV. 1965

EXHIBIT #29

EXHIBIT #29



NOTE:

BOOM GUYS OMITTED FOR CLARITY

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
REPUBLIC OF VIETNAM	
"HOUSE FALLS" ISOMETRIC.	
BY: A. F. B	DATE: NOV. 1965

EXHIBIT # 30

EXHIBIT # 30

often be provided for at little additional cost, and without additional piles.

Petroleum service and storage, shown as Bulk Phase, will, under past policy whereby operators provide their own facilities, come about when they wish to fund the construction, perhaps on a leaseback arrangement. Provision of a smaller petroleum facility could be incorporated as a part of the Phase I improvement. This initial or smaller petroleum service facility can have storage tanks located in the undeveloped site adjacent to its Phase I counterpart, while service to and from ships can be accommodated at the most westerly portion of the initially constructed wharves.

Small craft landings for transfer of cargo through transit sheds or warehouses, will be required, when space is not available at major berths. This operation can be carried on at the easterly end of the dredged cargo basin. In this location, a sloping sand bank will remain following dredging. Barges, landing craft or junks can be accommodated there.

Breakwaters to protect the cargo basin and its entrance channel from surge and wave action are required. Wave energy passing through the narrow gap will be diffracted and most of it spent on the "spending beach". That which passes through the beach gap will again be diffracted in the basin.

The breakwaters or jetties will also serve as groins against which littoral drift, either up-coast or down, will lodge. Since littoral movement is mostly in the wave zone, the breakwaters need extend only far enough to

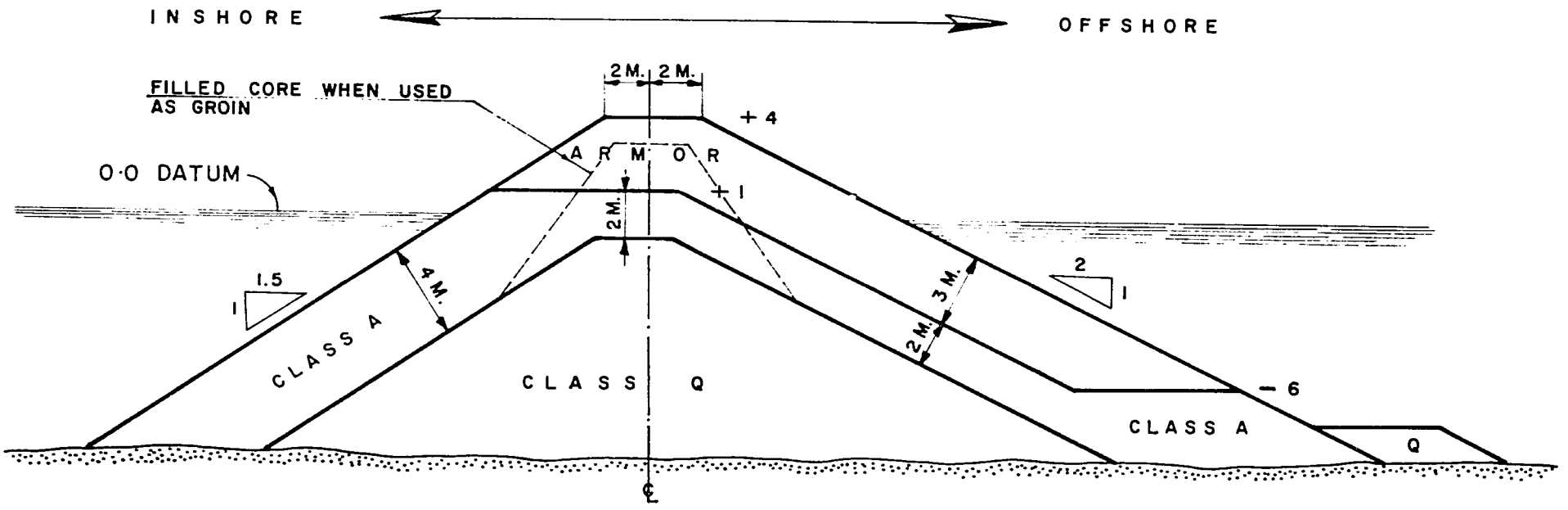
provide a diffraction basin, and to intercept the most of the littoral drift. The narrow throat will also tend to channel tidal ebb and flow and prevent silt from settling out. To these ends, it is important that the breakwaters have as tight a core as practicable.

