ACP — AUTORIDAD DEL CANAL DE PANAMÁ

Contract No. CC-3-557

Architectural and Engineering Services for Engineering Site and Assessment, Conceptual Design and Related Services

PRELIMINARY STUDY OF ISLAND DEVELOPMENT AT THE PACIFIC ENTRANCE OF THE PANAMA CANAL

Executive Summary

December 2001

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1 INTRODUCTION

The proposed Third Locks project and related expansion of the Panama Canal will generate significant quantities of excavated and dredged material. Estimates of the volume of material vary from 55.0 to 85 million m3. It is expected that the excavation from the Locks will be made in the dry, with a significant percentage of rock. The remainder is expected to be silts and clays, typical of the formations in the area. A further 15.0 million m3 of similar material will be dredged to create a new channel from the Canal to the new locks

This Executive Summary provides an overview of the commercial, technical and environmental issues related to the use of this material to create a new island at the Pacific entrance to the Panama Canal. For additional detail, the reader is referred to the two volume Main Report. The first volume includes the technical and environmental evaluation and cost estimates for the island, while the second volume contains technical appendices used to support the analyses.

2 COMMERCIAL DEVELOPMENT SCENARIOS

Development options for the island may include, but are not necessarily limited to:

A. Hub Container Terminal or terminals complex

B. Pacific-Area Commerce Complex, this could include:

- A container terminal or terminals
- Value-Added Distribution and Warehousing Center
- Manufacturing sites requiring close proximity to Port or Airport facilities
- Commercial services
- Regional access links, including highway, rail and sea-lane approaches.

3 DEMAND FOR CONTAINERIZED CARGO BASED SERVICES

3.1 Container Terminals

Existing and expected future handling capacity of the existing container terminals on the Pacific and Atlantic sides was evaluated. Capability on the Pacific side is limited to Farfan and possibly Rodman, with both projects being within the high traffic area of the Canal and potentially reserved for other uses.

Consequently, it was assumed that the maximum potential capacity on the Pacific side of the Canal is unlikely to exceed 1.00 million twenty foot units (teu) per year, compared with the existing installed capacity of 253,000 teus per year.

3.2 Value Added and Commercial

Asian exports of consumer product components and finished goods are increasingly facilitated by the accomplishment of value-added activities in route. These activities include:

- Logistics services;
- Sorting and Labeling
- Repacking / "Pick & Pack"
- Packaging Design & Manufacture
- Repair
- Bar Coding and Scanning
- Preparation & Insertion of Marketing Material
- Manipulation and Storage.
- Internet Fulfillment
- Local outlets

It is likely that major international retail and wholesale distribution companies will take advantage of an opportunity to store, inventory, manipulate and distribute to outlets in South and Central America and the Caribbean. With interconnected marine terminals on both oceans, Panama provides them with an attractive location for economically servicing markets on both the Atlantic and Pacific coasts. It also provides a single regional location from which the final destination of the contents of containerized cargo can be determined with a minimum of ensuing transportation time.

4 FACILITIES REQUIREMENTS

4.1 Container Terminals

The completion of the Third Locks project will set a new Panama Canal standard for container vessels and other ships. It therefore is reasonable to design the first phase of container facilities on the island to meet the new size limit. Using the proposed dimensions of the new Locks as a general guideline, the capacity of a container vessel will be on the order of 9,000 to 10,500 teu. It will have a length of some 386 meters and a fully loaded draft of 15.2 m. Assuming a terminal module designed to receive a 9,200 and a 10,500 teu mainline vessel at the same time, this then indicates a berth length of approximately 850 m per module, with a depth at the berth of 16.75 m.

The capacity of each terminal module will be on the order of 950,000 teus, including empties, occupying a total area of 32 ha.

5 ISLAND LOCATION

Figure 5-1 shows that the island is located east of the flight path into Howard AFB, and to the west of the Pacific and Explosives Cargo anchorage areas. Navigation access will be via a new channel, which would intersect the main Panama Canal approach some 2.00 km south of the limits of the Explosives Anchorage area.

Landside access to the island is via a causeway, which includes an open piled section to permit movement of littoral material along the shoreline and offer a passage for marine life. At approximately the mid point of the causeway, it is recommended that a bridge be placed to permit fish passage and permit small craft to navigate the shallow waters along the coastline.

FIG 5-1 - RECOMMENDED LOCATION FOR ISLAND

6 CIVIL ENGINEERING EVALUATION

6.1 Materials Quantities

Materials quantities for the P1 and P2 alternatives are shown in Table 6-1 below. For this study, only the Phase 1 lock excavation and Canal deepening quantities were used to compute the initial island size. Later excavation materials could be used to increase island area, or taken to other disposal sites, depending upon the cost or land values at the time of undertaking the work.

Table 6-1: Materials Characteristics and Quantities

Phase	Lock Option	Volume (m3)				
		Overburden		Rock		Total
		Wet	Dry	Wet	Dry	
1	P1	1,450,000	12,420,000	5,820,000	49,660,000	69,350,000
	P2	2,050,000	5,430,000	8,200,000	21,730,000	37,410,000
Canal Deepening		2,400,000		3,266,851		5,666,851
2	P1	960,000	-	3,840,000	-	4,800,000
	P2	730,000	-	2,930,000	-	3,660,000
Canal Deepening				10,043,395		10,043,395
3	P1	680,000	-	2,720,000	-	3,400,000
	P2	520,000	-	2,070,000	-	2,590,000

6.2 Construction Schedule

The construction schedule for the island must follow the excavation program for the Locks and Canal deepening projects. The following milestone dates were assumed:

Locks Feasibility Studies complete by .... end of 2003

Engineering and Contract Awards .... end of 2005

Locks construction .... 2005 to 2010

7 DEVELOPMENT CONCEPTS

7.1 Introduction

Island development concepts were developed to respond to the following alternatives:

Materials from P1 Lock Alignment

- Offshore Breakwater Option
- Revetment/Breakwater Option

Materials from P2 Lock Alignment

- Offshore Breakwater Option
- Revetment/Breakwater Option

The two sub options examine the size, and cost of the island assuming construction with and without an offshore breakwater to protect the main and future berth areas.

7.2 Construction Process

A considerable portion of the excavated material will be rock. While this will provide armor stone for the revetment and breakwater, its use raises issues related to building foundations, utility corridors, construction sequencing and long term settlement.

It is recommended that as much rock as possible be placed in the lower layers of the island where it can also displace the soft silts below. The upper layers of the island would be placed in the dry, with areas also designed to receive dredged materials if necessary.

7.3 Materials Transportation Alternatives

A report prepared by Harza[1] for ACP in August 2000 provided cost estimates for the removal and transportation of Locks material to a number of designated disposal sites located within some 10 km of the excavation site. Due to the number of sites and proximity to the excavation areas, the transportation cost computations were based on a trucked operation, using large volume off road dump trucks.

Since the island project is a single point of materials placement, located some 20 km from the excavation site, transportation cost studies in this report were extended to include rail and conveyor systems.

