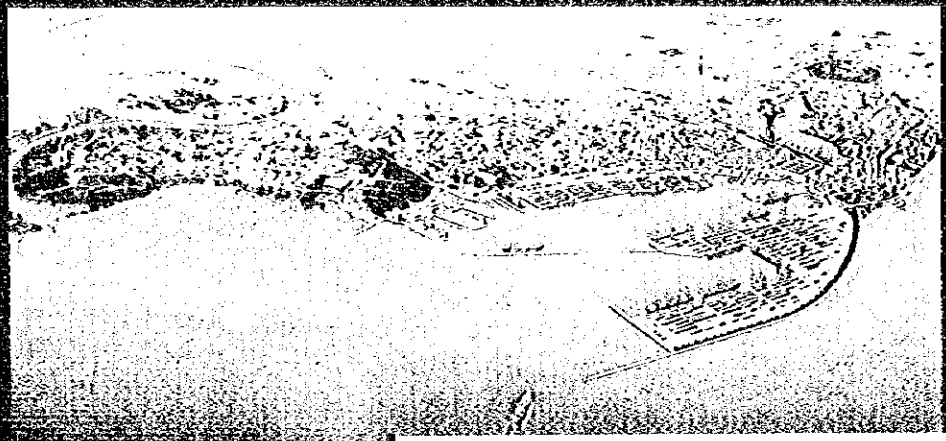
社会開発調査部報告書

NO. 52

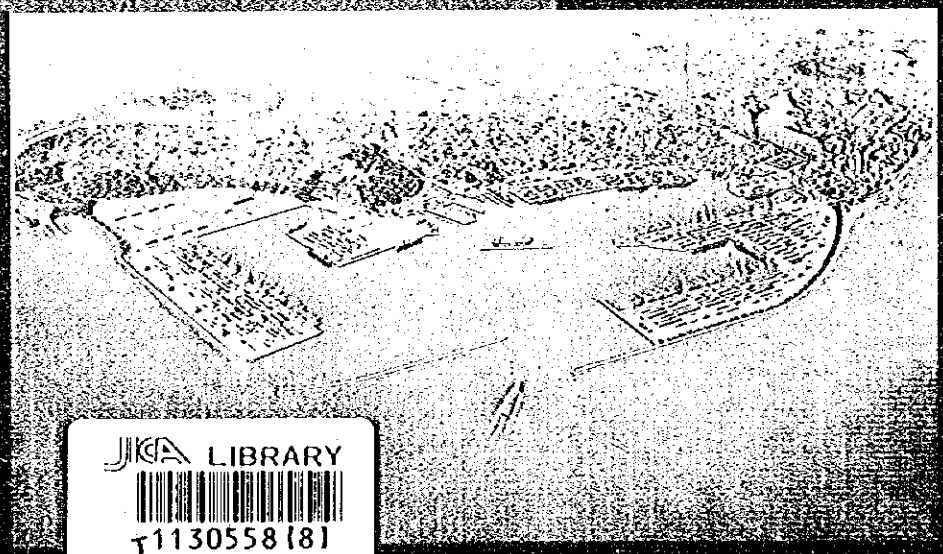
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SRILANKA PORTS AUTHORITY

STUDY ON THE DEVELOPMENT OF NEW PORT OF COLOMBO IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

FINAL REPORT



SUMMARY



SEPTEMBER 1996

The Overseas Coastral Area Development Institute of Japan
Japan Port Consultants, Ltd.

Exchange Rate
US$1.00=Rs.53.36
US$1.00=¥104.4
(January 1996)

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SRILANKA PORTS AUTHORITY

STUDY ON THE DEVELOPMENT OF NEW PORT OF COLOMBO

IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

FINAL REPORT

SUMMARY

SEPTEMBER 1996

PREFACE

In response to a request of the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan took pleasure in conducting a study on the development of the new port of Colombo and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA organized a study team headed by Mr. Yukio Nishida, Senior Executive Director of the Overseas Coastal Area Development Institute of Japan (OCDI), and consisting of members from OCDI and Japan Port Consultants, Ltd. (JPC). The study team visited Colombo three times between July 1995 and June 1996 and implemented on-site studies including field surveys of the natural and environmental conditions.

Based on the findings of these studies and surveys, the study team affirmed the advantageous location of the port of Colombo and realized its enormous potential to be a relay port to the Indian Subcontinent. However, the team also reported disadvantages in the port construction in severe natural conditions and the importance of productivity improvements in cargo handling operations as well as the quality of services. Bearing in mind these advantages and disadvantages, the study team hereby proposed a master plan for the development of the new port and a short-term development plan to meet the urgent demand.

JICA sincerely hopes that this report will contribute to the development of the Port of Colombo and, through which, to the economic development of Sri Lanka. JICA also wishes to thank the Sri Lanka Ports Authority, the Ministry of Shipping, Ports, Rehabilitation and Reconstruction, and other related ministries, government agencies, authorities, shipping lines and agents for their assistance and valuable suggestions extended to the study team.

September 1996

Kimio Fujita
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

September 1996

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Sir,

I have the honour to submit the Final Report of the Study on the Development of New Port of Colombo in the Democratic Socialist Republic of Sri Lanka.

The study was commenced in July 1995 by the study team consisting of the Overseas Coastal Area Development Institute of Japan (OCDI) and Japan Port Consultants, Ltd. (JPC) and concluded in September 1996 as per the contract with the Japan International Cooperation Agency (JICA).

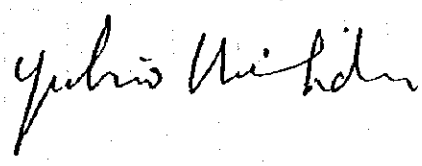
In line with the scope of work agreed in December 1994 between both governments, the study aims at formulating a new development plan of the regional hub port, which comprises a master plan of the Port of Colombo for the coming 20 years culminating in 2015 and a short-term development plan for the period of 10 years culminating in 2005.

The study team carried out on-site studies, field surveys on natural and environmental conditions, interviews and discussions with various port-related agencies, and prepared hereby the Final Report of the Study.

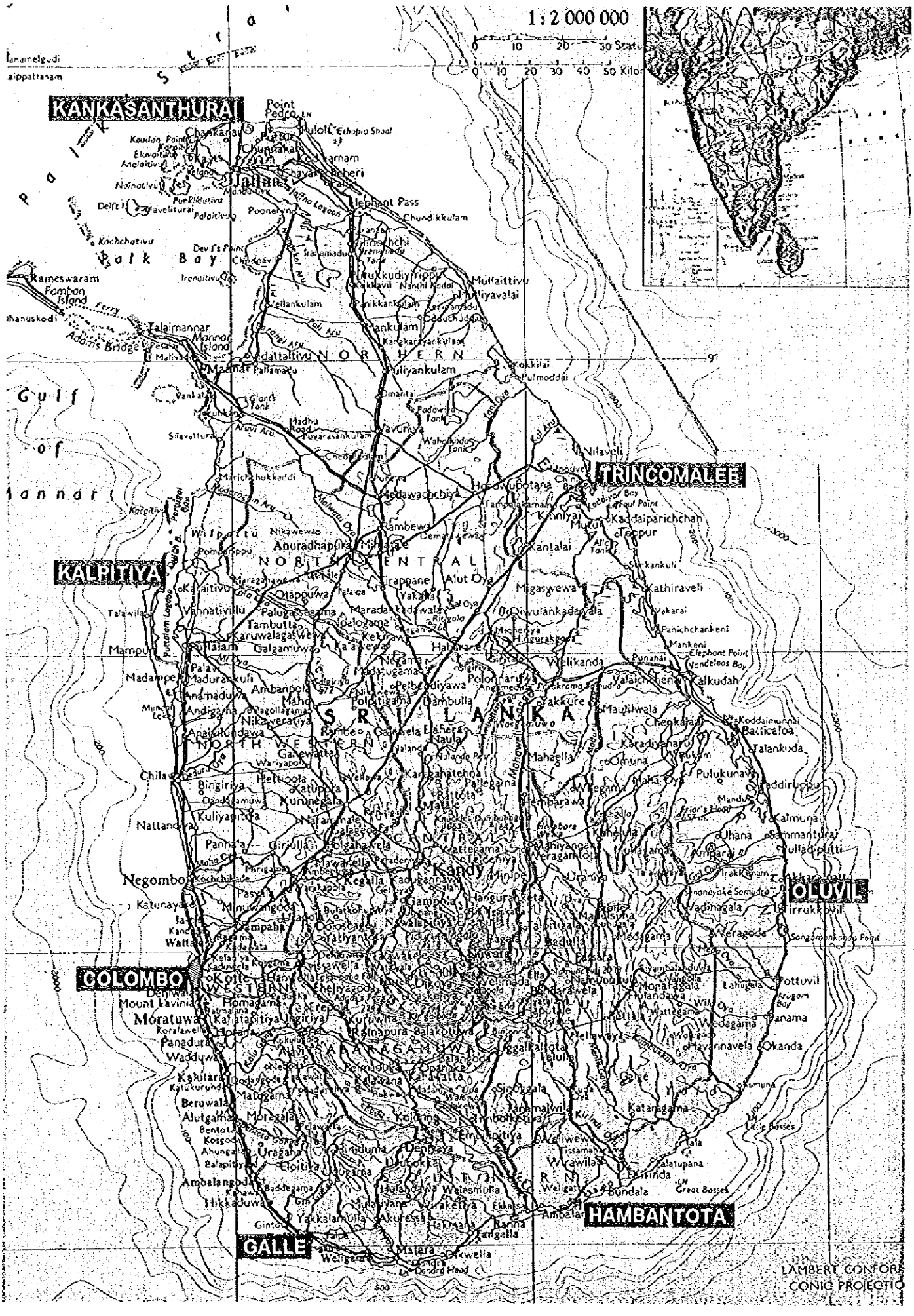
I would like to note that the completion of the study is greatly owed to the collaboration with the Sri Lanka Ports Authority and the cooperation of the Ministry of Shipping, Ports, Rehabilitation and Reconstruction, and other related ministries, government agencies, authorities, shipping lines and agents concerned in Sri Lanka.

I wish to thank the JICA, the Ministry of Foreign Affairs, the Ministry of Transport and the Overseas Economic Cooperation Fund for their assistance and suggestions extended to the study team throughout the study.

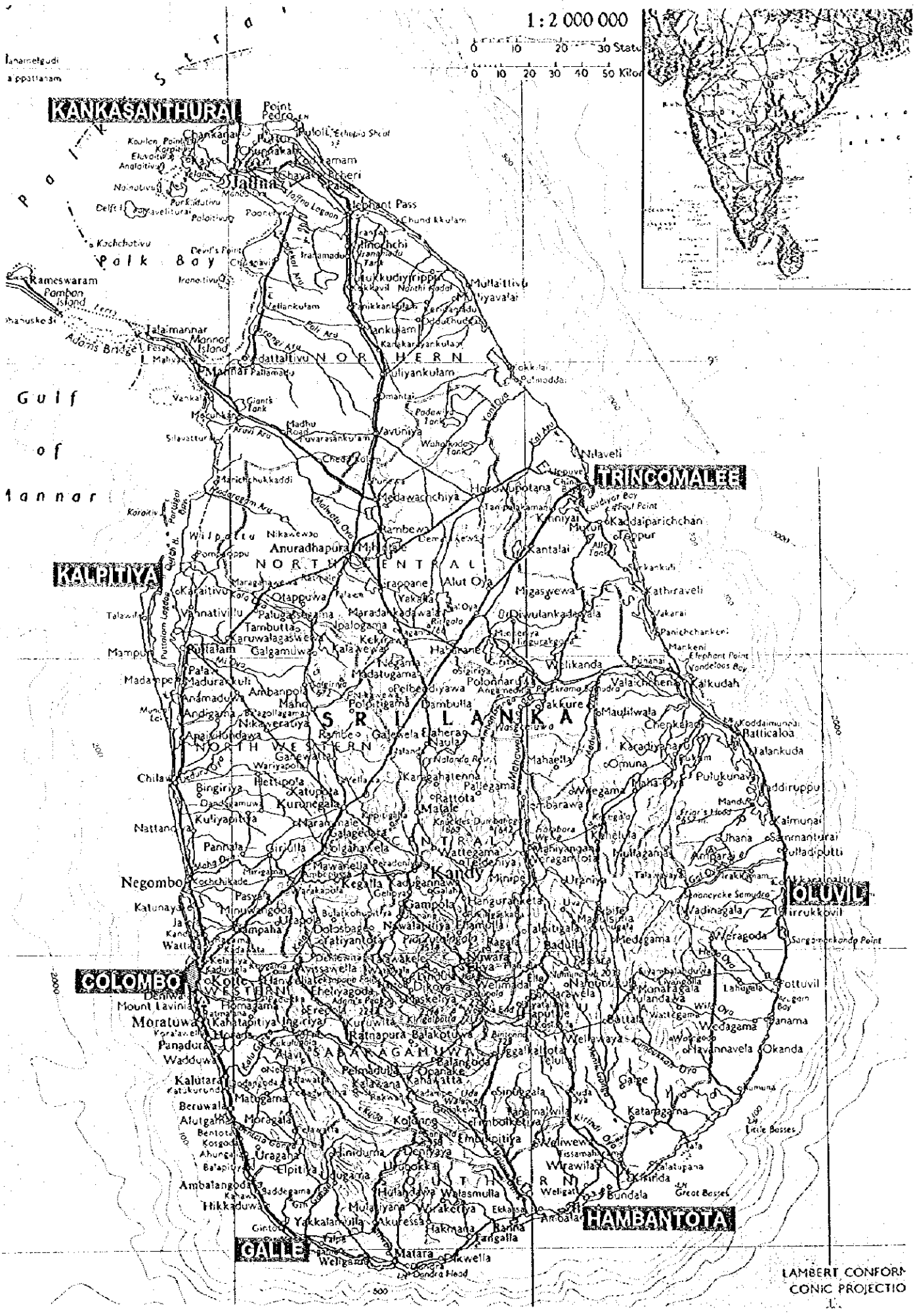
Yours sincerely,



Yukio Nishida
Team Leader for the Study
on the Development of New Port of Colombo