As the breakwaters or jetties will never be subjected to perpendicular ocean waves, the smaller section, Exhibit 31, may be used instead of the ocean exposure section, Exhibit 32, as at Rocher Noir Bay and other exposed locations.

Transit sheds (55 meters x 124 meters) are proposed for two of the three initial berths. Some cargoes will require assembly, customs clearance, and other processing in secure covered areas. One berth should be tried as an open berth, until needs are better defined.

Warehouses for storage of cargoes for longer periods of time, will be needed if the business community does not provide adequate warehousing in Da Nang. During the course of this contract, plans and specifications have been prepared for standard warehouse buildings or transit sheds of this size.

Stream diversion will be required to prevent shoaling of the cargo basin by the Song Phu Loc. Simple dredging will provide a new outlet for the stream on the westerly side of the terminal site. Revetted banks will prevent the stream re-entering its former channel through the cargo basin. A meandering of the same stream, near the southerly edge of a cargo storage area is



BREAKWATER FOR TERMINALS AND BASINS WITHIN NATURAL HARBORS

SCALE : 1 ÷ 250

ARMOR ~ 10,000 LB. ROCKS - SPECIFIC GRAVITY OF 2.65 - RANDOM PLACEMENT

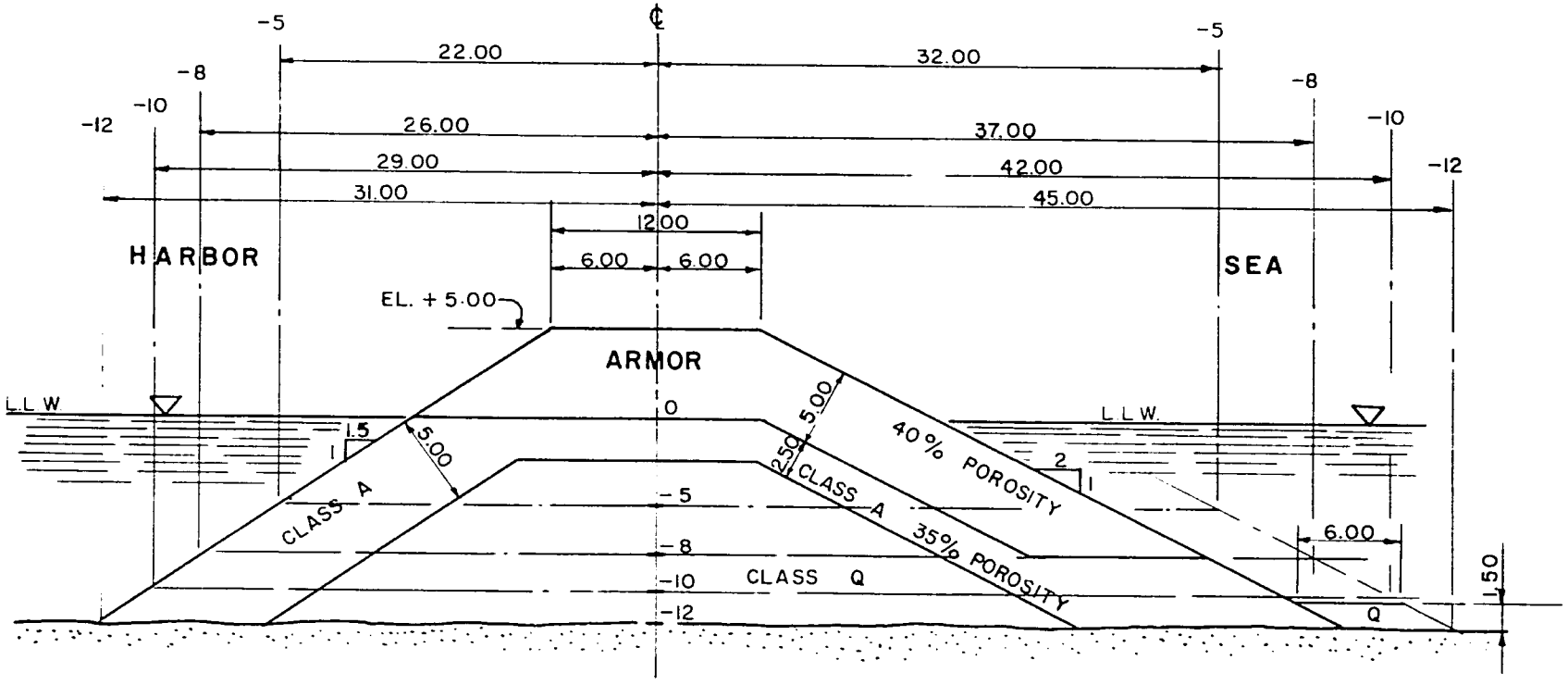
CLASS A ~ 1,000 LB. TO 2,400 LB. WITH LARGER STONE PLACED ON OUTER SURFACES

CLASS Q ~ WELL GRADED QUARRY-RUN WITH LARGER STONE PLACED ON OUTER SURFACES

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
BREAKWATER FOR SEMI-PROTECTED LOCATIONS	
BY: W.J. MURPHY	DATE: SEPT. 17 '65

EXHIBIT # 31

EXHIBIT # 31



TYPICAL BREAKWATER SECTION

SCALE: 1:40

ARMOR – 12 TON FOR SPECIFIC GRAVITY 2.62. ROCK PLACED PELL MELL.

CLASS A – 1000 # TO 2400 # WITH LARGER STONE PLACED ON OUTER SURFACES.

CLASS Q – WELL GRADED QUARRY-RUN WITH LARGER STONE PLACED ON OUTER SURFACES.

ROCHER NOIR BAY	—	SCHEME # 1
NAMO POINT	—	SCHEME # 4
LIEUCHEOU BAY	—	SCHEME # 5

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT-AID 430-990
PORT OF DA NANG	
TYPICAL BREAKWATER SECTION	
BY: J. LUTTMAN-JOHNSON	DATE: JULY 1965

EXHIBIT # 32

EXHIBIT # 32

similarly scheduled for re-routing.

Miscellaneous service utilities and adjunct facilities will be required to enable the Port of Da Nang to function efficiently. Discussion of these follows:

Water will be required for sanitary, mechanical, washing and fire protection purposes. About two ship service outlets should be provided at each berth. Because of Scheme VII being convenient to Da Nang, it may be economical to connect the terminal distribution system to city water mains. It is understood that a program is now underway to increase the supply and improve the quality of that supply.

In the event that municipal water cannot be obtained from city mains, wells should be drilled near the terminal site to obtain required quantities of water. Depending on the quality of water produced by such wells, some purification may be required prior to use.

Administrative offices for the conduct of port business functions and storage of records are recommended and should be located at the Port. Adequate parking area should be provided adjacent to the office. Certain customs and other Government functions should also be allotted space in the Port administrative office.

Service shops for Port maintenance and minor improvement operations are recommended.

Personnel facilities. Adequate toilet facilities for men and for women longshoremen are basic, and should be spaced not less than every two berths. Gang showers should be installed. Other facilities must be approached carefully, considering the Vietnamese custom of the siesta, at home if possible. A personnel center, with food service and other amenities might be well advised.

Fire protection arrangements for the terminal area will be the primary responsibility of the Port administration, but should be arranged on a cooperative basis with the municipality of Da Nang. As the terminal area and operations are expanded, a station at the terminal should be encouraged, and plans should be made toward that eventuality when the need develops.

A simply truck equipped with pumps, hoses and chemical devices should be maintained specifically for fire fighting purposes. One tug should be equipped with fire pumps and nozzles.

Electrical service should be obtained from municipal sources for:

a. Illumination of working areas and perimeter security zones.
b. Water pumps for sanitary and fire protection purposes.
c. Illumination etc., of offices.
d. Operation of equipment such as cranes or conveyors.