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[1] Evaluation of Lock Channel Alignments, Harza, August 2000

7.4 Transportation Costs

Transportation production and cost models were constructed for each system indicated above. The estimated costs include:

- Mobilization
- Construction of Haul roads, conveyor or rail system
- Maintenance of access corridors
- Equipment rental/operating and maintenance costs based on cycle times, materials characteristics and volumes
- Contractor's profit and overhead

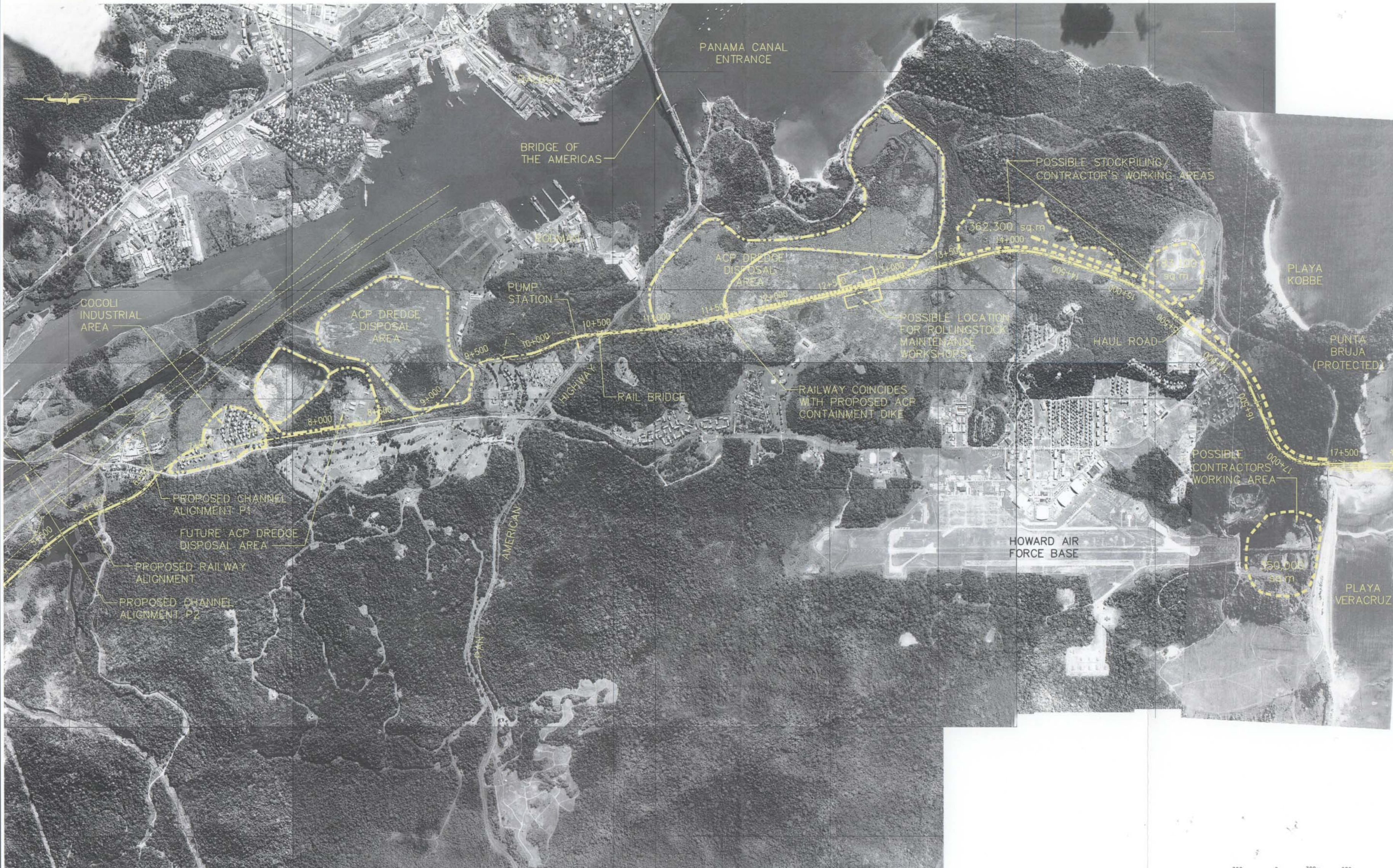
Table 7-1 shows the comparison of transportation costs for the three systems analyzed. As a practical matter, only the truck haul and rail systems are considered to be technical viable alternatives, since there are considerable doubts as to whether the conveyor system could handle the irregular rock size expected to be produced by this project.

From the evaluation of costs and productivity criteria to meet the construction schedule, it is clear that a rail-based system will offer the most economical transport system for the project. It also offers considerable residual value, which in turn will enhance the future commercial viability of the island as interaction between terminals on the two coasts develops.

Table 7-1: Cost Summary - Materials Transportation Systems

Alignment P1	
Truck Haul	$1,079,066,701
Rail Haul	**$257,572,557**
Conveyor Haul	$519,480,637

Alignment P2	
Truck Haul	$585,192,642
Rail Haul	**$144,376,630**
Conveyor Haul	$326,590,088



300m 0m 300m 600m
GRAPHICAL SCALE

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT PROPSOED ROUTE FOR RAIL LINE – AERIAL	ACP AUTORIDAD DEL CANAL DE PANAMÁ	MOFFATT & NICHOL ENGINEERS SKIDMORE, OWINGS AND MERRILL LLP LOUIS BERGER INTERNATIONAL	Designed by: D.J.Mac Dwn by: D.J.Mac Ckd by: M.G.H. Reviewed by: T.J.S. Submitted by: M.G.H.	Date: NOV, 2001 Rev. Design file no. Drawing Scale: AS SHOWN Plot scale: 1 = 1

AREA DE TRABAJO

FIG 7–1

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7.5 Access to the Island

7.5.1 Landside Connections

Figure 7-2 shows a typical cross section of the proposed causeway. It includes a four- lane highway, rail access and service road, a utility corridor, pedestrian access and separation areas. Figure 7-3 shows a typical section of the open piled trestle section of the access. It is approximately 40 m wide, and carries all of the features noted above for the causeway, except for the landscaping elements.

7.6 Navigation Access

Given the existence of a number of small islands and rock outcrops in the area of the proposed channel, a substantial proportion of the dredging may be rock. As a first phase, in order to reduce infrastructure costs, the channel could be sized for one way traffic for mainline vessels, with two way traffic for ships below a given size limitation. Under these conditions, the channel width would be approximately 225 m. Later expansion would widen the channel to some 350 m to accommodate two way traffic of the largest vessels

The initial depth of the channel is set at 16.75 m to accommodate a loaded vessel draft of 15.20 m, as indicated in the preliminary design parameters for the Third Locks project.

7.7 Wave Protection

The typical wave climate in the area of the island is relatively mild, but long period waves are occasionally generated by storms in the Pacific. These can cause considerable movement of a vessel at an unprotected berth and container transfer operations are particularly vulnerable to this condition. Liquid and dry bulk operations are less impacted and would not necessarily require protection at the project location.