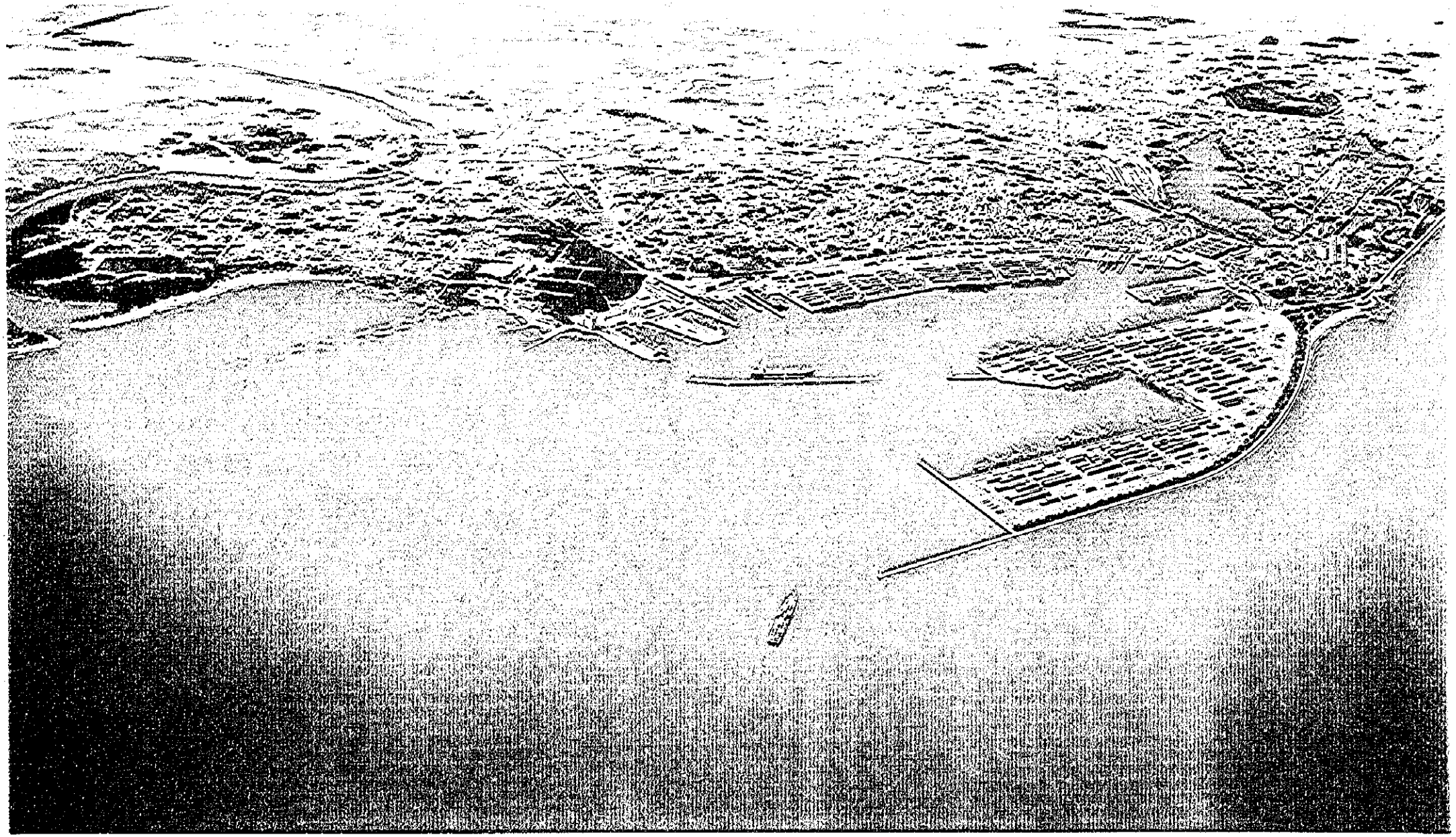


Location Map

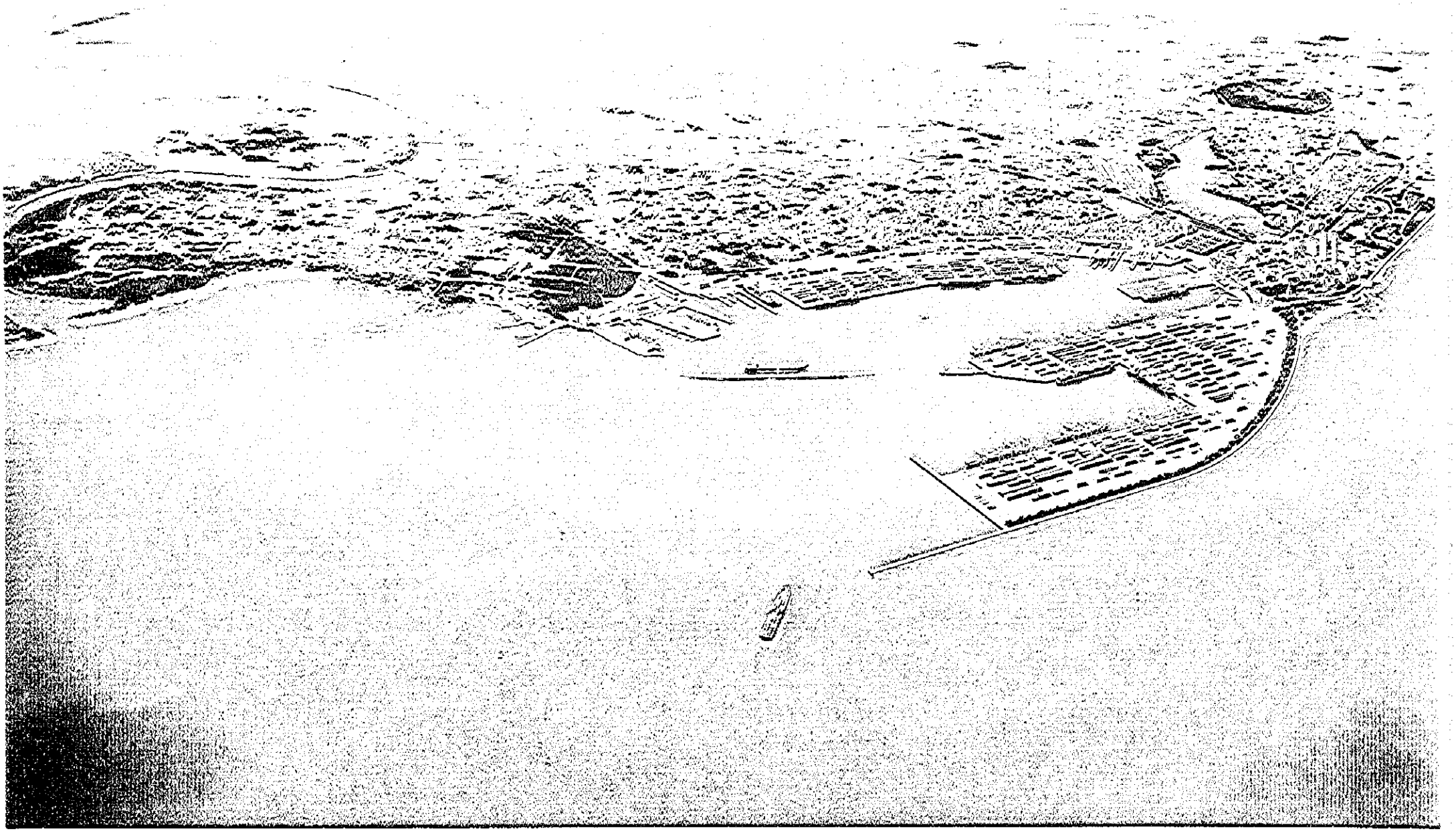


Location Map

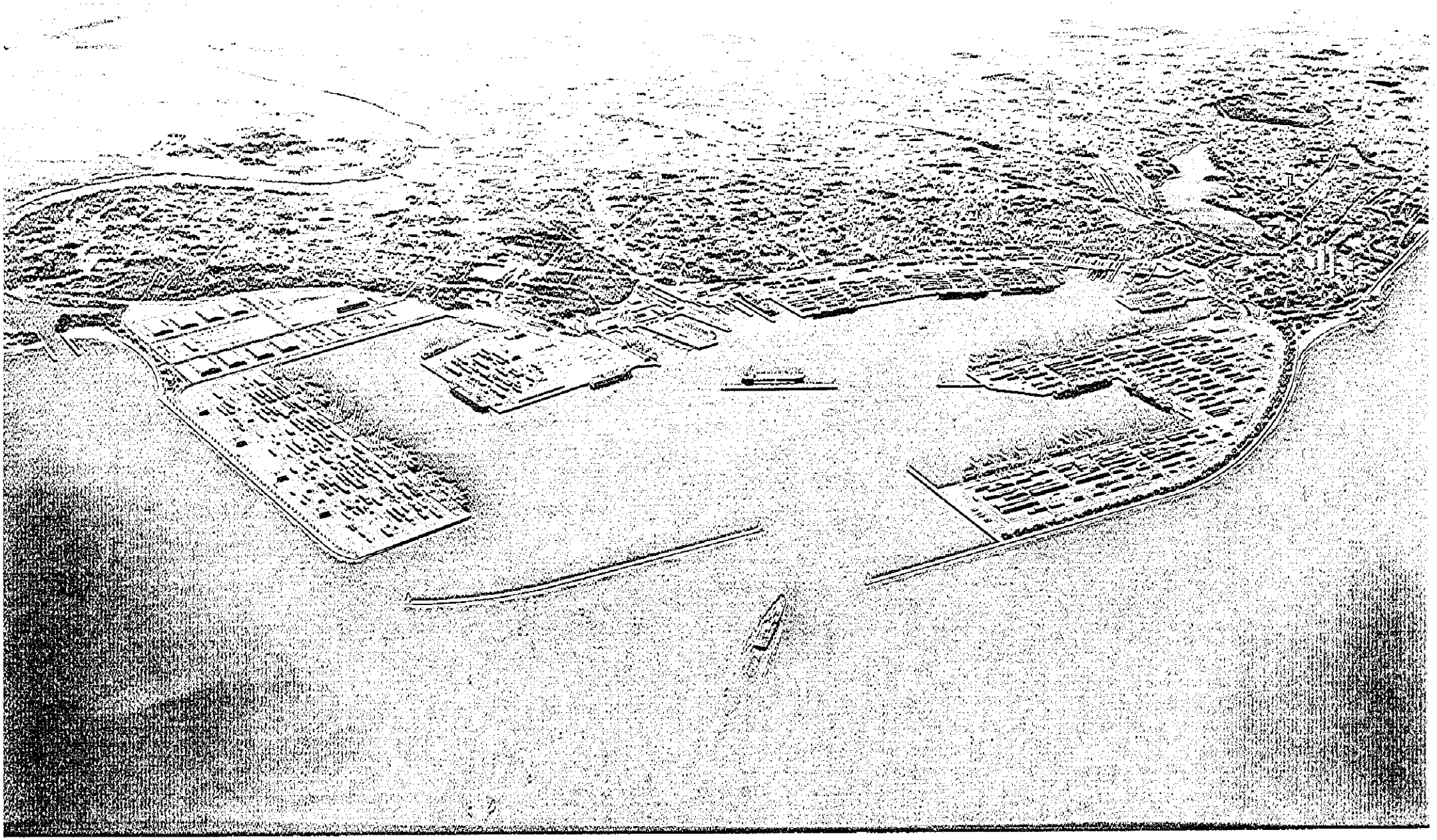
LOW/MEDIUM GROWTH CASE MASTER PLAN



LOW/MEDIUM GROWTH CASE MASTER PLAN



HIGH GROWTH CASE MASTER PLAN



LIST OF ABBREVIATIONS

ADB	: Asian Development Bank
AGV	: Automated Guided Vehicle
APL	: American President Lines, Ltd. (USA)
BOI	: Board of Investment of Sri Lanka
BOT	: Build, Operate and Transfer
BQ	: Bandaranaike Quay in Colombo Port
BTL	: Bengal Tiger Line GMBH (Germany)
CASA	: Ceylon Association of Steamer Agents
CCD	: Coastal Conservation Department
CEA	: Central Environmental Authority
CFS	: Container Freight Station
CGM	: Compagnie Generale Maritime (France)
CMA	: Compagnie Maritime D'Affretement (France)
COD	: Chemical Oxygen Demand
COSCO	: China Ocean Shipping Co. (China)
CPC	: Colombo Port Commission or Ceylon Petroleum Corporation
CSC	: Ceylon Shipping Corp., Ltd. (Sri Lanka)
DWT	: Dead Weight Tonnage
EDI	: Electronic Data Interchange
EIA	: Environmental Impact Assessment
EMC	: Evergreen Marine Corp. (Taiwan)
ESCAP	: Economic and Social Commission for Asia and the Pacific
FIRR	: Financial Internal Rate of Return
GDP	: Gross Domestic Product
GNP	: Gross National Product
GP	: Guide Pier in Colombo Port
GRT	: Gross Registered Tonnage
HANJIN	: Hanjin Shipping Co., Ltd. (South Korea)
HAPAG	: Hapag-Lloyd AG (Germany)
IALA	: International Association of Lighthouse Authority
IAPH	: International Association of Ports and Harbors
ICD	: Inland Container Depot.
IBRD	: International Bank for Reconstruction and Development
IEE	: Initial Environmental Examination
IMO	: International Maritime Organization
JCT	: Jaya Container Terminal in Colombo Port
JICA	: Japan International Cooperation Agency
JPC	: Japan Port Consultants, Ltd.
K-Line	: Kawasaki Kisen Kaisha, Ltd.(Japan)
LOA	: Length Overall
LWL	: Low Water Level
MAERSK	: Maersk Line (Denmark)
MIS	: Management Information System

MISC	: Malaysian International Shipping Corp. BHD (Malaysia)
MOL	: Mitsui-OSK Lines, Ltd. (Japan)
MPPA	: Marine Pollution Prevention Authority
MSPRR	: Ministry of Shipping Ports Rehabilitation and Reconstruction
NDB	: National Development Bank of Sri Lanka
NEA	: National Environmental Act
Nedlloyd	: Nedlloyd Lines (Netherland)
NOL	: Neptune Orient Lines, Ltd. (Singapore)
NP	: North Pier in Colombo Port
NYK	: Nippon Yusen Kaisha (Japan)
O/D	: Origin and Destination
OCDI	: Overseas Costal Area Development Institute of Japan
OECD	: Organization for Economic Cooperation and Development
OECF	: Overseas Economic Cooperation Fund
OOCL	: Orient Overseas Container Line, Ltd. (Hong Kong)
P&O	: P&O Containers, Ltd. (UK)
PSA	: Port of Singapore Authority
PVQ	: Prince Vijaya Quay in Colombo Port
QCT	: Queen Elizabeth Container Terminal in Colombo Port
QEQ	: Queen Elizabeth Quay in Colombo Port
RO/RO	: Roll on / Roll off
Rs.	: Rupees
SAARC	: South Asian Association for Regional Cooperation
SAPS	: Special Assistance for Project Sustainability
SDR	: Special Drawing Rights
Sea-Land	: Sea-Land Service Inc. (USA)
SLPA	: Sri Lanka Ports Authority
SP	: South Pier in Colombo Port
SPBM	: Single Point Buoy Mooring
SS	: Suspended Material
TEU	: Twenty Footer Equivalent Unit
UASC	: United Arab Shipping Co. (UAE)
UNCTAD	: United Nations Conference on Trade and Development
UNDP	: United Nations Development Programme
VTS	: Vessel Traffic Services
YML	: Yangming Marine Transport Corp. (Taiwan)
ZIM	: Zim Israel Navigation Co., Ltd. (Israel)

Contents

EXECUTIVE SUMMARY

Executive Summary

Study on the Development of New Port of Colombo

(July 1995 - September 1996)

Background and Objectives

1. The Port of Colombo is located just off the international main shipping route between Europe and East Asia and has been playing an important role as a relay port to the Indian Subcontinent. Together with the evolution of oceangoing steam boats, the development of the Port was commenced in the mid-1870s by constructing the South West breakwater to provide a safe anchorage throughout the year.

2. Coping with the evolution of containerization, the Queen Elizabeth Quay was developed as a container terminal in the 1970s. The development of Jaya container terminal, a full scale modern container terminal, funded by the Government of Japan, was started in 1982 and its fourth berth was completed in 1995.