Pavement & drains. Following placement and compaction of fill in areas inboard of the wharf structure, utilities should be installed and the area paved with rock base and asphalt concrete. Such pavement will slope

to inlets or collection manholes. From such collection features, storm drainage should be piped to outfalls under the perimeter wharf.

All open terminal yard areas should be surfaced with bituminous concrete pavement except areas infrequently used or reserved for future development and petroleum handling sites, which should be surfaced with Portland cement concrete pavement.

Communications. As business activity at the Port of Da Nang increases, it will be found expedient to install a telephone switchboard. Telephone jacks should be provided at each berth.

Communication with ships and/or pilots should be provided by short wave radio tied in the port pilot terminal.

Tugs will be required to turn and warp vessels to berths. Wind conditions (Exhibit 8) will often dictate tug assistance to large vessels berthing or getting under way, otherwise more consideration could be given to a basin large enough to permit maneuvering unaided. Two 500 or 600 hp tugs are required.

Security fence around the port terminal area is recommended. Though such a fence is not thief-proof, its presence is in fact a strong deterrent if it stands clear of buildings and other obstructions to possible surveillance. Guards should patrol cargo handling areas and vital utilities to prevent pilferage or sabotage.

Mechanical Equipment. Maintenance, operation and improvement of facilities will require certain mechanical equipment. The following items will be required at various stages in the port's expansion.

a. truck or trucks for hauling tools and supplies or for cleanup.
b. power sweeper for cleaning streets and paved areas.
c. road grader for maintaining street shoulders and unpaved storage areas (Provincial Public Works)
d. small carpentry, plumbing, electrical & painting shops with supplies.

Economic Justification

A review of the future transportation requirements of Da Nang and its hinterland indicates that in the past decade there has been a basic intra-country requirement for about 200,000 tons annually, mostly from Saigon, much of that rice originating in the Mekong delta. Some statistics on this traffic are given in Table IX, discussed on pages 79 and 80. The future of this trade has been studied in some detail in the report on the Port of Can Tho, in the rice growing area. It appears that this traffic will continue at about the same level.

Table V presents future general cargo projections for the Port of Da Nang, reaching a total 900,000 tons within 5 years after stability is achieved. This means 700,000 tons of international trade, about the capacity of the three berths proposed for Phase I construction, at a cost estimated at $12,812,000. The problem then is one of justifying this expenditure, and considering the alternatives to the building of the ideal deep water port facility at Da Nang.

The provision of port facilities so that a country like Viet-Nam can carry on international trade hardly needs justification. Several dollars per ton will not stop a consignee who has paid perhaps $160 per ton for steel, $6 a ton to load it in the United States, and another $40 per ton for shipping it across the ocean. The owner of the facility that can best land the cargo can exact $5 a ton, if necessary.

The general philosophy of port location in Viet-Nam is discussed in the Basic Information volume. If Viet-Nam has 10 deep water berths now, additional facilities needed should be built where they will do the most economic good. This often brings out the fact that at one site a berth may cost more than at another, and yet be favored by overall economy. The added construction cost must then be justified by added annual savings.

Annual cost of the proposed Phase I development (Scheme VII) will be:

Amortization (40 year period) and 3-1/2% interest on estimated construction cost of $12,812,000 x .0468	$ 600,000
Dredging maintenance - 5%/yr. on $1,917,000.	96,000
Maintenance of balance of facilities (1%)	109,000
Operating expense, reimbursable.	0
TOTAL ANNUAL COST	$ 805,000

Status quo alternative, in light of the above considerations, does not appear favorable. In the past, there has been a tendency to ship international trade through Saigon, relying upon coasters between Saigon and Da Nang; this has already proven uneconomical. For the future, with more tonnage at both Saigon and Da Nang, and more facilities needed in the Saigon-Vung Tau area, it is necessary only to consider whether the savings through elimination of transshipment will amortize the increased cost of a facility at Da Nang, if any, over building the same capacity at Saigon-Vung Tau. Trans-ocean shipments will be delivered to Da Nang for about the same cost as at Saigon,

assuming that both ports have adequate facilities. Saigon is handicapped by its channel, and Da Nang by being a comparatively small port slightly off the "beaten path".