Given the need to offer maximum flexibility for future development, and taking into account the large volume of rock that will be derived from the Locks excavation, two breakwater configurations are suggested.

- The offshore breakwater concept would give good protection to berths on the east, south and west face of the island, enabling container operations to be extended to all three areas.
- Protection to the east face of the berths by a “stub” breakwater some 1,000 m in length, extending from the south east corner of the island. Based on experience at other locations subject to similar wave conditions, unprotected berths on the south face would probably not be acceptable for container ships but might work for bulk carriers.

Several breakwater types can be considered for this project, with the final selection heavily dependent on the type and size of rock that could be removed economically from the Locks excavation site. Figure 7-4 indicates a typical cross section of an offshore berm breakwater concept that would appear to suit the expected rock size and wave climate.

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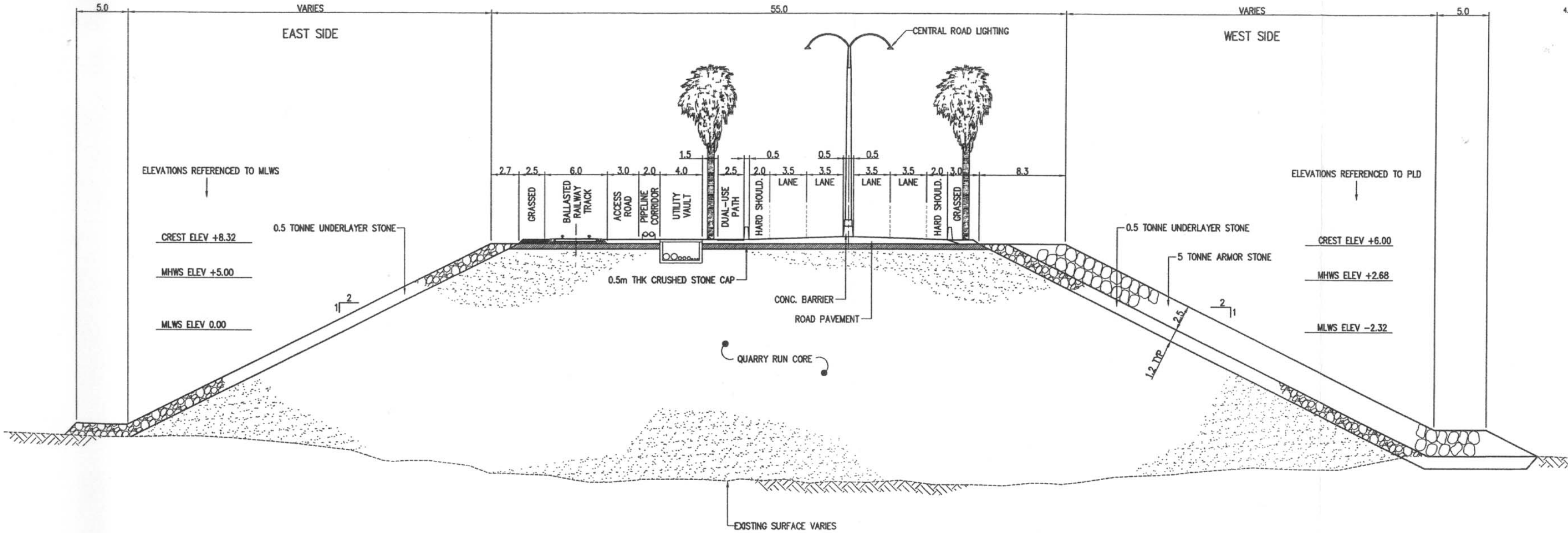