3. Owing to the economic boom in the Indian Subcontinent, cargo throughput at the Port of Colombo has rapidly increased since 1990 and reached one million TEUs in 1995. However, the Port of Singapore is attracting more transhipment containers from the Indian Subcontinent and the Port of Colombo is therefore required to develop a competitive transhipment terminal with enough capacity, deeper berths, high productivity and quality services.

4. In this regard, the Government of Sri Lanka requested the Government of Japan to review the master plan of 1989 and to elaborate on a new development plan of the regional hub port. In response, the Japan International Cooperation Agency (JICA) organized a study team and carried out the study to formulate a master plan of the Port of Colombo for the coming 20 years culminating in 2015 and a short-term development plan for the period of 10 years culminating in 2005.

Implementation of the Study

5. Since the Port of Colombo is a regional hub in the South Asian region, the study covered port development plans and cargo throughput forecast at major ports in India, Bangladesh and Pakistan. Sri Lankan exports and imports are also predicted in connection with the country's economic growth forecast.

6. To meet the requirements for a competitive hub port, the Port needs to expand capacity significantly and to accommodate post Panamax vessels of 6,000 TEU class. Consequently, the development of the outside of the present port became the main factor in the new master plan. The study implemented surveys of waves by installing an ultrasound wave recorder at a depth of

minus 16 meters. Surveys of tidal currents, water quality, soil conditions, ecological characteristics as well as residents in the project area were carried out as part of the study.

7. Optional development sites identified are the outside of QEQ and the north of the present port. The inner harbour side of QEQ is also a potential development site. The study proposed a master plan for high growth case and a plan for low-medium growth case with a stage-wise development plan. The feasibility of the project is examined by financial and economical analyses of the short-term development plan and by an environmental impact assessment.

Conclusions

(Demand Forecast)

8. A considerable increase in the container traffic, both in the transhipment and in the country's imports/exports, is envisaged owing to the economic boom in the South Asian region. Future container throughput at the Port of Colombo is estimated at about 2.3-3.6 million TEUs in the year 2005 and at about 3.8-6.7 million TEUs in 2015 based on the cargo growth rate forecasted at 8.5%-12.7% in the low-high growth cases for the period of 1995-2004 and at about 4.7%-6.5% respectively for the period of 2005-2015.

(Capacity of the Present Port)

9. The annual container handling capacity of the JCT, QCT and NP terminals amounts to approximately 1,500,000 TEU as of the end of 1995 when JCT No. 4 terminal was completed. The capacity in the year 2000 is estimated to reach about 1,900,000 TEU subject to the rehabilitation and redevelopment of QCT and NP and to the improvement in handling productivity.

(Bottlenecks)

10. Bottlenecks of the present port are: 1) curved fairway, very narrow entrance and short stopping distance; 2) little under keel clearance in the approaching channel and basin; 3) shallow North Channel; 4) poor equipment for ship traffic control; 5) slender container yard (QEQ); and so forth. Operational problems are also recognized such as 6) extra cost for inter-terminal transportation between JCT and QCT; 7) less priority to feeder vessels; 8) hidden cost besides the tariff; and 9) productivity of cargo handling.

(Role of the Port of Galle)

11. The port of Galle can be a supplement to the port of Colombo serving vessels with cargo from/to the Southern Province. At the first stage, the port of Galle should cater to bulk and breakbulk carriers. As far as transhipment services are concerned, efforts should be placed on the development of Colombo so as to enable the port to enjoy economies of scale.

(New Port Development)

12. Priority was given to the South Port Development in consideration of construction cost and period. The development of the South Port enables the expansion of QEQ container terminal

to the outside as well as the construction of new deeper berths. The North Port can be economically developed after the completion of the South Port, which will afford shelter to the North site. The development of the North Port shall be flexible in accordance with the demand for cargo throughput.

Project Outline

(Mater Plan)

13. Master Plan for 2015 has two development scenarios. In the low/medium growth case, the South Port Development will be able to cover the demand anticipated in 2015 but in the high growth case, North Port Development will be necessary in addition to the South Port Development. North Port has two optional plans, Crow Island Offshore Development and PVQ North Development, which will be reviewed following a series of wave and current observations.

Facilities	High Growth Case		Low/Medium Growth Case
	PVQ North Development	Crow Island Offshore Dev.	
Terminal Area	236 ha	340 ha	120 ha
Additional Berths	Main CT: 10 Feeder: 7	Main CT: 11 Feeder: 5	Main CT: 6 Feeder: 3
Handling Capacity	7.7 mil. TEUs	7.7 mil. TEUs	4.9 mil. TEUs
Breakwater/Seawall	6,350 m	7,010 m	3,610 m
Dredging	12.5 mil. m^3	13.3 mil. m^3	5.3 mil. m^3

(Short-term Development Plan)

14. The proposed projects for the short-term development are:

1) QEQ Outer Terminal as a part of South Port Development;
   Breakwater/Seawall: 3,130 m,
   Berths: Main 3, Feeder 3
   Terminal Area: 73 ha
   Capacity: 2.0 million TEUs
   Estimated Cost: US$840 million
2) Redevelopment of Bandaranaike Quay (US$17 million);
3) Widening the West Entrance (US$27 million);
4) North Channel Dredging (US$6 million);
5) Inter-terminal Road Expansion (US$18 million);
6) Navigation Aids (US$33 million); and
7) Renovation of JCT Cargo Handling Equipment (under E/S).

(Urgent Plan)

15. Urgent plan comprises 1) QEQ No.6 extension; 2) rehabilitation of QEQ Nos.2-3; 3) reinforcement of JCT container handling equipment; 4) redevelopment of North Pier; 5) redevelopment of Bandaranaike Quay; 6) dredging North Channel; 7) encouraging installation of Inland container depots; and 8) upgrading tug boats and other port service facilities.

(Construction Procedure)

16. Economic and rapid construction of breakwater is a key factor in outer port development. After comparing possible structural types of breakwater, it was concluded that caisson structure will be the best for breakwater and seawall in the deep water from the viewpoint of stability and construction period. Construction works start with the new South-West seawall and the extension of QEQ No.6 berth. Shortly after the commencement of construction, the back yard of QEQ can be expanded and be utilized as a container yard. After the completion of QEQ No.6 extension and the rehabilitation of QEQ Nos.2-3 with outer container yard, cargo handling capacity of QEQ will reach 0.9 million TEUs.

(Cost Estimates)

17. Project cost of Master Plan 2015 is estimated at about US$1.1-1.4 billion in case of the South Port Development. Estimated cost of the North Port Development is about US$1.1-1.4 billion in case of Crow Island Offshore Development and at about US$1.0-1.2 billion in case of PVQ North Development including all other projects and relocation of oil pipeline and sewer outfall. Project cost of the short-term development plan is estimated at about US$940 million for a period of 10 years, of which the estimated cost for the new port is about US$840 million. Project cost for the urgent plan is assessed at about US$500 million.

Project Evaluation

(Economic Analysis)

18. EIRR of the short-term development plan is assessed at 20.5% in the high growth case, 18.7% in the medium growth case and 11.5% in the low growth case. The short-term development plan has enough economic viability in terms of EIRR and will bring a large economic benefit to the Sri Lankan economy.

(Development Scenarios)

19. The following scenarios are considered for the development of the new port:

Scenario 1) All breakwaters/seawalls will be developed by SLPA and land reclamation/terminal facilities of the Berths Nos.6,7,8 be developed by SLPA while land reclamation/terminal facilities of the Berths Nos.9,10,11 be developed by private sectors;

Scenario 2) All breakwaters/seawalls will be developed by SLPA and land reclamation/terminal facilities of the Berths Nos.6-11 be developed by SLPA;

Scenario 3) All breakwaters/seawalls will be developed by SLPA and land reclamation for the Berths Nos.6,7,8 be carried out by SLPA while terminal facilities of the Berths Nos.6-11 be developed by private sectors.

In case that private sectors develop terminal facilities, the operations of their terminal(s) shall be carried out by the developer. In case that the SLPA develops terminal facilities, the operations shall be carried out by the SLPA or by private sectors given an SLPA's mandate.

(Financial Analysis)

20. FIRR is calculated based on three scenarios and assessed at 4.8%-5.3% in the first scenario according to the cargo growth case, and at 7.2% in the second scenario. FIRR in the third scenario is estimated at 4.2% based on the assumption that the rent of terminal covers the construction cost of infrastructure. Owing to the large initial investment in the civil works, the proposed short-term development plan is infeasible if cargo handling productivity is not improved and if actual construction cost exceeds the estimates.

(EIA)

21. Field surveys covered waves, currents, water pollution, shoreline configuration, sediment contamination, port-related road traffic and air pollution, terrestrial flora and fauna, as well as local residents and cultural assets. Biological survey showed that the project area is rather poor in terms of the biological abundance as it has already been urbanized.

22. Initial environmental examination is used to study changes in current patterns, disposal of dredged material, impacts on water quality, coastal hydrology, traffic load on access roads, and air pollution. To assess the impact of the port development, tidal currents and the dispersion of water pollution are identified by means of computer simulation. Adverse effects on air pollution and shoreline configuration are also studied. As a result no significant adverse effect is shown in the preliminary EIA.

(Overall Evaluation of the Project)

23. Economic benefits borne by the port have greatly contributed to the Sri Lankan economy in terms of foreign currency earnings, job opportunities, trade promotion and industrial development. However, the development of a new port requires a large capital investment in breakwaters and reclamation work in the deep sea area, so that financial feasibility is very critical in connection with construction cost and port revenues. EIRR is estimated at 11.5% and 20.5% in the low and high growth cases respectively, but FIRR is at 4.8% and 5.3% in the low and medium growth cases of the development scenario 1). In this regard, Master Plan for 2015 is economically a very important project to Sri Lanka but difficulties are envisaged in the financial management of the project.

24. Since the project needs a large investment and is not so profitable for the private sector, it will only be feasible in case that the public sector develops all port facilities or in case that the public sector develops the port infrastructure and invites the private sector to invest in and to

operate port superstructures, subject to the payment of royalty to SLPA for the use of port infrastructure. Soft loans or other financial assistance to the private sector can encourage their participation. In both cases, cargo handling productivity plays a key role in the feasibility of the project.

Recommendations

(Basic Concept of Public Port)

25. Port is a basic infrastructure for a nation's imports and exports so that the public sector should administer the port from the viewpoint of people's welfare. However, commercial activities related to the port are basically supported by private sectors in the field of terminal operations, stevedoring, harbour services and other ancillary services. Participation of the private sectors in these fields needs to be encouraged under the administration of SLPA.

(Participation of Private Sectors)

26. In view of privatization of a part of SLPA functions, following schemes can be applied to the new terminals. These alternatives should be selected appropriately according to the financial situation of the project and the prospect of terminal operations.

Scheme 1: SLPA develops all port infrastructures and superstructures, and requests the private sector to operate a terminal.

Scheme 2: SLPA provides only basic port infrastructures and invites the private sector to build superstructures and to operate its own terminal.

Scheme 3: SLPA prepares only the breakwater and basin, and invite the private sector to build and operate a terminal.

(Port Development Policy)

27. There should be a legal scheme in which SLPA proposes a master plan for the development of the port of Colombo and seeks authorization from the Government. It would be helpful to coordinate all related development projects such as the road development project or oil pipeline project. It would also be useful to encourage private sector participation in port development. SLPA should be given a mandate to consent to the development plan proposed by the private sector in accordance with the authorized master plan. Periodical review of the master plan is important to cope with changes in shipping environment and the demands for the port.

(Necessities for a Competitive Hub)

28. Factors required for a successful hub port are 1) Strategic Location; 2) Excellent Infrastructure; 3) Reliable Operations; 4) Skilled and Disciplined Work Force; 5) Good Banking and Financial Services; 6) Efficient Telecommunications; and 7) Stable Government. Though the port of Colombo is located in a strategic position, the port fails to meet most of the other requirements. Efforts should be made to satisfy all of the requirements.

(QEQ Redevelopment)

29. To meet the urgent demand for main/feeder berths and additional container yard in QEQ area, it will be helpful to develop the inner side of QEQ. However, QEQ expansion to the inner harbour should be minimized from the viewpoint of ship maneuvering in the harbour, interalia berthing at the Bandaranaike Quay and QEQ Nos. 1-2 Berths and turning of lengthy Panamax vessels in the restricted basin between JCT and QEQ.

(Widening the West Entrance)

30. The navigable width of the present entrance channel is 125 meters for a Panamax vessel with a draft of 13 meters, which is far below the internationally accepted standard, i.e. more than 5-6 times of the breadth of the maximum ship entering the port, namely 160-200 meters in case of a Panamax. The present entrance should therefore be widened as soon as possible.

(Ship Traffic Separation)

31. As a result of the proposed development, future ship traffic will increase by 1.7-2.6 times in 2005. Daily in/out traffic will reach 31-46 moves so that separation between incoming and outgoing vessels becomes necessary. Short-term Development Plan includes a project to dredge North Channel to minus 12 meters. Installation of Vessel Traffic System (VTS) is recommended to control the approaching and outgoing vessels.

(Wave Observation)

32. With a view to economical design of port structures, a considerable series of wave data is essential so that the wave observation at the offshore point of Crow Island should be continued for more than five years, preferably ten years.

(Project Implementation)

33. On-site work period for the construction of outer seawall and breakwater is limited to the NE monsoon season so that it will take more than eight years to complete the first berth on the outside of the present breakwaters. With a view to filling the gap between demand and capacity foreseen, the development of the new terminal shall be started as soon as possible.

(Improving Cargo Handling Productivity)

34. To improve container handling productivity, it is recommended that 1) container handling facilities be augmented; 2) crane operator's skill be enhanced by training at an advanced terminal; and 3) container terminal planning/operation system be established so that the simulation of and preparation for terminal operations (ship and yard) can be completed before ship arrival.