Coaster transshipment of 700,000 tons thus would be entirely added expense, and would require additional wharf space both at Saigon and at Da Nang. Shipping charges alone, at about $10/ton, or $7,000,000/year, answer this question.

Lighterage of deep draft cargoes has become the established practice at Da Nang. It was a step in the right direction, and definitely more economical than transshipment out of Saigon, but this method does have some serious shortcomings. First, there is the extra cost of discharging to lighters, and the haul to a wharf. This operation appears to cost about 300 piastres or $4 per ton under present conditions. This appears high for normal conditions, or as compared to Saigon costs. Resumption of free competition probably would drive the price down, perhaps to $2/ton, compared to $0.75 for direct unloading to a wharf. The direct savings, $1.25 x 700,00 = $875,000.

Pilferage, loss and damage also weigh against the lighterage system. Theoretically, the stevedore can protect against pilferage and loss through human error by proper checks and documentation, but these procedures in themselves cost money, and pilferage can never be completely checked, though containerization is a long step in that direction. In an case, the cost, as usual, is paid by the consignee.

Damage to cargo is almost unavoidable, and is multiplied and increased by the two handlings involved in lighterage.

Cargo comes out of the hold in cargo nets, slings, or on stevedore pallets. Not only is it in second jeopardy when again offloaded from the lighter, but it may be subject to careless storage in the lighter. On the wharf, a different system of handling may damage a crate that would survive handling in a sling. Reliable figures on loss and potential savings are difficult to establish, and depend upon many factors. However, all agree that considerable improvement is possible.

A knowledgeable estimate on major U. S. ports places the pilferage rate at about 10 cents per ton of cargo. In fact, the pilferage is heavy in small radios antibiotics, and similar high value items. It is extremely doubtful that Viet-Nam is losing only 10 cents per ton, or $70,000 on the Da Nang 700,000 ton potential. Under 1965 lighterage operating methods at Da Nang, the 1970 savings could be guessed at $140,000 - $70,000, or $70,00 saved.

Ship delay because lighterage usually is slower than direct unloading, may result in surcharges at the offending port. Night work is difficult at the anchorage. Then comes the monsoon season when days are lost with no production. If a vessel can be unloaded at a wharf at the rate of about 1000 tons per day, 700,000 tons involve 700 days alongside. If the same tonnage by lighterage takes 50 percent longer, or 350 days, at $3,500/vessel-day, extra cost is $1,200,000. How much of this would actually be charged to the consignee is problematical, but something approximating $1,200,000 must be expected.

Benefits to the consignee, from the above, thus include:

Stevedoring cost savings	$ 875,000
Ship's time savings	1,200,000
Pilferage, loss, damage reduction	70,000
	$ 2,145,000

These values are based upon three berths operating at about 700,000 ton capacity within 5 years. Refinement of computations would call for additional funding during the construction period, etc. This would be more than offset by the fact that Phase II and III, and bulk in years to come would benefit from the substantial channel development, road, railway, and other costs entirely charged off, and justified by, Phase I.

Benefit-cost, based upon Scheme VII:

$$\frac{\text{Annual benefit}}{\text{Annual cost}} = \frac{2,145,000}{805,000} = 2.6$$

Via Da Nang - Cam Ranh. There remains also the question of whether some other port, plus coaster or rail haul to Da Nang might better serve the Da Nang area. Only the preparatory costs such as dredging, breakwater, railroad and highway would need to be justified at the second port, such as Da Nang, if these "one time" costs were built at two ports instead of one. Deep water berths needed at either port to receive the overseas cargo would cost about the same. Rail facilities presumably are adequate to either port or city, but transshipment by coaster would require additional facilities at

both ends of the transshipment. Then:

Rail haul from Cam Ranh to Da Nang .015 x 576 km = $8.60/ton

Coaster haul from Cam Ranh to Da Nang .011 x 540 km = $5.95/ton

The coaster, however, would require additional berth space, both at Cam Ranh and at Da Nang. Cargo capacity per meter of coaster wharf is less than for a deep sea wharf, and the cost is not a great deal less.