FIG 7-2: CROSS SECTION OF ACCESS CAUSEWAY

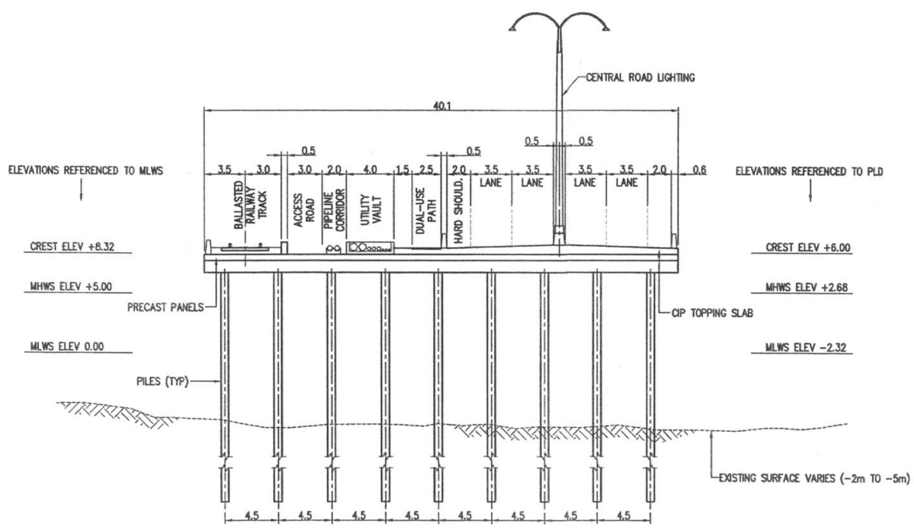

FIG 7-3: CROSS SECTION OF ACCESS TRESTLE

SCALE: 1 : 200

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

TYPICAL CAUSEWAY AND TRESTLE CROSS SECTIONS

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MOFFATT & NICHOL ENGINEERS

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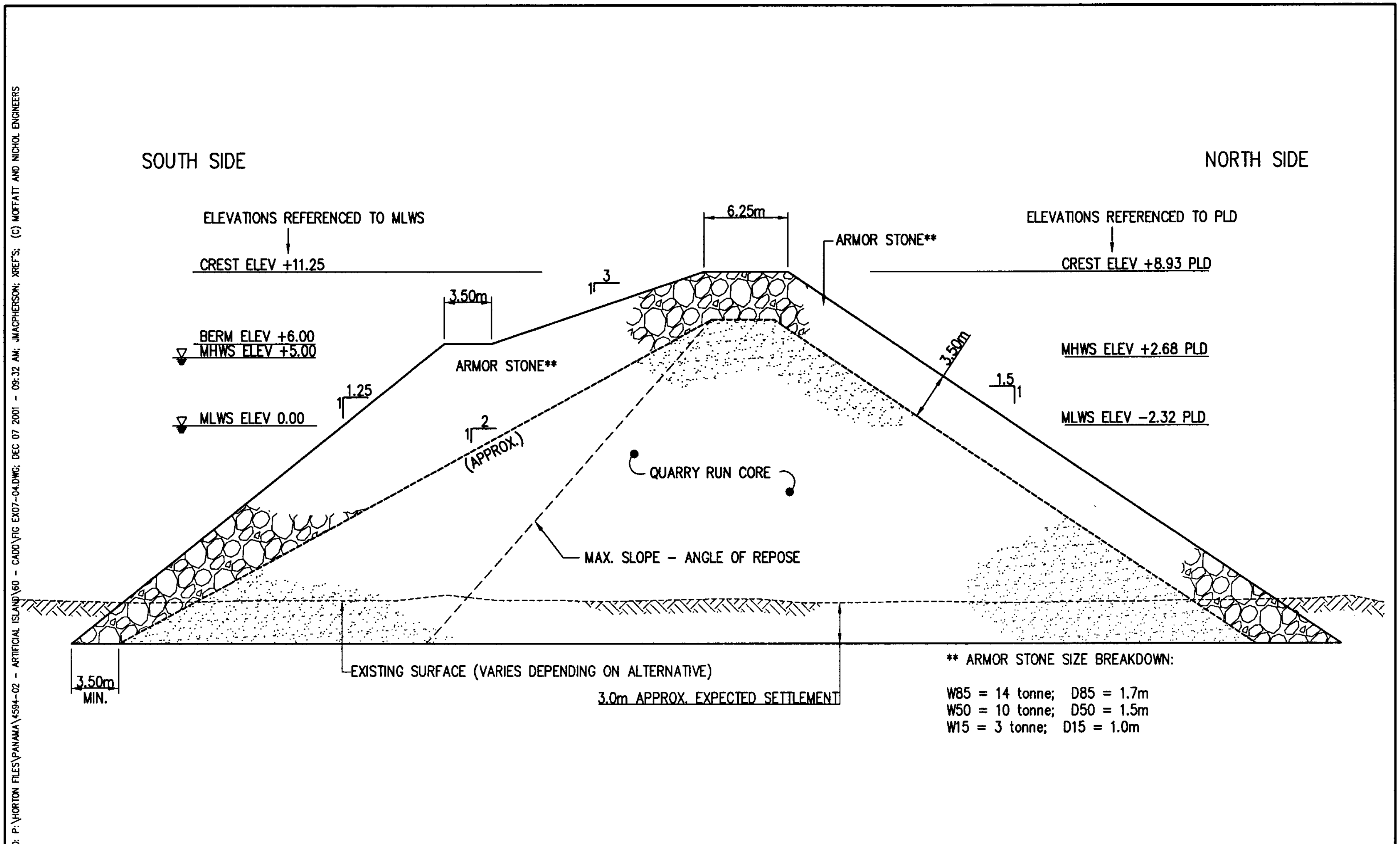

FIG 7-4: TYPICAL CROSS SECTION OF OFFSHORE BREAKWATER

8 DEVELOPMENT CONCEPTS

8.1 General Arrangement

Figure 8-1 shows a general concept for the island, causeway connection, navigation channel and land links, based on the recommended rail access system. Figure 8-2 to Figure 8-5 show a series of island layouts, based on the volume of materials derived from the P1 and P2 Lock alignment alternatives and the navigation and wave protection considerations discussed earlier. Sub-options are also indicated for each island alternative, whereby the offshore breakwater is eliminated in order to reduce costs.

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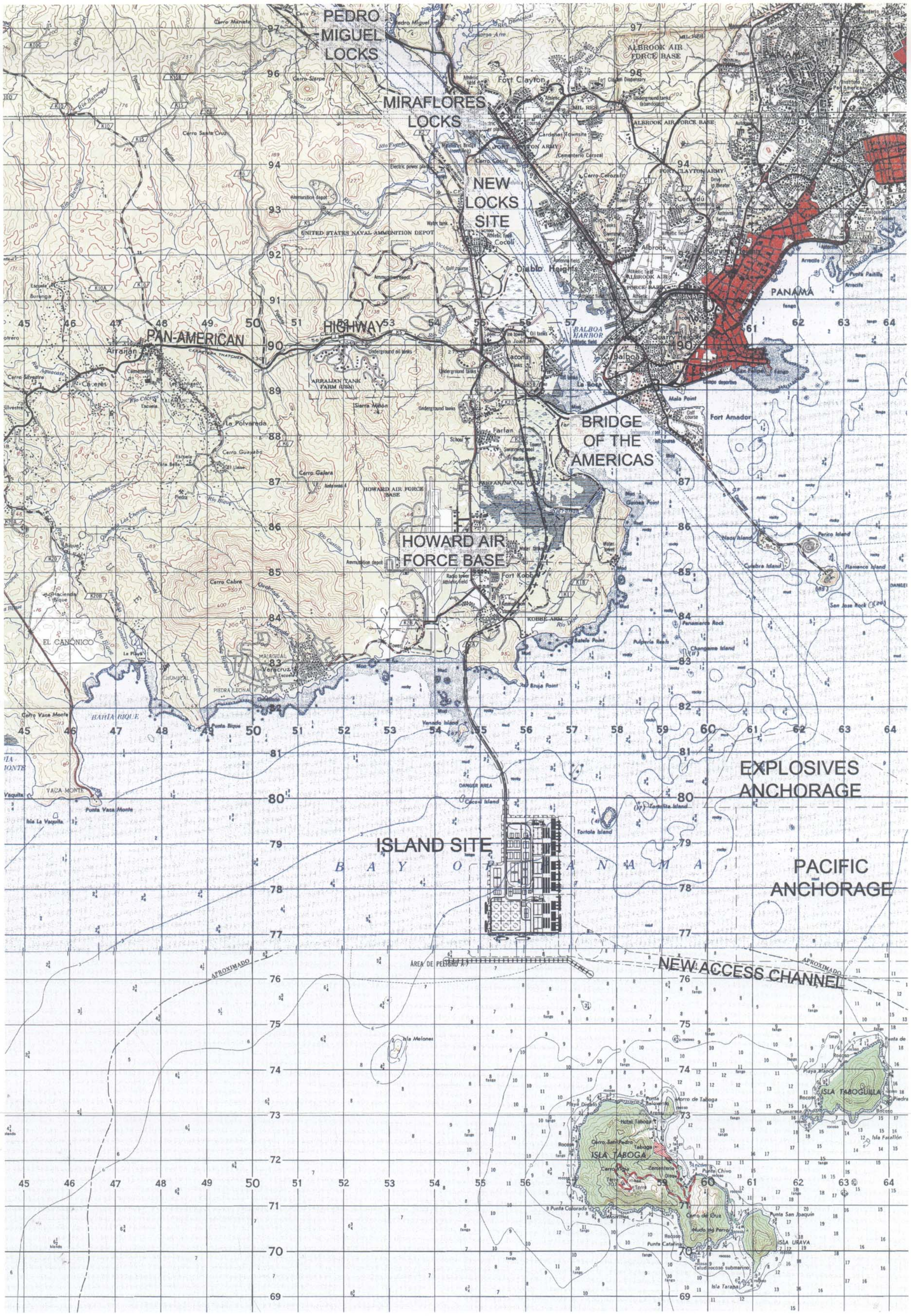

800.0m 0m 800.0m 1600.0m

SCALE: 1 : 40000

FIG 8-1

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

GENERAL PLAN OF ISLAND AND ACCESS CONNECTIONS (SHOWING ALTERNATIVE P1-A)