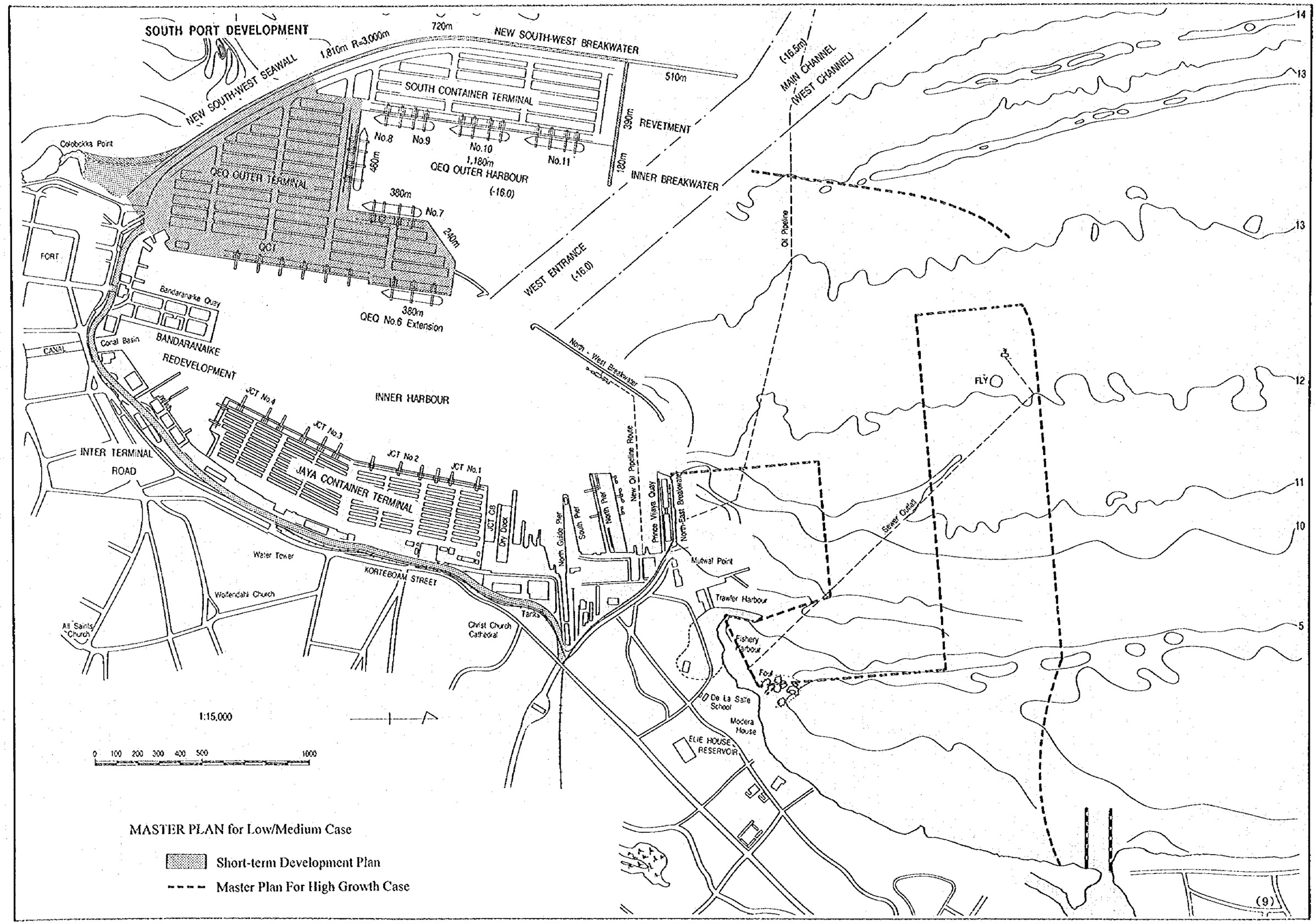
35. It is also important to introduce a proper incentive system (preferably linked to work productivity) to speed up cargo operations. Introduction of private operators into terminal operations will also encourage efficient cargo handling. Urgent improvements should be made in berth assignment to feeder vessels, in priority berthing to regular mother vessels, and in reducing inter-terminal container transportation.

(Port Management and Operations)

36. To cope with changes in the demand for the port, SLPA should be given the power to operate the port in its own capacity, particularly in terms of investment, procurement, decision of labour wages, and other financial management with the responsibility for the balance.

(Financial Assistance)

37. Bearing in mind that the project is economically propitious to the country but financially not so profitable, public sector should play an important role in developing the port infrastructure and efforts should be placed to encourage the participation of private sectors in terminal development and operations by preparing soft loans or through other financial assistance.


SOUTH PORT DEVELOPMENT
NEW SOUTH-WEST SEAWALL
1,810m R=3,000m
720m
NEW SOUTH-WEST BREAKWATER
510m
SOUTH CONTAINER TERMINAL
No.8
No.9
No.10
No.11
1,180m
390m
REVETMENT
180m
460m
QEQ OUTER TERMINAL
QEQ OUTER HARBOUR
(-16.0)
380m
No.7
240m
GC1
380m
QEQ No.6 Extension
Colobokka Point
FORT
Bandaranaike Quay
Coral Basin
BANDARANAIKE
REDEVELOPMENT
CANAL
INNER HARBOUR
JCT No.4
JCT No.3
JCT No.2
JCT No.1
INTER TERMINAL
ROAD
JAYA CONTAINER TERMINAL
JCT G8
Dry Dock
North Guide Pier
South Pier
North Pier
Water Tower
KORTEBOAM STREET
Wolfendahl Church
All Saints Church
Tanks
Christ Church Cathedral
WEST ENTRANCE
(-16.0)
INNER BREAKWATER
(-16.5m)
MAIN CHANNEL
(WEST CHANNEL)
Oil Pipeline
North - West Breakwater
New Oil Pipeline Route
Prince Vilaya Quay
North-East Breakwater
Mutwal Point
Trawler Harbour
Fishery Harbour
Fort
De La Salle School
Modera House
ELIE HOUSE RESERVOIR
FLY
Sewer Outfall
14
13
13
12
11
10
5
1:15,000
0 100 200 300 400 500 1000
MASTER PLAN for Low/Medium Case
Short-term Development Plan
Master Plan For High Growth Case
(9)

SOUTH PORT DEVELOPMENT

720m
NEW SOUTH-WEST BREAKWATER
1,810m R=3,000m
NEW SOUTH-WEST SEAWALL
510m
SOUTH CONTAINER TERMINAL
390m
REVETMENT
180m
No.8
No.9
No.10
No.11
1,180m
QEQ OUTER HARBOUR
(-16.0)
460m
QEQ OUTER TERMINAL
Colobokka Point
390m
No.7
240m
OCT
380m
QEQ No.6 Extension
INNER BREAKWATER
WEST ENTRANCE
(-16.0)
(-16.5m)
MAIN CHANNEL
(WEST CHANNEL)
Oil Pipeline
FCRT
Bandaranaike Quay
Canal Basin
BANDARANAIKE
REDEVELOPMENT
CANAL
INNER HARBOUR
North - West Breakwater
FLY
JCT No.4
JCT No.3
JCT No.2
JCT No.1
JAYA CONTAINER TERMINAL
INTER TERMINAL
ROAD
JCT C8
Dry Dock
North Guide Pier
South Pier
North Pier
New Oil Pipeline Route
Prince Vijaya Quay
North-East Breakwater
Sewer Outfall
Water Tower
KORTEBOAM STREET
Mutwal Point
Wolfendahl Church
Trawler Harbour
All Saints Church
Tanks
Christ Church Cathedral
Fishery Harbour
Fort
De La Salle School
Medera House
ELIE HOUSE RESERVOIR
14
13
13
12
11
10
5
(9)

1:15,000

0 100 200 300 400 500 1000

MASTER PLAN for Low/Medium Case

Short-term Development Plan

Master Plan For High Growth Case

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Mr. M. Ramanayake	Addl General Manager
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SUMMARY

Chapter 1 SOCIO-ECONOMIC CONDITIONS OF SRI LANKA

1. Socio-economic Conditions of Sri Lanka

1.1 Location

1. Sri Lanka is located off the Southern Coast of India between northern latitudes 5°55' and 9°50' and eastern longitudes 79°42' and 81°52'. The island is separated from India by Palk Straight which stretches 35 kilometres. Covering a land area of 65,608 square kilometres, it stretches a maximum length of 435 kilometres and a width of 225 kilometres.

1.2 Natural Features

2. The country consists of three zones : the northern plain including Jaffna and Trincomalee the central mountain district including Kandy and Nuwara Eliya, and the southern coastal area which extends from Colombo to Galle.

1.3 Climate

3. Located southwest of the Asian monsoon zone, Sri Lanka has two monsoon seasons, the longer southwestern monsoon season from May to September in the summer and the shorter northeastern monsoon season from December to February in the winter. The mean temperature over the lowlands is 28°C, while the lowest mean temperature is 16°C at Nuwara-Eliya, a hilly area of the island.

1.4 Population

4. According to the estimation of the Central Bank of Sri Lanka, the total population of Sri Lanka at the end of 1994 reached 17.865 million, which is 1.2 times the population of 1981. The annual population growth between 1981 and 1990 was 1.6 percent.

5. Growth is expected to shift from the eastern and northern parts of the country to the western, central, and southern areas. There was some outmigration from the Colombo metropolitan area between 1981 and 1990, but the trend is expected to reverse during the current decade. This pattern would be consistent with the growth of jobs and economic opportunities in greater Colombo and surrounding areas. It is also consistent with the decentralization of employment in the metropolitan area.

1.5 Economic Characteristics

6. According to the provisional estimate of the Central Bank of Sri Lanka, Gross Domestic Product (GDP) of Sri Lanka recorded 159,124 million Rupees in 1994 at constant 1982 factor cost prices. GDP expressed at 1994 market prices is 576,171 million Rupees or 10,270 million US Dollars and GDP per capita is 575 US Dollars.

7. The recent trend of GDP is shown in Table 1.5. GDP, in real terms, increased by 5.6% in 1994. As for the share of each sector in GDP growth, the Services sector (including Construction) accounted for 54.3% and the Industrial sector contributed 30.8%, while the share of Agriculture (including Mining and Quarrying) was 14.9%. On the other hand, the shares of private consumption, public investment and private investment in GDP are 78%, 14% and 10%, respectively.

TABLE 1.5 Trends of GDP

Year	GDP at '82 Prices (mil. Rs.)	Growth Rate (%)
1989	121,729	2.3
1990	129,244	6.2
1991	135,204	4.6
1992	140,960	4.3
1993	150,783	7.0
1994	159,269	5.6

1.6 Industry

8. The economy of Sri Lanka has historically relied on agriculture, which can be classified into two sectors, the export oriented plantation sector including tea, rubber and coconut plantation and the traditional sector which consisted of peasant cultivation of paddy and other food crops for domestic consumption. However, recently, in order to relieve the heavy dependence on the export oriented plantation sector, export development policy such as encouragement of foreign investment, promotion of the growth of the private sector, which includes privatization, and development of the rural areas has been adopted. The agricultural sector's share in GDP has dropped and that of the industrial sector including garment and textile industry has risen.

9. In spite of the policy of developing the rural areas, the greater Colombo area, which consists of Colombo, Gampaha, and Kalutara is still clearly the most dynamic and productive part of the country. As for provincial per-capita gross regional product (GRP), Western province has the highest output and Eastern and North Western provinces have the second and third highest levels. However, in terms of per-capita growth rates over the last 10 years, Western province has grown the most, while Central and Southern provinces rank second and third. In the manufacturing sector, Western and Sabaragamuwa provinces have grown the most, while growth in the trade and tourism sector has been more evenly distributed among all provinces. Agriculture has declined in the Western province and expanded dramatically in the Eastern province due to the success of the irrigation projects.

1.7 Transportation

(1) Ports

10. Sri Lanka Ports Authority manages and operates four major ports around the country, namely the ports of Colombo, Galle, Trincomalee and Kankesanturai. Key performance indicators of three major ports in 1994 are summarized in Table 1.7.

TABLE 1.7 Selected Performance Indicators at Ports of Colombo, Trincomalee and Galle (1994)

		Colombo	Trincomalee	Galle	Total
No. of ship calls		3,251	243	74	3,568
Cantainer Throughput	(TEUs)	954			954
Total Cargo Tonnage	('000 ton)	16,014	1,650	304	17,968

Source: Port Statistics, Sri Lanka Ports Authority

11. The Port of Trincomalee, located on the east coast of Sri Lanka, is a good natural harbour. The volume of cargo handled in 1994 was 1,650,000 tons, which accounted for 9% of the total port cargo throughput of the country, and imported wheat held 52 % of the said volume.

12. The Port of Galle is located on the southwest coast of Sri Lanka. During the southwestern monsoon season it is difficult to secure calmness in the Port. The volume of cargo handled in 1994 was 300,000 tons, of which 64% was clinker.

(2) Road

13. The total length of the road network in Sri Lanka amounts to 97,370 km. The network consists of national roads administrated by the Road Development Authority, provincial roads administrated by the Provincial Councils, local roads administrated by the Municipal Councils and roads under the management of specialized agencies. Among the total road length, 32% is paved which includes 100% of the national and 71% of the provincial road length.

(3) Railway

14. The railway system in Sri Lanka is operated by the Sri Lanka Railways, a government agency. The total length of the railway network amounts to 1,462 km, most of which is broad gauge lines with single track.

15. Passenger service was disrupted due to the civil conflict but has since resumed and the passenger-km rate has recovered to previous levels. The volume of cargo handled has gradually decreased on the whole since 1984, which points to a shift from rail to road in cargo transportation. Railroad is mainly used for transportation of bulk cargo, such as cement and its material, petroleum products and flour, though a small amount of exported garments in containers is transported by rail as well.

Chapter 2 MARITIME TRANSPORT IN SOUTH ASIA

2.1 World container ship fleet and its operation

1. Containerisation in regular marine transport service has been steadily growing, and the capacity of deep-sea full-containership fleet has more than doubled over the last ten years. To keep pace with the three major economic regions of the world, the fleet comprised 1,147 vessels totalling 2.16 million TEUs at the end of 1994, up 230,000 TEUs or 11.8% over the previous year.

2. Containership operators in the world have completed their recent round of fleet build-up for key routes, and expanded their global service networks including North-South and intra-regional trades.

3. The tonnage newly-ordered in 1994 registered an all-time high of 420,000 TEUs consisting of 218 containerships. The "fleet on order" totals 650,000 TEUs consisting of 292 vessels. Most of them are scheduled to be delivered from 1995 to 1996, thus more than 320,000 TEUs a year will newly join the market, and over 80% of that capacity is likely to be deployed on international deep-sea trade routes.

4. Due to the doubling of the fleet capacity, the environment of container ship operation is becoming increasingly stringent. Furthermore, conference's pricing mechanism and national legislation are evidently oriented to deregulation in pursuit of an economic system more governed by market forces. Maritime transportation industry will remain in severe competition in the future.

5. In view of economies of scale, larger vessels of 5,000 to 6,000 TEUs are deployed by global alliances and are selecting ports of call taking into consideration safety and port facilities.

6. In this connection, hub ports are requested to provide a deeper and wider passage, sufficient mooring facilities with capable cargo handling equipment and effective port services for container operators to realize the "just in time" position of calling vessels.

2.2 Economic Evolution of South Asia

7. Many countries in South Asia have, in recent years, tried to undertake wide-ranging reform programs to lessen government controls and promote liberalization. Sri Lanka improved its basic capacity for economic growth through structural reforms and specific policies, whereby high growth rates of 6.9% in 1993 and 5.6% in 1994 were achieved.

8. In the Indian economy, an average annual growth rate of about 5 percent in the 1990s is projected, and faster growth is anticipated in the second half of the 1990s as these reforms bear fruits. Based on macro economy targets related to the 8th Five year plan, GDP growth rates are 5.6% in 92-2001, 6.05% in 97-2001and 6.51% in 2002-2006, respectively.

9. In Pakistan's economy, GDP growth rate of 7.7% in 1992 was achieved but then fell to 2.3% in 1993. The economy has ben recovering since then. Target growth rate in the 8th Five Year Plan (1993~1998) was 7.5%, however, actual growth rate was recorded at 4 % in 1994.

10. According to ADB report (Asian Development Outlook 1995 and 1996), the following future growth rates are expected in 1995 and 1996.