Deep sea berths cost about $8 per ton-year of cargo capacity, and coaster berths about $6.50 per ton-year. Thus, the 700,000 tons to be transshipped would cost:

Shipping cost	$	5.95
Handling, both ends		1.25
Annual cost of berth .06 x 6.50 x two		.80
	$	8.00 per ton

While this is cheaper than railroad transshipment, the annual cost for 700,000 tons is over 5 million dollars. Clearly, a separate deep water port is warranted at Da Nang.

Alternate Schemes. There remains the question of whether Scheme VII, though well justified, is the best that can be done. That the location should be adjusted in final design to the most economical position has already been mentioned, as has a possible different position on the coast. The location should not be closer to Da Nang; Figure 38 shows one reason why. Oceano-

graphic considerations might suggest a location farther west. This, say at Nam O Point, would require 9 kilometers of additional truck haul into Da Nang and to the larger part of the Port of Da Nang hinterland, including An Hoa to the south. At 5.8 cents per ton-kilometer on possibly 500,000 tons backhauled 9 kilometers, annual shipping costs are increased $260,000 per year. Savings in construction cost to warrant this annual expense would need to be in the order of $\frac{260,000}{.0468}$ = $5,500,000. No such savings are in sight at Nam O, Lien Chieu, or Nam Chon.

While it is assumed that Observatory Point (Scheme O) will never be available for commercial cargo, the possibility is worth considering if the facility is "free". The 15 kilometer distance to Da Nang would surcharge every ton by .058 x 15 or 87 cents, plus the inefficiency of cargo operations off both sides of a too narrow pier. For small tonnage, this would be accepted, but for the full capacity of around 700,000 tons, the $805,000 total annual cost of the Scheme VII is approached. Furthermore, Observatory Point may not be a complete facility, lacking probably transit sheds (and they, if added, would be poorly located), railroad connections (which would cost about $1,500,000), and complete administrative facilities. Much of this tonnage also would travel through or around Da Nang, involving additional cost and traffic problems for all concerned.

Existing port future will clearly be limited to coaster operation or less, even after the deep water port is completed. As long as it is operable

without excessive dredging cost, it may as well be used for in-country shipments such as rice for the local population. The phase-out of the present port will probably be dictated by considerations such as heavy channel shoaling, need for small craft berthing, redevelopment plans for this part of Da Nang, need for recreational esplanade, or possibly a general failure of the existing wharves. In the latter case, the transit sheds might still serve as warehouses. In any case, coaster port operations will be consolidated in the deep water port at an opportune time, perhaps with the second phase construction. Coasters and deep sea vessels would use the same berths interchangeably.

Reliability of the above analysis rests on many values that could be subject to change. The ton-kilometer costs may be refined in the pending Transportation Consultants' reports. Labor and handling costs may change significantly. Cost estimates used herein are generally based upon continuance of inflation and are considerably higher than for comparable work in the United States. The tonnage projections used are subject to major decisions on An Hoa, cement, and other resouce developments. However, these factors affect more the timing than basic validity. It is evident that a deep water port at Da Nang is a sound venture.

X. CONCLUSION

A modern terminal to accommodate deep water ocean freighters is economically justified for the Port of Da Nang.

It is the recommendation of this report that an expandable terminal be constructed westerly of the city's congested urban area. At this protected site, the Port can grow to serve the expanding Da Nang economy without the penalty of expensive maintenance dredging.

The Port of Da Nang has a substantial hinterland in Quang Tri, Thua Thien, Quang Nam and Quang Tin provinces. These, and the Industrial Complex at An Hoa, plus probably the country of Laos, will generate a large increase in international trade, reaching an estimated 700,000 tons within 5 years after peace is restored. This tonnage should be shipped directly through the Port of Da Nang.

Savings in handling of this tonnage directly over a wharf, instead of lightering, will be more than sufficient to fund a modern three berth port facility.