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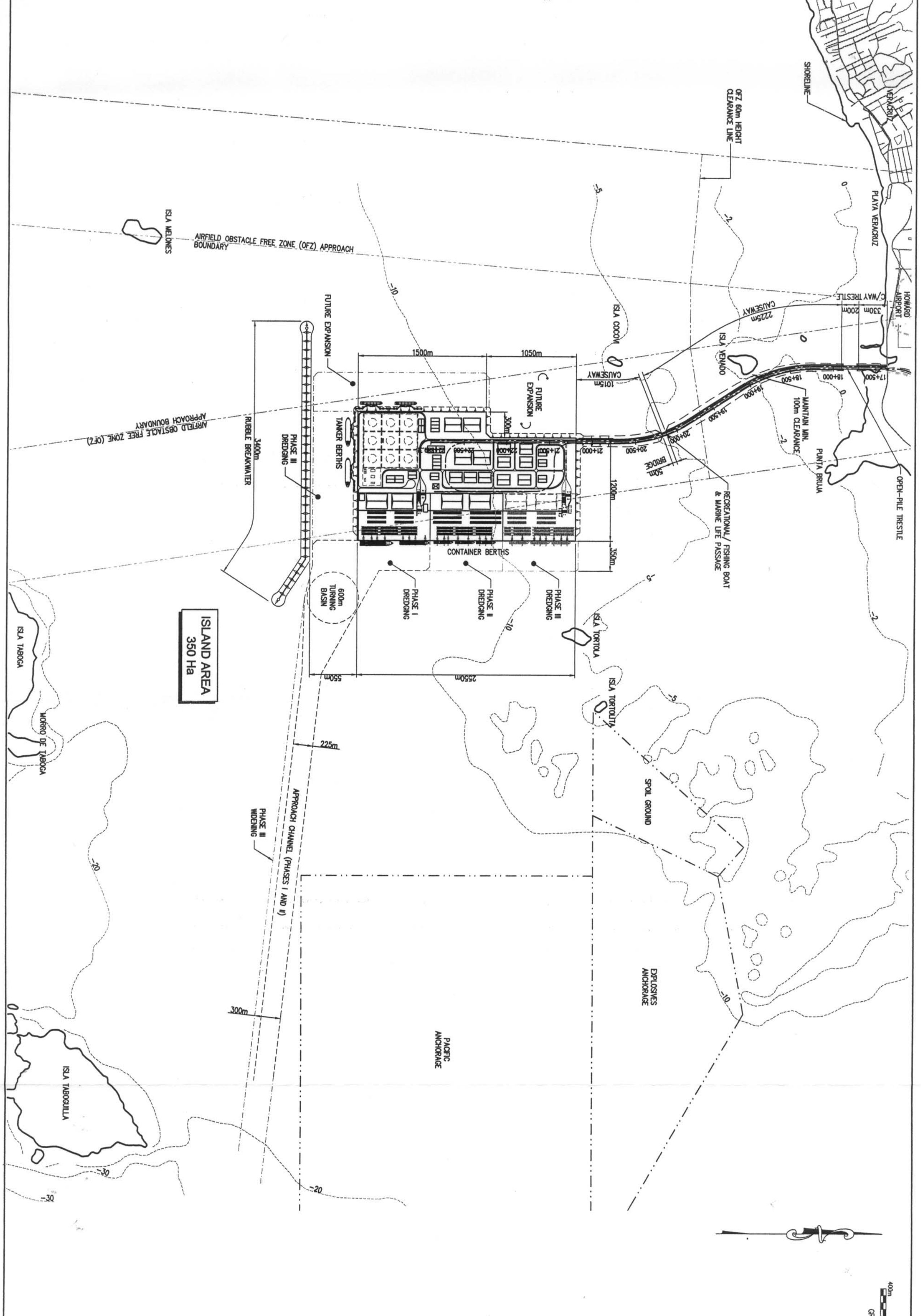

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND CONCEPT PLAN ALTERNATIVE P1-A

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FIG 8-2

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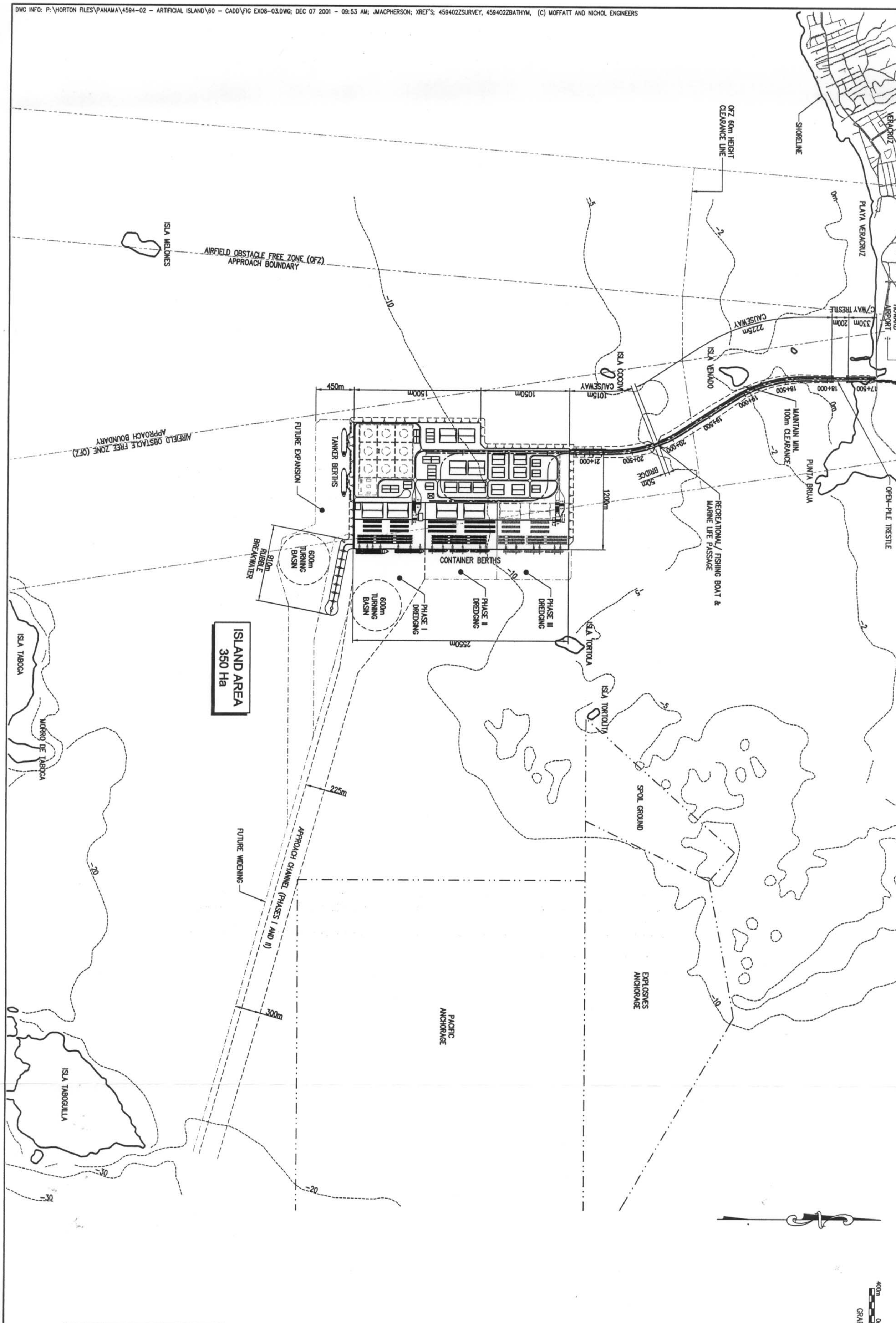