Region	1992	1993	1994	1995	1996	Target Growth Rate by Government
Sri Lanka	4.3	6.9	5.7	6.0	7.0	Year 1995~1999: 6.9%,Year 1999:7.7%
India	4.3	4.3	5.3	6.1	6.5	Year 1997~2001: 6.05%, Year 2002~2006: 6.51%
Pakistan	7.7	2.3	4.0	4.6	6.0	
Bangladesh	4.2	4.5	4.6	5.0	5.3	
Nepal	4.6	2.9	7.0	2.6	5.0	

Source: Asian Development Outlook 1995 and 1996, ADB
Public Investment 1995-1999, Department of National Planning, Sri Lanka

2.3 Port Development of India, Pakistan and Bangladesh

(1) India

11. In order to attract private investment along with modern technology, the process of privatization of Indian port facilities/management has already started with the new economic policy in 1991. The following TABLE 2.3(1) indicates container cargo throughput in the region's ports, which shows a sharp increase in 1993 at Indian ports.

12. Container throughput in major Indian ports recorded 1.24 million TEUs in 1994/95, an increase of nearly 23% over the previous year. As indicated in the following TABLE, throughput at Jawaharlal Nehhru Port grew by 41 % and that at Cochin Port by 30%. Development plan of major Indian ports are shown in TABLE 2.3(2).

(2) Pakistan

13. During 1994/95, total container throughput reached 513,001 TEUs , however, growth rate of container throughput at Karachi port leveled off at 0.6% in comparison with1993/94 because of low productivity and reliability from frequent labour disputes and political problems.

(3) Bangladesh

14. Chittagong Port handled 227,172TEUs in 1994/95 and growth rate was 30% in comparison with the previous year. Future container throughput by Chittagong Port Authority is estimated as 378,000TEUs in 2001/2001and 509,000 TEUs in 2004/2005, respectively.

15. At present, Chittagong Port Authority does not plan to construct additional container berths. However, an area of 200,000 m^2 is reserved for expansion of the container yard.

TABLE 2.3.5 Indian Ports' Throughput for Fiscal Years (1993-1995)

Port	1993-1994	1994-1995	% change
Bombay	427,600	486,993	13.9
Jawaharlal Nehru	173,000	244,070	41.0
Madras	163,087	200,540	22.9
Calcutta	102,018	112,032	9.8
Cochin	66,000	86,450	30.1
Tuticorin	48,110	57,000	18.5
Kandla	28,459	51,250	80.0
Total	1,008,345	1,238,335	22.8

Source : Containerisation International, October 1995

Note : Other port throughput includes: Visakhapatnam-11,145TEUs, New Mormagao-1,168TEUs, New Mangalore-868TEUs

TABLE 2.3(2) Development Plan of Major Indian Port

Port	Annual Capacity Mil. TEUs /Year	Completion by end
Jawaharlal Nehru : 2 berths(450m)	0.20	1999
Madras : 600m quay extension + 2 gantries	0.25	1998
Cochin : Yard & depth enhancements	0.28	1999
Calcutta : Handling equipment	0.10	1996
Tuticorin : Conversion of multipurpose berth to containers	0.15	1998

Source: Ocean Shipping Consultants Ltd.

2.4 Development of the Ports of Singapore and Hong Kong

(1) Port of Singapore

16. Container traffic through the Port of Singapore has reached 1.2 million TEUs in 1995, a growth of 15% from the previous year. Transhipment traffic from the Indian ports is reported to have increased by 19%. The port is believed to be carrying out the most efficient port operations in the Asia and Pacific region.

17. PSA is building a new container terminal, Pasir Panjang, whose development plan has four phases with a total capacity of 36 million TEUs. Phase one of the development was commenced in 1993 and the first five berths are expected to enter into services in 1998. Phase two of the development has already started and is planned to be completed by 2008. When the two phases are completed, there will be a total of 26 berths and a capacity of 18.3 million TEUs.

18. In planning the new terminal, a berth is designed to handle 700,000 TEUs per annum. Brani Terminal was designed to handle about 600,000 TEUs per berth annum. Cost of the phase one is estimated at about S$2 billion, which is S$250 million per berth, while phase two is assessed at S$5 billion, or S$280 per berth.

19. Outline of the new terminal is shown in Table-2.4.1

TABLE 2.4(1) New Container Terminal at Pasir Panjang

	PHASE I	PHASE II
Terminal Area	127 ha	222.6 ha
Berths	8	18
Handling Capacity	5.4 million TEUs	12.9 million TEUs
Start of Reclamation	Sep. 1993	1995
Completion Milestone	First 5 berths by 1998	First 2 berths by 2001
Completion	2000	2009
Estimated Cost of Development	more than S$2 billion	some S$5 billion

Source: Port of Singapore Authorit

(2) New Container Terminal Development Plan of the Port of Hong Kong

20. The development of port facilities in Hong Kong has been carried out as a part of the Port and Airport Development Strategy (PADS) proposed in 1989. Economic changes in Hong Kong and other countries have necessitated reviews of the development plan for port facilities which was originally based on the data of 1988. The First and Second Reviews, made in 1992 and 1995, estimate that the volume of container handled at the port of Hong Kong will increase

at an annual rate of 7.6 percent between 1992 and 2011. This volume is expected to reach 31.8 million TEUs (4.0 times greater than in 1992) in 2011.

21. Based on the conclusion of this review, No. 9 container terminal, with four berths, will be constructed at Tsing Yi between 1998 and the middle of 1999 and Nos. 10 to 13 container terminals, with seventeen berths, will be constructed on the island of Lan Tao between 1999 and 2004. Although the companies undertaking the development, control and operation of the No. 9 container terminal have been decided upon by inviting tenders, its development has fallen greatly behind schedule because of the stiffening in the relationship between Great Britain and China.

Table 2.4(2) Outline of the Container Terminal Development Plan

Location	Terminal	Number of Berths	Operator	Berth Length (m)	Area of Terminal (Ha)	Construction Schedule
Tsing Yi	CT 9	1 2 1	MTL TWC HIT	1,280	60	1996-99
Lantawu Port	CT 10	4				1996-98
	CT 11	4				1997-99
	CT 12	5				1998-01
	CT 13	4				2000-03

Note: TWC;Tsing Yi Consortium(Jardine Matheson Ltd.)

Chapter 3 PRESENT SITUATION OF THE PORT OF COLOMBO PORT

3.1 Natural Conditions

(1) Winds

1. Observation records obtained at the Pilot Station built at the Southwest Breakwater indicate that the prevailing wind direction all the year round is WSW followed by SW. During the NE monsoon season and the two intermonsoon periods, the wind directions show different patterns of changes in the morning and in the afternoon. The directions are rather easterly in the morning and rather westerly in the afternoon. Strong winds exhibit a higher frequency of occurrence in the afternoon.

(2) Waves

2. During the period between October 1995 and February 1996, field observations of wave height, period and direction were performed with the aid of an integrated ultrasonic wave recorder/electromagnetic current meter installed at a depth of -15 m off the northern shores of the Port of Colombo. The predominant wave direction during the field observation period was SW followed by SSW with a combined frequency of occurrence of over 90%. WNW to NNE waves were limited in occurrence with a combined frequency of only about 5% of all the frequencies of wave occurrence observed, of which N waves showed a frequency of occurrence with about 2%.

3. Wave heights above 1.0 m accounted for 45.8% of the total wave height measurements and this indicates that the site of the proposed new port is susceptible to attacks of high waves. During the June-September period, the days when wave heights of 1 m or more occur a total of more than 24 days. Offshore construction activities during this period are likely to be virtually impossible. Data on maximum wave heights were extracted from the wave observation records obtained since 1980 and were processed statistically. In consequence, the design wave parameters (50 year return period) obtained for breakwaters and other proposed port structures were the wave height of 5.7 m and wave period of 10.0 sec. The stability of the existing Southwest Breakwater in the port was studied for the purpose of verifying the soundness of the design wave parameters obtained. As a result, the parameters were deemed appropriate.

(3) Currents

4. Field observations of offshore current velocities and directions were carried out at the same location and time as the wave observations using the same integrated instruments. In addition, 25-hour spot current observations were made at 9 selected points in the area off the northern shore of the existing Port of Colombo with the aid of a direct-reading current meter. The observation records indicated that the predominant current direction was N, and the current velocity measurements were almost entirely below 0.1 m/sec with a frequency of occurrence of approximately 95%. Further, during the southwest and northeast monsoon periods littoral currents were observed along nearly 3 km of northern coastline of the port by means of float tracking. Generally, the littoral current off the southern shore near the fishery harbour travels in

the S to SW directions (toward the port), while along the coast north of the Kelani river mouth the littoral current movement is toward the north.

(4) Soil Conditions

5. Soil borings were carried out at five offshore points and six onshore points. The data derived from these soil borings and previous soil data revealed that in the sea area off the northern shore of Colombo Port, sand is the predominant stratum which extends from the seabed downward in a substantial thickness which exceeds 10 m in some places. The sand stratum is relatively loose with N-values less than 10 in the part lying above the elevation of -15 m. In the part below this elevation, however, the sand showed N-values ranging from 10 to 30. In part of the area off the Kelani river mouth, a clay stratum is formed in a thickness of some 6 m.

6. The bedrock with N-values of 50 or more occurred at a depth of about 13 m in the area north of the fishery harbour. In the area extending from outside of the opening of the Northeast Breakwater to offshore of the fishery harbour, the bedrock is presumed to occur at a depth of about 15 m.

7. In the area off the Southwest Breakwater, sandy soil is the predominant stratum and the bedrock was encountered at depths ranging from 20 to 25 m. In the onshore part of the coastline, sand predominates down to an elevation of about -10 m and a clay stratum was formed at an elevation of -10 m in some parts of both banks of the Kelani river.

(5) Bathymetric and Shoreline Surveys

8. Prior to the bathymetric and shoreline surveys, survey stations were set up at 10 different points on the northern shore of the port to set out the offshore operations. A bathymetric survey aided by an echosounder was carried out to cover depths down to -16 m in the area extending from the base of the Southwest Breakwater to a point some 1 km north of the Kelani river mouth. The survey results were presented in the form of sounding map on a 1/10,000 scale and a contour map. A survey of the shoreline and backup area including main buildings, roads and beach profile was also carried out in a coastal area extending nearly 5 km along the north shore of Colombo Port. The survey results were presented in the form of plan views on 1/5,000 scale and other maps.

(6) Sediment Transport from Kelani River

9. During the southwest and northeast monsoon periods, a sediment transport survey was performed which included surveying river profiles and measurement of river discharge and suspended sediment. Discharge measurements at the Kelani river mouth showed 130 m^3/sec during the southwest monsoon period and 30 m^3/sec during the northeast monsoon season. During the northeast monsoon season, the lower river discharge was attributable primarily to a smaller amount of rainfall, and backward currents of water (from the sea) were observed at flood tide. The rate of sediment transport averaged 0.3 to 0.6 kg/sec during the survey periods.

3.2 Environmental Conditions

(1) Water Quality and Bottom Sediment

10. The investigations showed no distinct seasonal variation in the water quality of the area investigated. A high degree of water pollution was observed in the inmost part of the port and in the vicinity of the fishery harbour. Offshore waters showed rather good quality and high transparency. On the north of the Kelani river mouth, the water quality was intermediate between the vicinity of the fishery harbour and the farther offshore area. The water of the Kelani river had a fairly high content of organic and inorganic suspended sediment. Water from wells was clear and contained virtually no contaminants.

11. Sampling of bottom sediment was carried out at the same locations outside the port and at the same time as the water quality investigations. Natural sand was brown, gave forth little odour and showed limited ignition loss (a few percent). However, material of very fine particles, such as clay and silt, had a high content of contaminants. Contaminants showed a higher concentration near the sewage outfall, fishery harbour shoreline and the shore north of the Kelani river mouth.

12. Municipal sewage of Colombo is discharged into the sea through the outfall off the fishery harbour at a daily rate of approximately 44,000 m^3 (nearly 30% of the total amount of municipal sewage). The volume of contaminated effluents is estimated at about 9 tons/day for BOD and about 6 tons/day for SS on the basis of the observations made at the sewage outfalls in the city of Colombo.

(2) Air Quality

13. At a total of 12 points around the port, air pollution was observed once each during weekdays and over the weekend during both monsoon periods. The observed amount of suspended dust exceeded the standard value at almost all the observation points, while the NOx value invariably remained within the allowable limits. Air pollution tended to increase in the northern part of the port and its vicinity, but the air quality showed an improving tendency in the southern part.

14. In the neighbourhood of the Port of Colombo, road traffic is considered to be primarily responsible for air pollution. During both monsoon seasons, an air pollution observation and a road traffic survey on five different types of vehicles were conducted at the same locations. The peak volume of vehicular traffic to and from the port area was 1,600 vehicles, of which trailers numbered some 230.

(3) Biological Survey

15. Seashore vegetation is limited to the area along the Kelani river where artificial impacts are limited. Mangroves grow in scattered clusters in the river mouth area and along the Hamilton Canal. Growths of large seaweeds are limited both in species and in shapes due to thick deposits of silt on rocks and coral reefs or high-density silt suspended in the seawater.

16. Of the avifauna, waterfowl including migratory birds were observed in large numbers in non-arable lands and residential districts. As for the marine fauna, such insects as Sabellaried worms were living in limited numbers on offshore rocks in the face of an active sedimentary environment.

17. Fishing is an important industry in the area surrounding the Port of Colombo, and prawns and sardines are among the major species caught.

(4) Residents, Buildings and Cultural Assets

18. Surveys of the northern Colombo/Wattala area (having an area of 3.3 km^2 and population of 55,428) revealed a heavy concentration of factories, population, government offices and private firms in northern Colombo, and that tourism and fishery are the key and active industries in the Wattala area.

19. Throughout the whole of the northern Colombo/Wattala area a variety of social establishments were located, although unlawfully built shanties and slums were also found in large numbers. The area contains buildings dating back to the colonial days as well as historic relics and cultural property of value.

3.3 Port Facilities

20. The development of the Port of Colombo began in the mid-1870s with the construction of the South-West Breakwater to provide safe anchorages for ocean-going steam boats. The S-W Breakwater was completed in 1884. Construction of two other breakwaters, North-East and North-West Breakwaters, began in 1894 and was completed in 1906. Since then, the basic configuration of the port has remained unchanged for 90 years.

(Breakwaters)

21. All breakwaters have a concrete block structure, where about 30 ton cubes are piled up on the rubble mound deposits. Length of each breakwater is:

South-West Breakwater:	1,284 m
Extension arm from the S-W:	550 m
North-West Breakwater:	809 m
North-East Breakwater:	305 m

(Queen Elizabeth Quay)

22. QEQ was firstly developed during 1950-1954 and extended to six berths during 1969-1980 to cope with the containerization. Since the quay was developed along the S-W breakwater, the width is only 120 m and the container terminal is too narrow to install modern cargo handling equipment.

Total quay length:	1,035 m (6 berths)
Draft:	9.2-10.8 m
Container yard:	7.9 ha
Number of quay cranes:	3

(Jaya Container Terminal)

23. The construction of a full size container berth, JCT No.1, was started in 1982 and service commenced in 1985. Three other full size container berths have since been constructed and operations commenced in 1987 (JCT No.2), in 1994 (JCT No.3) and in 1996 (JCT No.4).