The most effective and economical location for the required facility is on the south shore of Da Nang Bay. Traffic for the entire Da Nang hinterland should not be hauled through the municipality of Da Nang, whether by truck or by railroad.

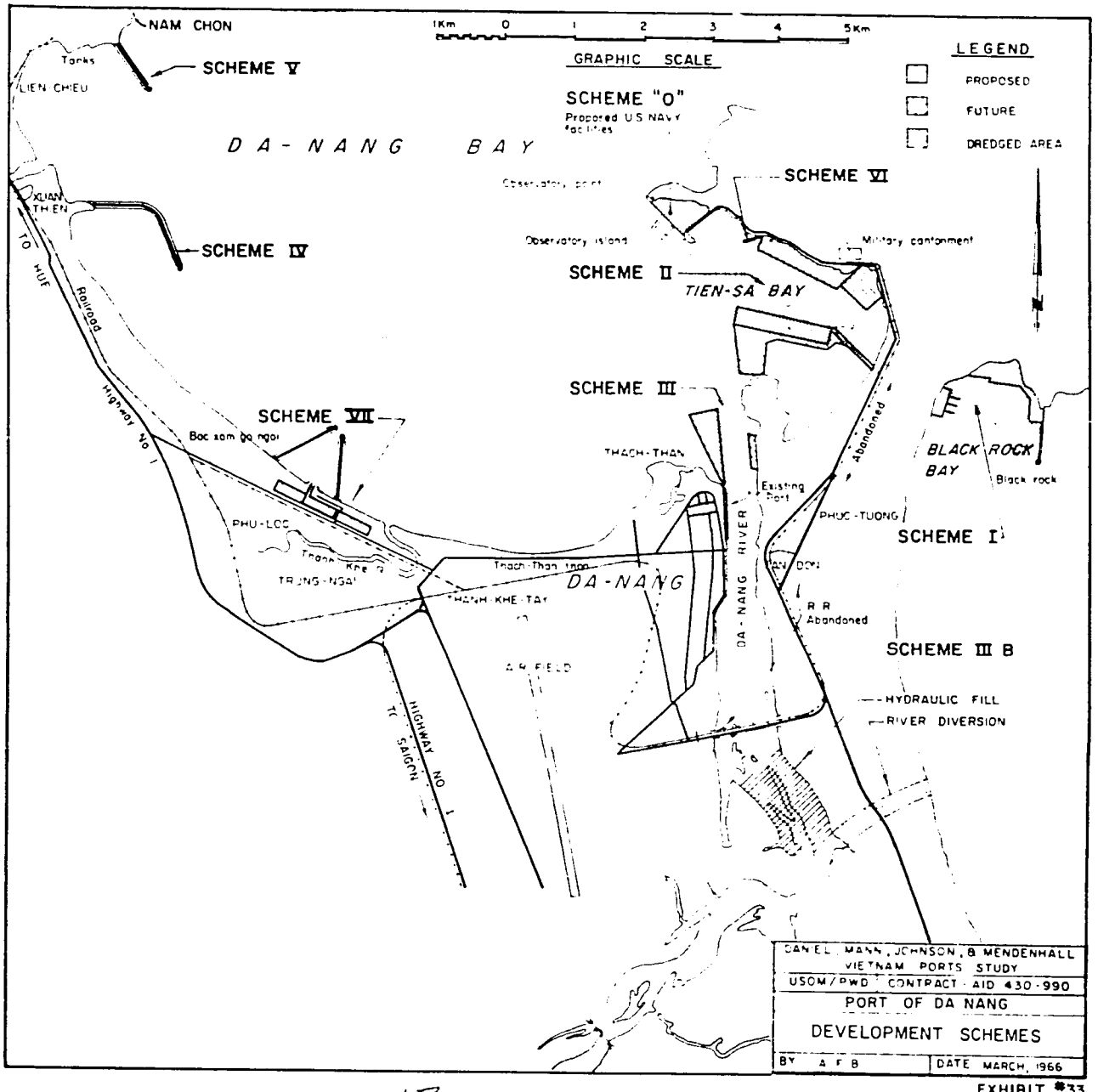


EXHIBIT #33