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PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND CONCEPT PLAN ALTERNATIVE P1-B

FIG 8-3

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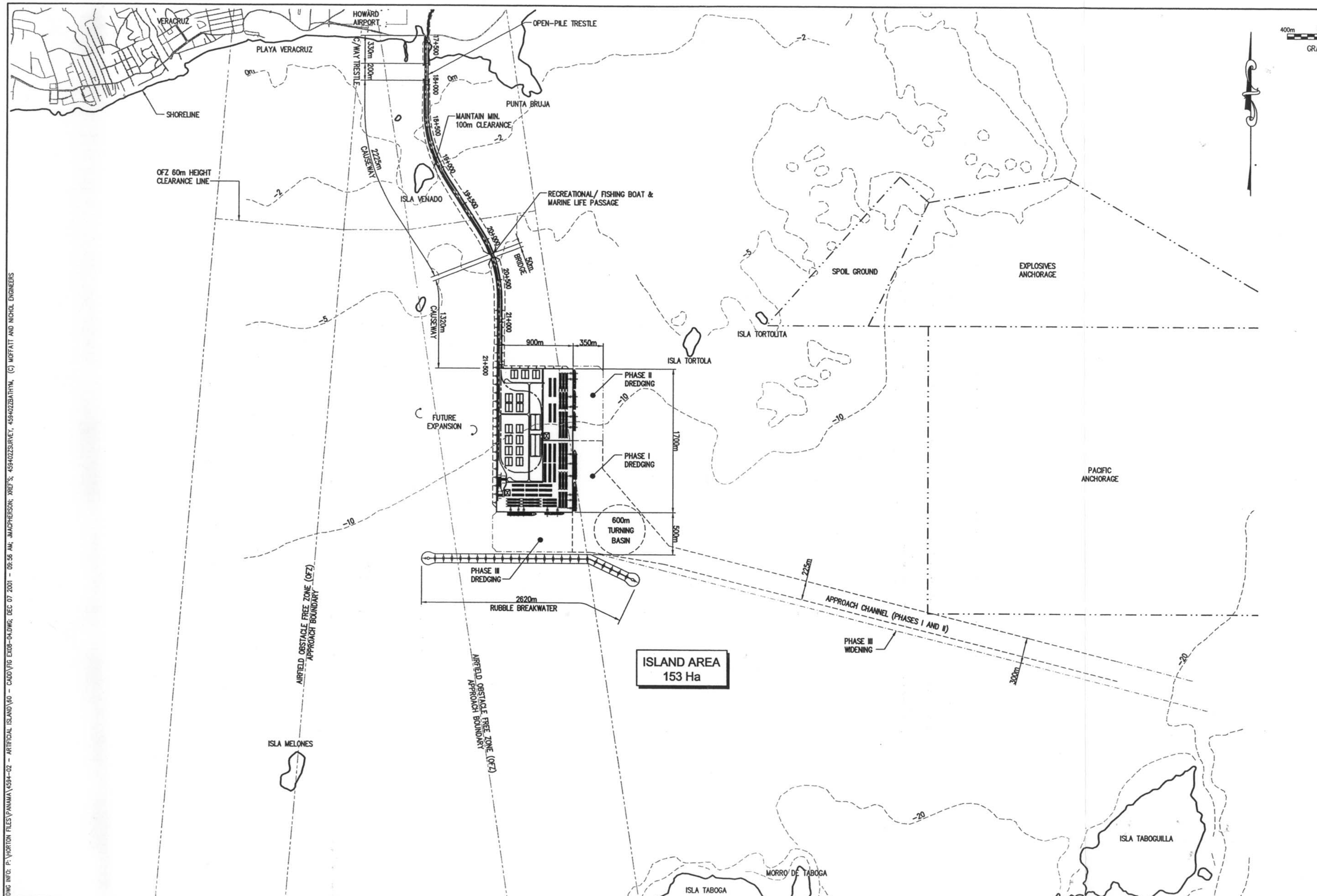

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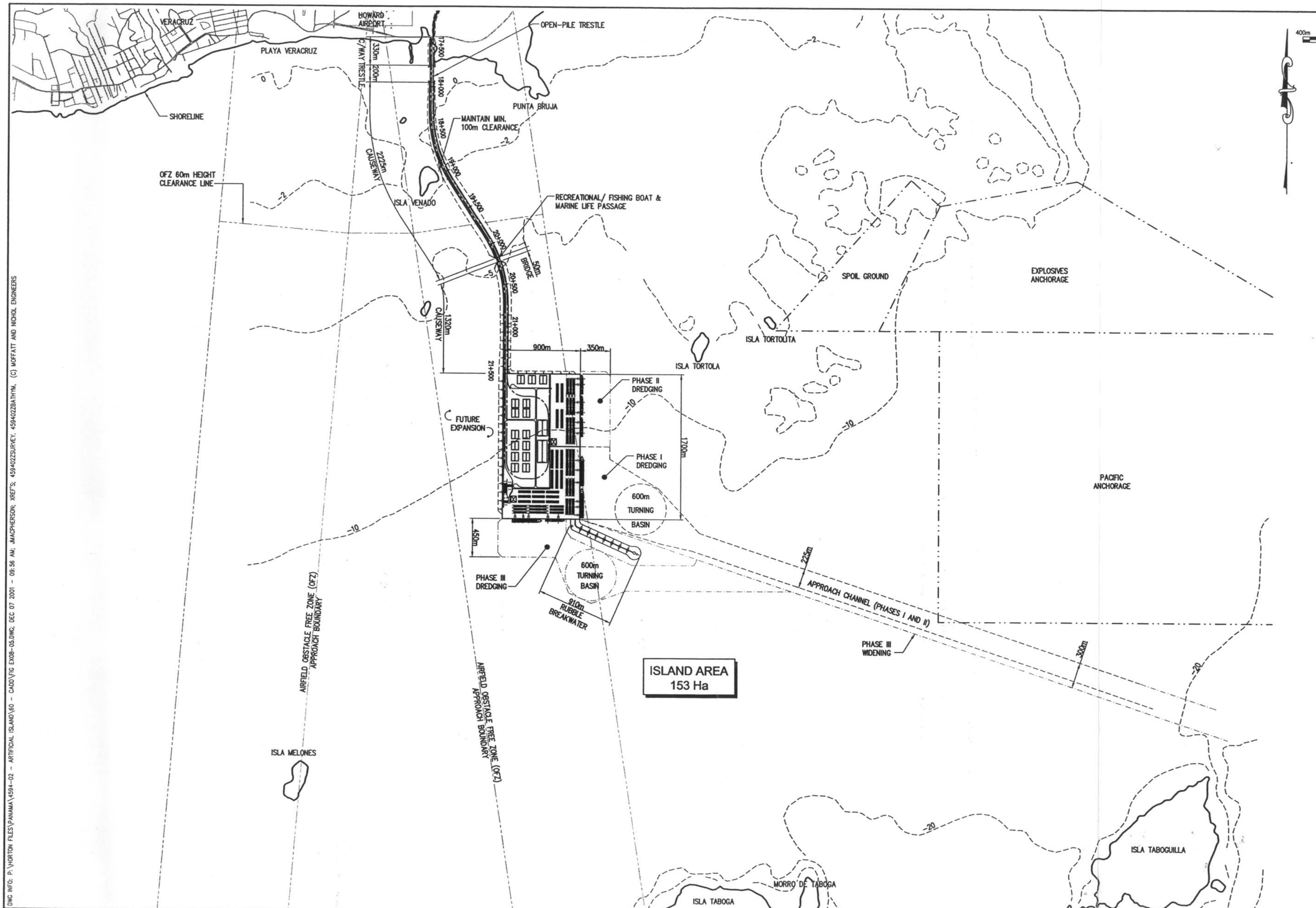
PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND CONCEPT PLAN ALTERNATIVE P2-A