Total quay length:	1,260 m
Draft:	12-14 m
Container yard:	32 ha
Number of quay cranes:	11

(Bandaranaike Quay)

24. Bandaranaike Quay was developed during 1950-1954 to handle breakbulk cargo and remains as a quay for conventional ships. Container feeder vessels sometimes berth at the quay and discharge boxes with their own gears.

Total quay length:	855 m (5 berths)
Draft:	6.5-10 m
Terminal area:	5.6 ha

(Prince Vijaya Quay)

25. PVQ was also developed during 1959-1954 along the North East Breakwater and is now used for conventional cargo and bulk cargo such as cement or grain.

Total quay length:	340 m (2 berths)
Draft:	9.2-9.5 m

(Others)

26. Guide Pier (GP), North Pier (NP) and South Pier (SP) are located in the north end of the harbour, and are used for handling oil products, vehicles, breakbulk and feeder containers.

GP: 363 m (Quay length); 7.9-9.2 m (Berth draft); 2 berths
NP: 294 m (Quay length); 10.4 m (Berth draft)
SP: 234 m (Quay length); 9.5 . (Berth draft)

3.4 Vessel traffic

(1) Access passages

27. There are two access passages of the W and the N. The W passage which leads to the W entrance, between SW and NW breakwaters, has been dredged at 300m wide and -15m deep for about 2,000m in 1995 and is being used as the main passage for almost all calling vessels. However, the passage has inherent problematic conditions such as a disturbed swell across this passage during the SW monsoon, the very narrow navigable width of only 137m at the breakwaters entrance, the passage alignment curves of about 15° close proximity to the entrance, and insufficient maneuvering basin after passing the entrance to the JCT quay for large container vessels. Although Panamax container carriers such as 4,300TEU have been calling regularly, the repeated apprehensions on the part of captains when passing the entrance is cause for concern and hazardous conditions should be recognized by the Port Authority.

28. The N passage which leads to the N entrance is -10.5m deep, less than 150m wide at the breakwaters entrance, an 8.5 m rock lies close outside this entrance, and without any navigation mark for the passage. The passage is currently being used as a sub access passage for middle/small size vessels.

(2) Ship Traffic

29. Total number of calling vessels in 1994 was 3,251, among which the number of container ships was 1,786. The number of ship arrivals by type of vessel is shown in Table 3.4.

30. Average size of conventional ships is 6,600 GRT and that of container ships is 20,900 GRT. Over the last five years, average size of conventional ships has not changed, while that of container ships has increased from 17,770 GRT to 20,900 GRT.

TABLE 3.4 Ship Arrivals by Vessel Type (1994)

Vessel Type	Number
Conventional Cargo	677
Dry Bulk Carrier	196
Oil Tanker	130
Roll on Roll off	132
Container Ship (fully Cellular)	1,786
Semi Container Ship	195
Passenger Ship	27
Other	108
Total	3,251

3.5 Cargo Traffic

31. The volume of cargo handled in the Port of Colombo steadily increased as a whole up to 1992. This increase was caused mainly by the high growth of transhipment cargo after the completion of Jaya Container Terminal in 1985 and 1987. Since 1992 the cargo throughput has increased sharply due to the Indian government's policy of liberalization. In 1994 the total volume of cargo reached about 16 million tons, which is 2.4 times greater than the volume of ten years ago. Trends of container and conventional cargo throughput is shown in Table 3.5(1) and 3.5(2).

32. The major commodities imported are cement, fertilizer, sugar, iron/steel and crude/fuel oil, while those exported are tea, rubber, coconut products and oil products. Recently, break bulk cargo throughput of tea, rubber and coconut products has decreased due to the progress of containerization. The share of transhipment among the total container throughput has been about 70%. The containerization ratio in export cargo has reached about 90%, while the ratio in import cargo is about 50% and is still growing.

33. According to Origin/Destination Survey of Container Cargo (1994) conducted by SLPA, 67% of total transhipment container is transported from/to Indian Ports, 9% from/to Pakistan and 23% from/to others. FIGURE 3.5 counts the share of incoming and outgoing containers from/to regional ports.

FIGURE 3.5 Share of Transhipment Container Cargo by Ports (1994)

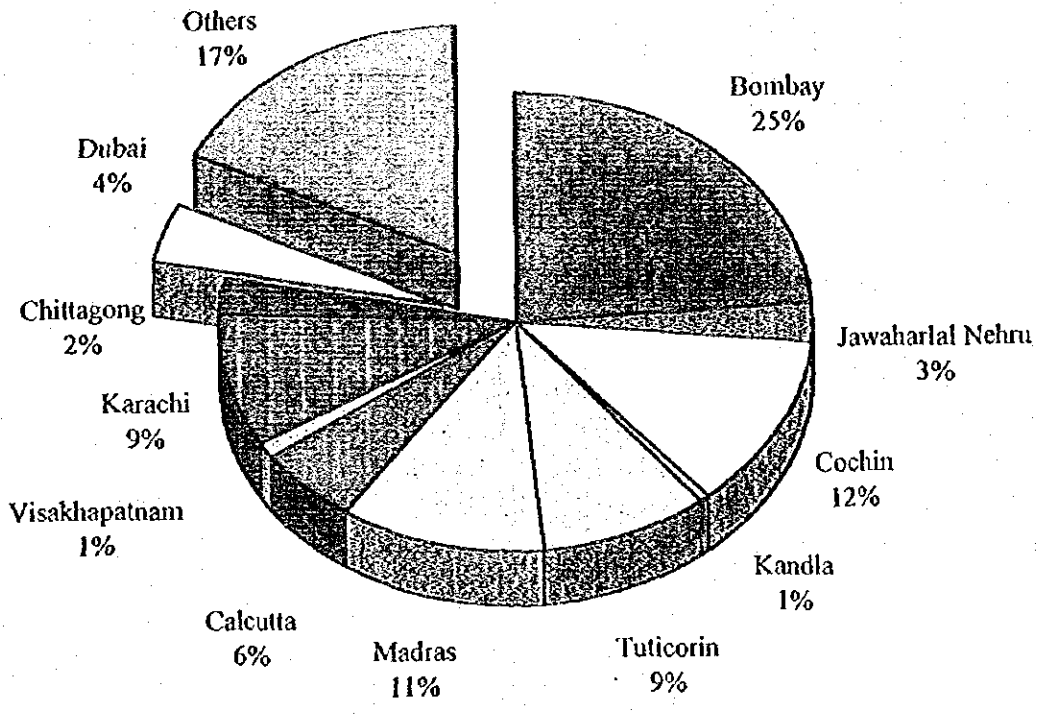


TABLE 3.5(1) Trends of Container Cargo Throughput at the Port of Colombo

('000TEU)

Type of Handling	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Domestic	103	121	129	135	159	173	188	212	252	288
Transhipment	113	220	300	486	385	411	470	451	591	666
Total	216	341	429	621	544	584	658	663	842	954

Source: Port Statistics, Sri Lanka Ports Authority
Note: Exclusive of Restowing

TABLE 3.5(2) Trends of Conventional Cargo Throughput at the Port of Colombo

('000 tons)

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Break Bulk	2,219	1,993	2,133	1,945	2,030	1,916	1,717	1,926	1,930
Dry Bulk	312	357	396	416	390	403	499	502	589
Liquid Bulk	2,202	2,236	2,086	1,758	2,083	2,100	2,131	2,408	2,529
Coastal Trade	239	210	194	179	235	323	355	356	310
Total	4,972	4,797	4,808	4,298	4,737	4,743	4,702	5,192	5,358

Source: Port Statistics, Sri Lanka Ports Authority

3.6 Terminal Operation

(1) Functions of JCT and QCT

34. JCT Nos. 1~4 berths receive oceangoing vessels of 30,000 GRT to 50,000 GRT which circumnavigate the world or connect with Europe, North America or East Asia. Feeder vessels which tranship containers to these vessels berth at JCT-CBN and JCT-CBS berths and JCT Nos. 1~4 berths. When many oceangoing vessels call at the container terminals simultaneously, JCT berths are fully utilized, making the berthing of feeder vessels there impossible. In such a case, feeder vessels berth at the conventional berths at GP, SP, PVQ, BQ, etc., for cargo handling.

35. QCT No. 4 terminal and QCT Nos. 5 and 6 terminals accommodate 10,000 GRT~30,000 GRT oceangoing vessels plying East Asia, Africa, the Near and Middle East, the Mediterranean and Indo-European routes as well as feeder vessels which tranship containers to these oceangoing vessels.

36. The ship agents of container vessels which call at the Port of Colombo are expected to declare to the container terminal manager ship names, estimated time of arrival(ETA) and number of containers handled by 96 hours (4 days) before the ships' ETA. Based on such declaration, the terminal manager allocates berths and informs the ship agents of the allocation. The ship agents need to declare the final time of arrival at least 24 hours before ETA for confirmation. If the actual arrival is delayed by six hours or more beyond the confirmed arrival time, the vessel concerned loses the priority right to use the allocated berth.

(2) Yard Operation

37. In both JCT and QCT ground slots are allocated for export containers, import containers and transhipment containers. The slots for transhipment containers are sub-allocated by ship agent. Transhipment containers are separately stacked on different ground slots in the order of ships handled by ship name, destination port and weight class. Terminals accept export container from one to five days in advance of the ship arrival.

38. The Port of Colombo container terminals adopt a 2-shift working system and operate 21.15 hours a day and 364 days a year, except for May Day (May 1).

(3) Performance of Container Terminal Operations

39. Berth occupancy ratio at both JCT and QCT exceeds 80% and average waiting time of container vessels reach 14 hours (from January to June 1995) which are very long compared to other terminals in the world .

40. The container handling productivity of the quay crane at JCT averages 18 to 20 boxes per hour for main vessels and 14 to 15 for feeder vessels, while QCT averages 14 to 15 boxes per hour for both main and feeder vessels(in July 1995). Ship-wise container handling productivity at JCT in the same period is 25 boxes per hours for main vessels and 14 boxes per hour for feeder vessels, while QCT averages 14 and 9 boxes per hour for main and feeder vessels respectively.

41. The dwell time of import and export containers was 8.4 and 4.8 days respectively, with that of transshipment containers standing at 7.4 days. The total dwelling time of the container averages 7.0 days (from January to June 1995).

3.7 Port Management

42. In Sri Lanka, the Sri Lanka Ports Authority (SLPA) has competence to manage and operate main port activities. Some port activities are undertaken by the Ministry of Shipping Ports Rehabilitation and Reconstruction (MSPRR) which supervises the SLPA, and by some other Ministries.

43. The SLPA is a statutory body established in 1979 under the Sri Lanka Ports Authority Act (SLPA Act).The port activities managed and operated by the SLPA - which are mainly port development, maintenance, port services such as stevedoring and pilotage, protective services, regulating and so on - are provided in the SLPA Act.

44. Employees of the SLPA classified into three grades, Executive grade, Non-Labour grade and Labour grade. The number of employees in 1994 is 16,617 persons, which is a 16.2% reduction compared with 1990. However, compared with the number of employees of Port of Singapore Authority (PSA) which is 7,447 persons in 1994, the SLPA has more than twice as many employees as the PSA, thus port activities undertaken by the SLPA are not efficient.

45. The SLPA has an independent accounting system and therefore subsidies are not given from the Government. The SLPA annually prepares the financial statements, " Profit and Loss Account" and "Balance Sheet".

46. In 1994, Operating Ratio of the SLPA is 67.6%, Working Ratio is 56.4%; the operational efficiency of the SLPA has been decreasing since 1990. Rate of Return on Net Fixed Assets of the SLPA in 1994 is 7.9%; the profitability has also been decreasing since 1990.

47. It is considered that increases in payroll and depreciation costs are the main reasons for the decline in the operational efficiency and profitability of the SLPA. As the quantity of facilities owned by the SLPA is increasing as part of port development, a further decline in profitability

is possible because depreciation costs will increase in future.

48. The current tariff of the SLPA was made when the SLPA was established by the merger of three independent organizations (The Colombo Port Commission, The Port Cargo Corporation, The Port Tally and Security Corporation). It is structured by the items covered by the former three organizations and the ones newly added when the SLPA was established.

49. When the SLPA revises a tariff, examination is made by Tariff Review Committee constituted by the executive staff of the SLPA. Final Approval by MSPRR is necessary. The SLPA revised the tariff of transhipment container handling on the 10th June, 1995. The other tariffs have not been revised since 1987.

Chapter 4 MASTER PLAN

4.1 Requirements for the New Port

1. The Port of Colombo has a possibility to share the transhipment containers from/to the Indian Subcontinent with the Port of Singapore so that the new port should comply with the following requirements with a view to consolidating the position as a regional hub port.

(1) To enable the port to accommodate post Panamax ships;

Presumed dimensions of a post Panamax vessel are 300-320 meters in length, 13.5-14.0 meters in draft and 40-43 meters in breadth. A new terminal should have a berth with a depth of minus 16 meters and a container yard with an area of 12 -15 hectares.

(2) To widen the West Entrance and assure safe manoeuvring;

The navigable width of the present West entrance is 125 meters for a Panamax vessel with a draft of 13 meters, which is far below the internationally accepted standard. The present entrance should therefore be widened as soon as possible. Minimum under-keel clearance shall be 10 percent of ship draft in the turning basin and 15 percent in the outer approach channel.

(3) To comply with an urgent need for increasing the capacity of container handling;

Coping with the rapid increase in transhipment needs, some part of new facilities should be completed in a short time after the commencement of construction. While the development of new breakwater will take a long time, new terminal should enter into service within 10 years.

(4) To be flexible to cope with future demand;

Development plan should be flexible enough to cope with demand changes in the future and should have an adaptable stage-wise plan.

(5) To mitigate adverse effects on the environment;

New South-West Seawall shall be on the inside of the extension of the shore line of Galle Face Coast, so as to minimize the possible effect on the littoral sand moves which mainly drifts from south to north. Special attention should be paid to impacts of reclamation, construction of breakwaters, loss of wetland, coastal erosion, and other possible adverse effects.

4.2 Demand Forecasts

(1) Population

2. Projected population in the future is estimated in "Statistical Abstract (1994)" and "Population and Labour Force" by the Sri Lankan Government Authorities. Since the high growth case of the latter forecast has proven to be quite accurate, future population is calculated by

multiplying the actual population in 1994 by the growth rate estimated in the above mentioned case.

TABLE 4.2(1) Results of the Forecast of Future Population in Sri Lanka

Year	1994	2005	2015
Population ('000)	17,865	20,053	22,169

(2) GDP

3. According to the Public Investment Plan 1995-1999, the growth rate of GDP during the planning period is expected to increase from 6.0% to 7.7% per annum. Therefore it is assumed that the rate after 2000 would be constant at 7.7% in the high growth case and the rate after 1995 would be constant at 5.6%, which is the rate of 1994, in the medium growth case. In the low growth case, the average growth rate over the past ten years, which is 4.3%, will continue after 1995.

TABLE 4.2(2) Results of the Forecast of Future GDP in Sri Lanka

Year	1994	2005			2015		
		High	Medium	Low	High	Medium	Low
GDP (10mil.Rs.) at 1982 Const. Factor Cost Price	15,927	34,761	29,087	25,347	72,987	50,291	38,670
Growth Rate (%)	5.6	7.7	5.6	4.3	7.7	5.6	4.3

(3) Domestic Cargo

4. Among the domestic cargo, containerized cargo volume is estimated both by macro forecast, which is based on the correlation between the total break bulk cargo volume and GDP of Sri Lanka, and by micro forecast in which break bulk cargo volume of each main commodity group is estimated individually and totaled. Other export/import and coastal trade cargo volume is estimated by micro forecast. The results of the calculation in target years are shown in Table 4.2(3).

(4) Transhipment Containers

5. The majority of transhipment container cargo at the port of Colombo consists of the traffic between developed countries and South Asia such as India (67%), Pakistan (9%), Chittagong (2%), other countries (22%).In this study, the cargo volume of transhipment container cargo is estimated based on the volume of container cargo in the related neighboring areas for transhipment containers. The method to forecast container cargo volume in India is: 1) Estimate the volume of containerizable cargo for the planning period by its correlation to GDP, 2) Estimate

the trend of the ratio of containerization over the planning period by applying a logistic curve, and 3) Estimate container throughput for the planning period by multiplying 1) by 2). The results of the future container throughput are shown in TABLE 4.2(4) and FIGURE 4.2.

TABLE 4.2(3) Result of the Forecast of the Future Container Throughput

('000TEU)

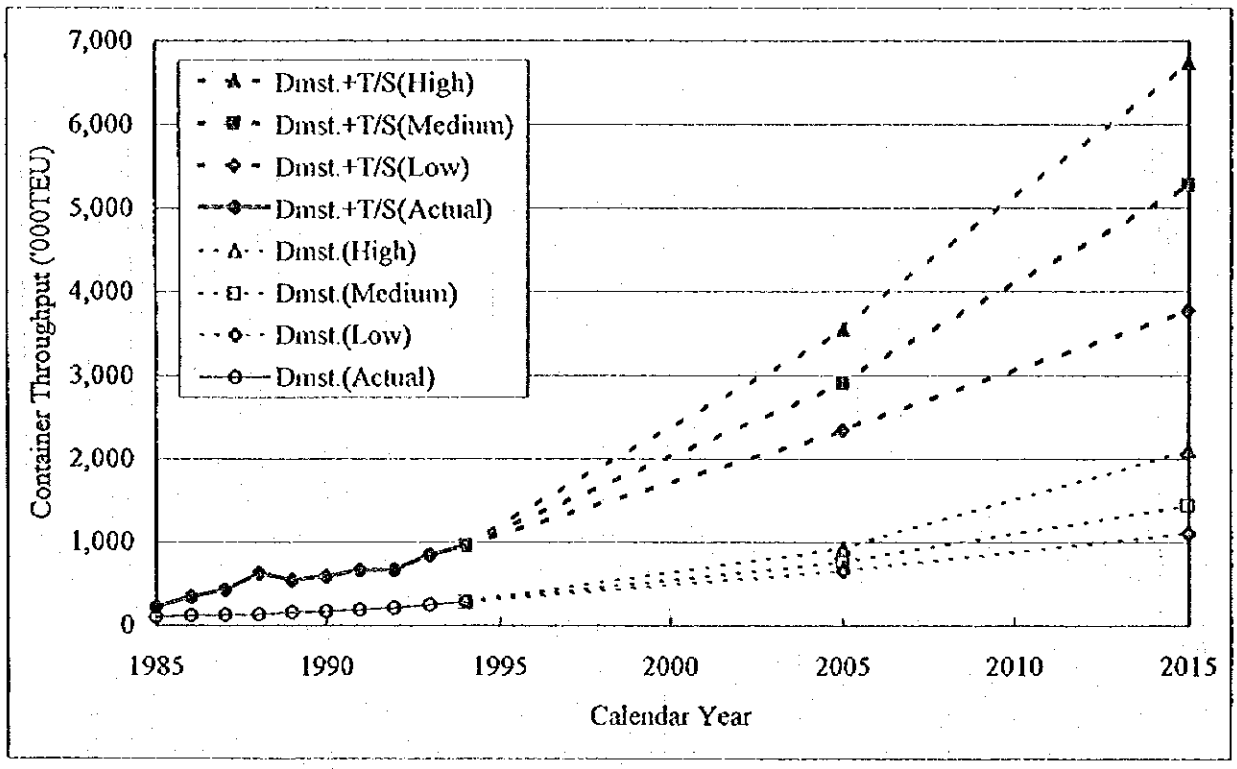
Year	Case	High Growth	Medium Growth	Low Growth
2005	Transhipment	2,616	2,145	1,684
	Domestic	929	767	660
	Total	3,545	2,912	2,344
2015	Transhipment	4,641	3,835	2,670
	Domestic	2,096	1,444	1,110
	Total	6,737	5,279	3,780

TABLE 4.2(4) Transhipment Container Throughput

Unit: 1,000TEU

Year	Case	Low Growth	Medium Growth	High Growth
2005	India	1,227	1,652	2,087
	Pakistan	144	180	216
	Others	313	313	313
	Total	1,684	2,145	2,616
2005	India	1,945	3,062	3,820
	Pakistan	192	240	288
	Others	533	533	533
	Total	2,670	3,835	4,641

FIGURE 4.2 Future Container Throughput



(5) Future Cargo Throughput at the port of Colombo

6. The results of the forecast for the future container and conventional cargo throughput at the port of Colombo are shown in Table 4.2(4) and 4.2(5), respectively. Container Cargo volume is estimated to reach 2.3-3.6 million TEUs in the year 2005 and 3.8-6.7 million TEUs in 2015, while the conventional cargo volume is estimated to reach 6.2-7.8 million tons in 2005 and 7.2-10.3 million tons in 2015. (TABLE 4.2(5))

TABLE 4.2.5 Results of the Forecast of Future Conventional Cargo Volume

('000 tons)

	1994	2005			2015		
		High	Medium	Low	High	Medium	Low
Break Bulk	1,930	1,981	1,639	1,408	2,311	1,594	1,207
	589	2,139	1,959	1,778	3,348	2,927	2,506
Liquid Bulk	2,529	3,337	3,072	2,827	4,266	3,747	3,265
Total Import/Export Cargo	5,048	7,458	6,669	6,013	9,926	8,268	6,978
Coastal Trade	310	376	277	179	376	277	179
Total	5,358	7,834	6,947	6,192	10,302	8,545	7,157

(6) Future Ship Traffic

7. Based on the future cargo volume and vessels' capacity forecast from the past trend of net tonnage of calling vessels, future number of calling vessels is estimated for each ship type. (TABLE 4.2(6))

TABLE 4.2(6) Results of the Future Ship Traffic

(No.)

Year	1994	2005			2015		
		High	Medium	Low	High	Medium	Low
Total Number of Calling Vessels	3,227	8,062	6,671	5,458	12,551	9,746	7,096

4.3 Development Plan for 2015

(1) Present Port Capacity

8. The annual container handling capacity of the JCT, QCT and NP terminals amounts to approximately 1,500,000 TEUs as of the end of 1995 when JCT No. 4 terminal was completed. The annual capacity in the year 2000 is estimated to reach about 1,900,000 TEUs subject to the rehabilitation and redevelopment of QCT and NP and to the procurement of additional cargo handling equipment at JCT.

9. To assess the capacity of ship traffic in the harbour, a computer simulation was carried out in cases of 1.8 million TEUs and 2.4 million TEUs. The simulation has shown that average ship wating time will decrease in both cases if the cargo handling productivity is increased to an ordinary level. The simulation has also indicated that the separation of ship traffic is necessary to cope with the estimated increase in ship calls.

(2) Optional Development Sites

10. The outside of QEQ and the north of the present port are two principal sites for the development of a new port. The inner harbour side of QEQ is also an potential development site. Advantages and disadvantages of the two development sites are summerized in Table 4.3(1).

11. Development of the north site has an advantage in terms of access from hinterland and less disturbance to operations of the present port. However, a shelter against south-west waves is required in advance, which entails a long construction period and a huge investment without financial returns.

12. Expansion of QEQ to the outside (South Port Development) also needs a large investment in the construction of breakwater and seawall, however, it is less than the investment required for the north development. An advantage of the south development is that it enables the extension of the present container terminal in a short period after the commencement of the construction.

13. QEQ expansion to the inner harbour should be minimized from the viewpoint of ship maneuvering in the harbour, otherwise ships will have a difficulty in berthing at the Bandaranaike Quay and QEQ Nos.1-2 berths. Lengthy Panamax vessels will also have a difficulty in turning in the restricted basin between JCT and QEQ.

14. The inner expansion of QEQ should solely aim at the construction of deeper berths and QEQ container yard should be expanded to the outside of the present South-West Breakwater. Construction of deeper berths and expansion of container yard should be carried out simultaneously to achieve an effective increase in the capacity. Rehabilitation work should not result in congestion for calling ships.

TABLE- 4.3(1) Characteristics of Development Site

Alternatives / Requirements	South Port Development	North Port Development
Navigation safety, & Widening Main Entrance	Widening the Main Entrance enabled by the development	New breakwater is necessary to widen the Main Entrance.
Shorter Period for Development	QEQ expansion increases the capacity at the early stage.	No significant increase in the capacity until the new terminal is completed.
Easy Access from hinterland	Inter-terminal road connecting QEQ to the New Gate shall be improved.	New access road from Crow Island is necessary.
Future Development	Expansion to the North Port is easy.	Expansion to the South Port is difficult.
Obstacles to the development	No significant obstacles identified.	Replacement of offshore sewage outlet and oil pipeline is necessary; Replacement of Mutwal Fishery Harbour required.

15. In this regard, Priority was given to the South Port Development in consideration of construction cost and period. The development of the South Port enables the expansion of QEQ container terminal to the outside as well as the construction of new deeper berths. The North Port can be economically developed after the completion of the South Port, which will afford shelter to the North site. The development of the North Port shall be flexible in accordance with the demand for cargo throughput.

(3) Development Plan for 2015

16. New master plan aims at developing the port for the coming 20 years culminating in 2015, bearing in mind the rapid increase of transhipment containers and economic development in the South Asian region. Short-term plan to be selected in the master plan, therefore, contemplates developing the port for the coming 10 years culminating in 2005.

17. In accordance with the demand forecast, master plans are drafted for a low growth case and high growth case. High growth case, in which container throughput is assessed at about 6.7 million TEUs, has two plans for the North Port Development, i.e. Crow Island Offshore Development (Figure 4.3.1) and PVQ North Development (Figure 4.3(2)).

18. In the low growth case, container throughput is estimated at 3.8 million TEUs in 2015 and in medium case at 5.3 million TEUs so that the master plan for low/medium growth case has five new main berths and one redeveloped berth with a handling capacity of 4.9 million TEUs (Figure 4.3(3)).

19. Details of port development plans in High Growth Case and Low/Medium Growth Case are as listed in Table 4.3(2).

TABLE 4.3(2) Development Plans for 2015

Items	High Growth (PVQ North Development)	High Growth (Crow Island Offshore Dev.)	Low/Medium Growth Case
Terminal Area	236 ha	340 ha	120 ha
Additional Berths	Main CT: 10 Feeder: 7 Multi: 1 R/R & Pssg: 1	Main CT: 11 Feeder: 5 Multi: 1 R/R & Pssg: 1	Main CT: 6 Feeder: 3
Handling Capacity (Container)	7.7 mil. TEUs	7.7 mil. TEUs	4.9 mil. TEUs
Total length of Breakwaters/Seawalls	6,350 m	7,010 m	3,610 m
Dredging	12.5 mil. m^3	13.3 mil. m^3	5.3 mil. m^3

Note/ Feeder includes the redevelopment of QEQ Nos.2-3

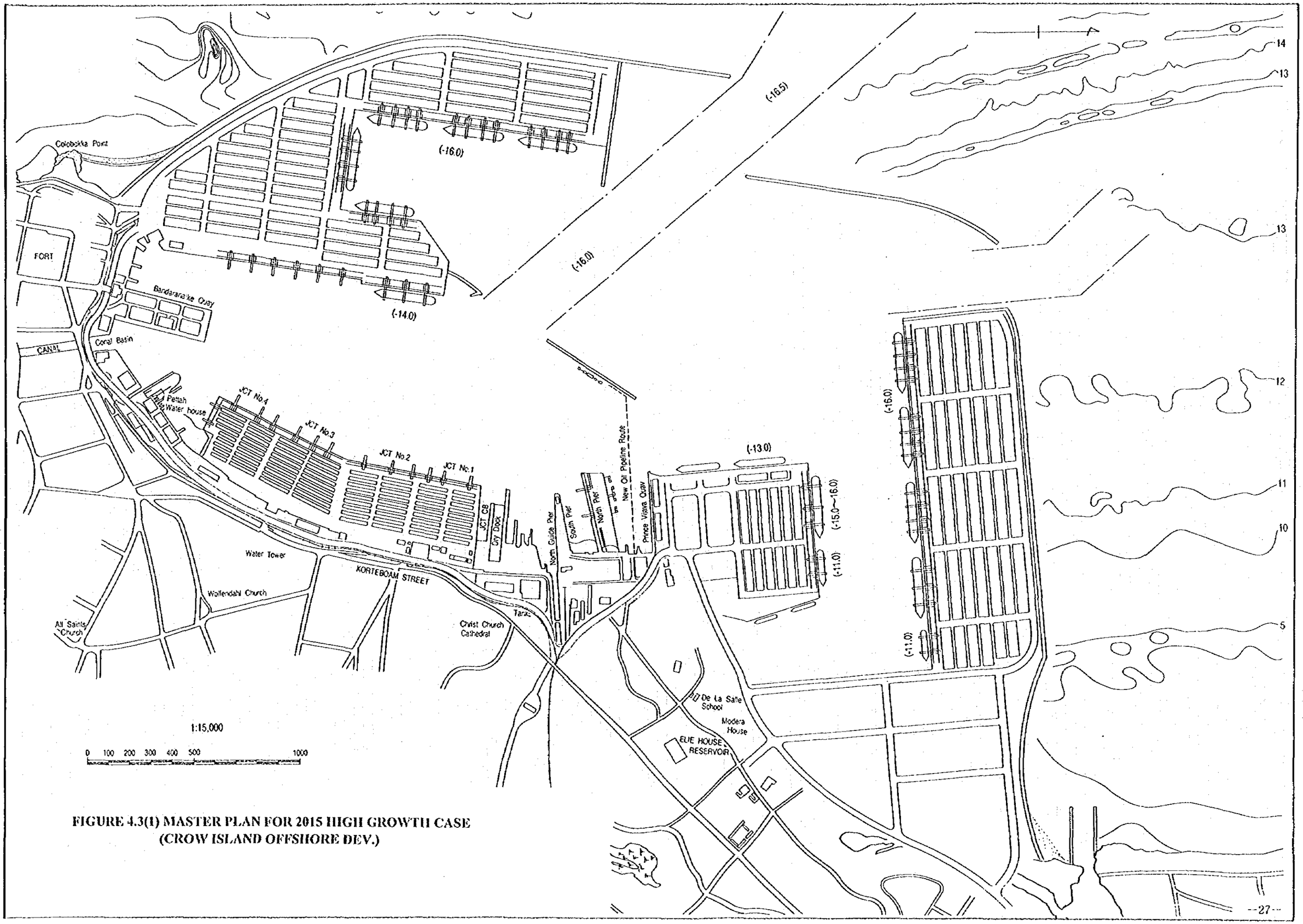


FIGURE 4.3(1) MASTER PLAN FOR 2015 HIGH GROWTH CASE (CROW ISLAND OFFSHORE DEV.)