FIG 8-4



400m 0m 400m 800m
GRAPHICAL SCALE

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PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND CONCEPT PLAN
ALTERNATIVE P2-B

FIG 8-5

8.2 Land Use Plan

A preliminary land use plan is presented in the following figures for the two Lock alternatives. It can be seen that the main focus of the development is container terminals, with the intention to provide at least three container modules for each island alternative.

Future development of marine facilities would depend very much on demand at the time, but could include a fourth container terminal for the larger island (P1), bunkering or bulk materials transfer facilities.

The concept plan indicates that the main distribution facilities will be located close to or even within the container terminal area. This reflects the recent trend to consolidation of distribution activities at the point of arrival of the cargo. It should also be noted that heavy demand for waterfront dependent activities on the island could trigger the displacement of Trade related but non water dependent uses to the Howard area, to the possible benefit of both developments. The economic, trade and commercial activity on the island will generate a need for banking, services and support facilities. At this preliminary stage, it is sufficient to acknowledge this need, but it is too early to discuss specifics.

8.3 Public Access Areas

As a major new development, the island will almost certainly attract public attention. It will also be the daily home for a significant number of employees, who will appreciate access to open spaces, exercise areas and other public facilities. The popularity of the Amador causeway is an indication of what might happen in terms of public access and this project offers a special opportunity to offer a pleasant environment for island workers and visitors.

Public access areas might include parks, public concert sites, recreational areas, churches or chapels, a fishing pier, sports fields, cycle paths, exercise areas and viewing areas. Revenue producing commercial facilities might include restaurants, banking, hotels, clinics, auto rental, shopping and theatres. These can be incorporated at a later date, but should be seriously considered during the planning phases.

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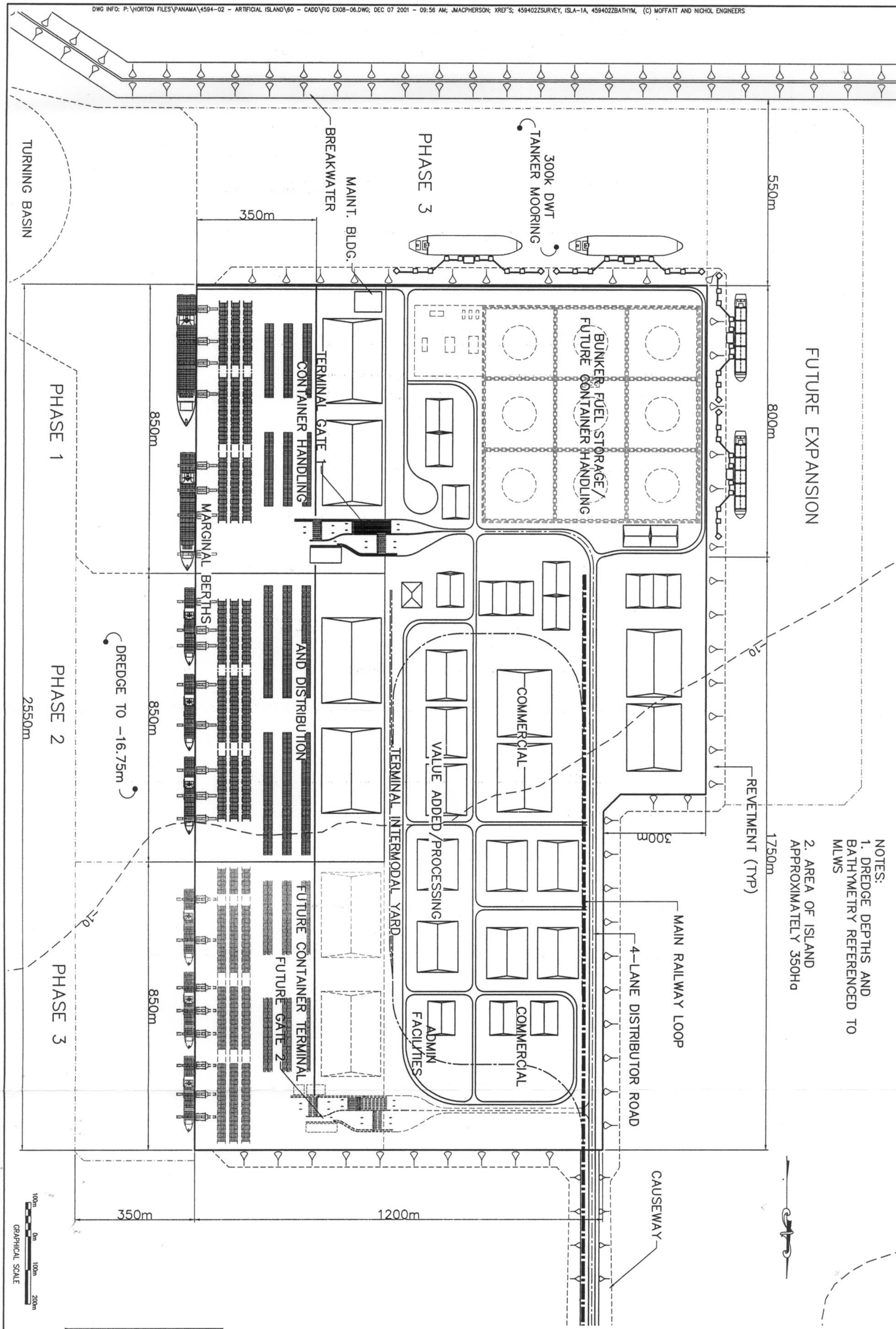

FIG 8-6

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND PORT COMPLEX CONCEPT ALTERNATIVE P1-A