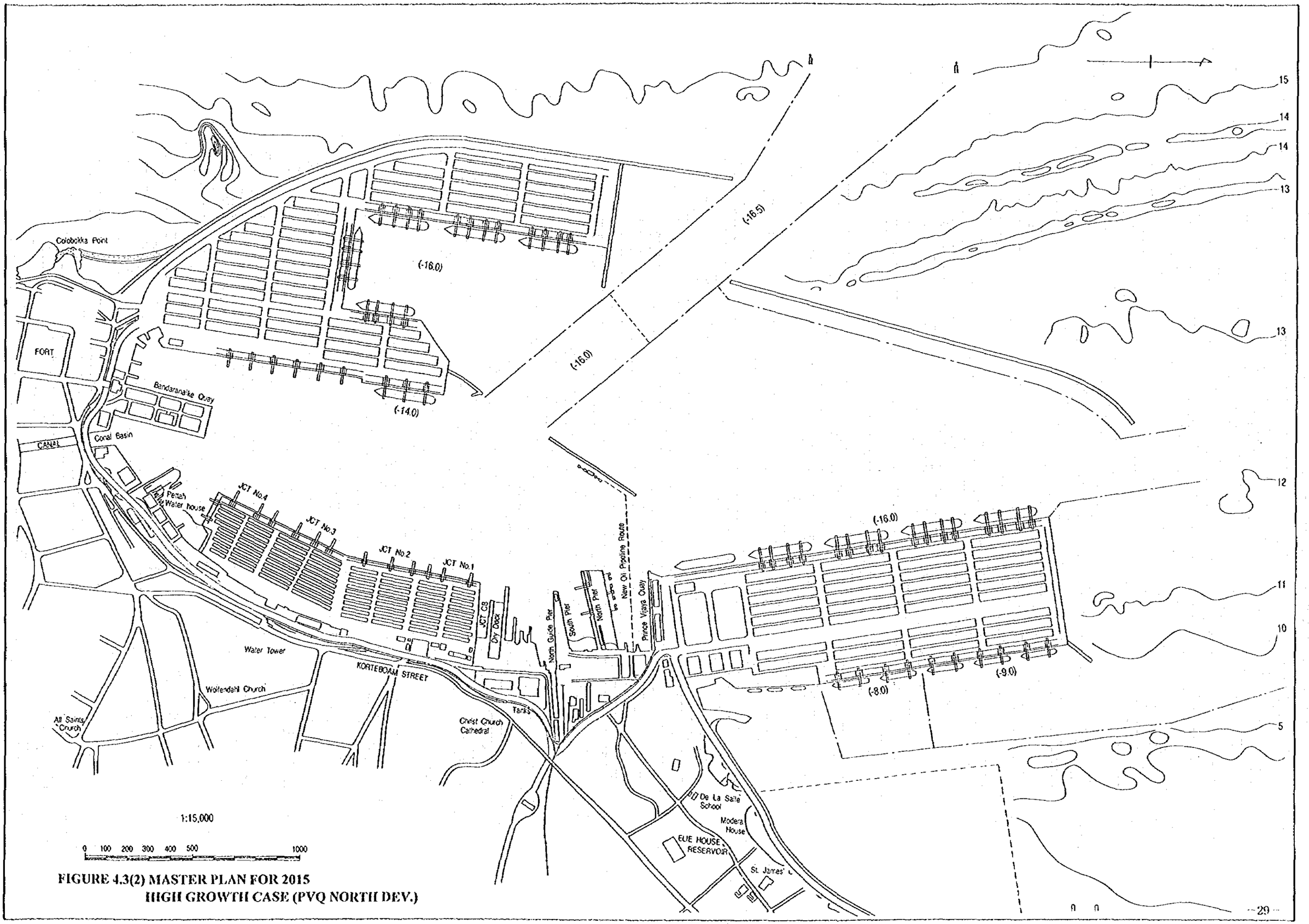


FIGURE 4.3(2) MASTER PLAN FOR 2015
HIGH GROWTH CASE (PVQ NORTH DEV.)

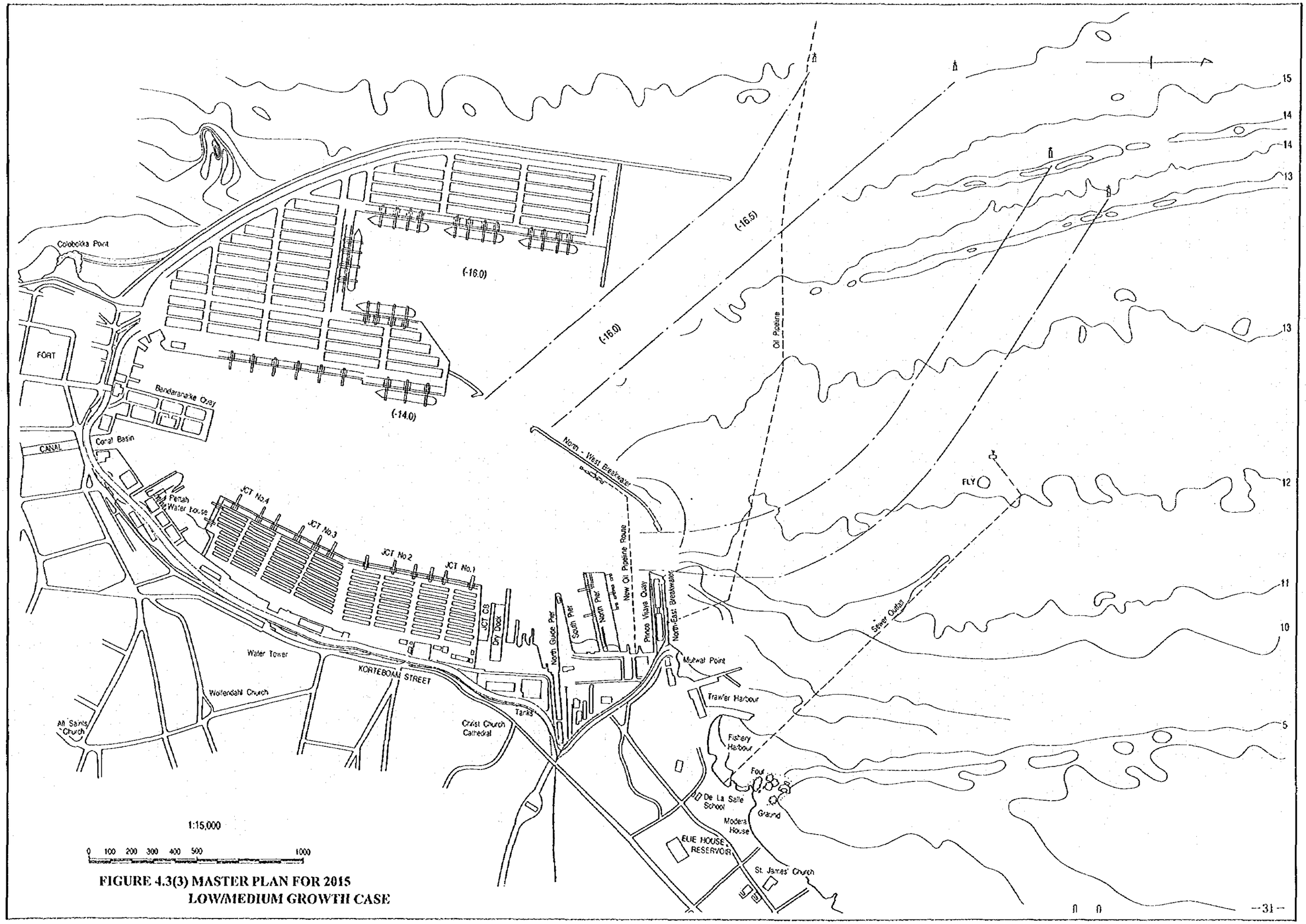


FIGURE 4.3(3) MASTER PLAN FOR 2015
LOW/MEDIUM GROWTH CASE

4.4 Preliminary Structural Design of Port Facilities

20. In the preliminary design of the planned port facilities, due consideration was given to the local operational conditions of construction works as well as structural stability and the following factors were taken into full account with a view to selection of structural types conducive to lower construction costs.

(1) Marine conditions including wave characteristics, tides, tidal currents and water depth
(2) Foundation soil characteristics
(3) Earthquake
(4) Properties of filling material for reclamation
(5) Needs for construction of container yard and quaywall
(6) Protection from wave overtopping, especially during the southwest monsoon period
(7) Impacts of new offshore structures on neighbouring sea areas and shores
(8) Relative ease of construction methods
(9) Stresses generated during berthing of post-Panamax container ships
(10) Watertight requirements of container ship quaywall and breakwater

21. In the preliminary design of the proposed breakwater and seawall, the following structural types were compared and evaluated in depth. The relative advantages and disadvantages of the seven different types are noted in parentheses.

(1) Rubble mound type
(Greater use of locally available materials is possible, longer construction period)

(2) Concrete caisson type
(Acceptable in terms of construction materials, relative ease of construction, and construction period and cost)

(3) Concrete caisson type armoured with wave-breaking blocks
(Problems with construction period and cost)

(4) Caisson type with case-in-situ concrete capping
(Large volumes of concrete needed)

(5) Composite block type
(Greater use of locally available materials is possible, longer construction period)

(6) Alt-block type
(Block fabrication and installation involves large amount of work, difficulty in construction, and longer construction period)

(7) Hull caisson type
(Problems with materials procurement, and construction method, period and cost)

22. The comparative evaluation resulted in the selection of the concrete caisson type as the optimum structural type for the breakwater and the seawall.

23. With regard to the container quaywall, a comparative evaluation was made of five different structural types, namely, gravity type, steel pipe sheet pile type, sheet piled wall type with relieving platform, steel sheet piled cellular cofferdam type, and open-type wharf with vertical piles primarily in terms of their capability for berthing large container ships (L 320 m, B 43 m, and Draft 14.0 m).

24. In consequence, the concrete caisson type was chosen for the new quaywall apart from the existing QEQ No.6 Berth.

25. In respect of the proposed extension of the QEQ No.6 Berth which is a quaywall with a depth of -11 m alongside built of concrete cylinders in stacks, the steel sheet pipe pile type was selected to enable dredging the quay frontage to -14 m.

4.5 Preliminary Economic Analysis

(1) Preliminary Cost Estimates

26. The preliminary estimates of the project cost were worked out in respect of the Master Plan targeted for the year 2015. The total project cost under the Master Plan was calculated in respect of three different cases (1) Medium Growth Case, (2) High Growth Case, and (3) High Growth Case envisaging PVQ North Development.

27. The preconditions for the cost estimation were as listed below.

1) The following exchange rates were used in estimating the construction cost broken down into the foreign and local currency components.
US$1.00 = Rs. 53.36 = ¥104.4 (as of January 1996)

2) All prices and rates imputed into the cost estimates for construction plant and materials were those prevailing in January 1996.

3) The cost of engineering services and a contingency sum (about 10%) were included in the cost estimates.

4) No price escalation was allowed for in the cost estimates for construction works, container handling equipment and engineering services including contingency.

28. The total project cost for the Master Plan is estimated at approximately US$ 1.1 billion to approximately US$ 1.4 billion in case the South Port Development is included, and at approximately US$ 2.1 billion to approximately US$ 2.7 billion if the North Port Development is implemented in addition to the South Port Development.

(2) Prerequisites of Analysis

29. The purpose of the preliminary economic analysis is to appraise the economic feasibility of the benefits in the master plan through a comparison of project costs from the view point of the national economy. The export/import container in the perquisites will be increased in spite of waiting ship condition. The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project by extracting benefits of increasing transhipment cargo.

1)The period of calculation (project life) in the economic analysis is assumed to be 35 years from the beginning of construction.

2)The foreign exchange rate adopted for this analysis is the same rate as used in the cost estimation.

3)"With"case: 2 cases of container demand forecast in target year 2015 consist of 3.7 million TEUs (High Growth Case) and 6.7 million TEUs (Low Growth Case).

4)"Without"case: Existing port capacities are estimated at 1.9 million TEUs including ongoing construction at the Port of Colombo.

(3) Benefit Items

30. As benefits brought about by the master plan of study port, the following items are identified. In this study the monetary benefits of items 1) and 2) are calculated.

1) Generation of foreign currency earnings from handling container cargo
2) Saving of the transport costs for import and export cargo
3) Promotion of earning for shipping agency
4) Savings in waiting costs of domestic cargo ship
5) Reduction of cargo damage and accidents at the port
6) Increase in employment opportunities and incomes

(4) Costs of the Projects

31. The items that should be considered as costs of the projects are construction costs and maintenance costs.

(5) Evaluation of the Projects

32. Based on the results, the EIRR of the master plan is calculated as 14~22% (it is generally accepted that infrastructure or social service projects are economically feasible if the EIRR exceeds 10%). Therefore, this master plan development project is viable from the viewpoint of the national economy. In addition, a sensitivity analysis was conducted (see table below), and EIRR is 11 % even in the Low Growth Case. In conclusion, the development of both South and

North South ports is more beneficial to the national economy than the sole development of the South Port.

TABLE 4.5 EIRR of Master Plan

Construction Cost	Higher Case		Lower Case	
Development Case		Sensitivity		Sensitivity
South Port Development	13.6%	11.1%	16.4%	14.8%
South and North Ports Development	18.9%	17.2%	22.3%	20.5%

**In the sensitivity analysis, costs increase by 10% and benefits decrease by 10%.*

4.6 Port Management and Operations

33. The operational efficiency of container cargo handling at the Port of Colombo is less than half compared with the Port of Singapore. The main causes of inefficiency are unskilled loading/unloading operation, insufficiency of preparation before loading/unloading operation starts, frequent delay of port entry due to the transhipment vessels from India, and so on.

34. To improve cargo handling efficiency, the SLPA should implement the following measures; 1) prepare sufficient number of transfer cranes and prime movers per one gantry crane for maximum utilization of gantry cranes capacity, 2) complete marshalling before container handling starts, and 3) implement CY cut on export containers. The SLPA should also restructure MIS and EDI, and carry out aggressive port sales to shipping companies and cargo owners.

35. The ultimate objective of privatization of port management and operation is to maximize economic return from the target port activity for both the public and private sectors under careful consideration on effective removal of possible inefficiency of public sector as well as adverse effects of monopoly by private sectors. The SLPA should introduce privatization considering its applicability to the situations of each target stage so that privatization could fully contribute in securing the total efficiency of port administration and its performance. At the same time, to prevent loss of public benefit, the SLPA should supervise port activities by private sectors, and in case of need, should have competence to control their activities supported by contracts or laws.

36. Recommended terminal operation patterns are shown in TABLE 4.6. The SLPA should operate JCT as "Private berths" or "Priority berths" to keep public benefit. However, to improve operational efficiency, the SLPA can operate only a part of JCT as "Exclusive lease berths". QEQ Nos.6,7,8 should be operated in the same pattern as JCT, and in the case that sufficient public benefit is maintained, the SLPA can operate all of QEQ Nos.6,7,8 as "Exclusive lease berths". Under the condition that public benefit is maintained, it is possible to consider introduction of BOT system for the development and operation of QEQ Nos.9,10,11.