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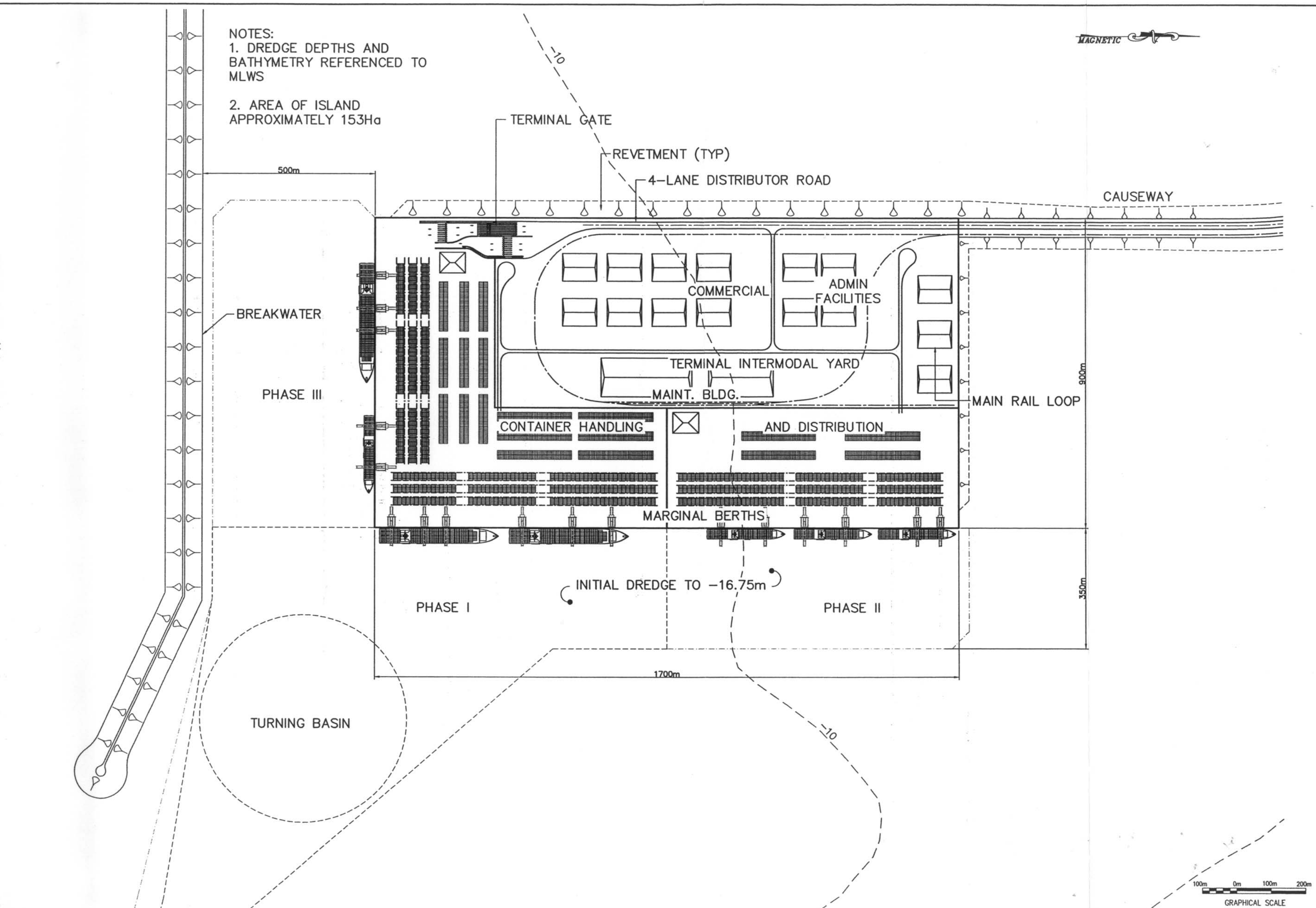

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PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT

ISLAND PORT COMPLEX CONCEPT ALTERNATIVE P2-A

FIG 8-7

9 ENVIRONMENTAL ISSUES

For the most part, impacts from the project will be local. However some impacts will be felt along the coastline.

The most important impacts fall within the following general categories:

- Air Quality and Noise
- Geology and Geotechnical Properties
- Water Quality
- Biological Environment
- Socioeconomic and Cultural Environment

The expected issues or impacts that may arise from this project are summarized in Table 9-1 below. Effective Citizen/Public participation is one of the most critical aspects of the permitting and environmental process for this project. For this initiative, surveys, interviews, workshops, work meeting, public announcements and forums and coordinated media campaigns are recommended.

Table 9-1: Preliminary Identification Of Environmental Impacts

Impact	Description	Recommendations
Interference in artisan & other fishing activities	The access to the island (viaduct) will interfere with the movement of small fishing boats and ships that move along the shoreline.	Early on, initiate the process of consulting with citizens. Evaluate traffic and operational characteristics.
Disruption of Hydrodynamic Movement In the bay	Interference caused by the island access complex in the main hydrodynamic complex of the Bay of Panama could affect sediments (erosion – local and zone deposits).	Develop a tri-dimensional hydrodynamic model that addresses issues of sediment and contamination. Calibrate according to the existing studies and conclusions made in the field.
Effects to soil use and potential interference with plans and tourist activities	The potential development of the Howard Canal corridor could affect the protected areas on the coast and the development of the tourist area of Veracruz.	The interests of the tourist sector should be analyzed through surveys, workshops and other forms of citizen participation relating to the development of the island.
Loss of marine habitat	The covering of the marine base by excavated material will signify a loss of approximately 350 hectares of marine habitat.	This can be mitigated by some form of land banking, environmental restoration or compensation.
Effects to coastal resources (Coral in Otoque and other areas)	Depending upon effects to the hydrodynamic, the disturbance could reach the coral resources in front of Punta Chame.	The hydrodynamic model should be used correctly in order to make a decision regarding this sensitive aspect.
Contamination at beaches and western coastline	Some sectors of the pacific coastline west of the canal could suffer from an increase in the concentration of contaminants caused by the island-viaduct complex.	The hydrodynamic model and project design should be sufficiently "robust" in order to answer and address these concerns.
Effects to landscape and visual impacts	The new island and access will visually disrupt the view from shore to the open sea. This could be exacerbated by the nighttime illumination of the island.	The survey process is fundamental to address this concern.
Increase of dredging in the canal	Depending upon the position and shape of the island and its accesses, dredging of the canal could increase.	The mathematic model should be capable of responding to this question.
Interference with maritime traffic and disruption during construction	The island construction may cause interference with maritime movement west of the canal, in particular ships in transit to and from the canal.	This effect can be mitigated but will require a specific study and formulation of detailed processes.

10 COST ESTIMATES

Project cost estimates were broken into the following categories:

1. **Island construction using the preferred rail transportation system, including:**
   - Provision of rail system from Locks site to island and associated civil works
   - Materials transportation and placement
   - Construction of breakwater and island wave protection
   - Island fill
   - Trestle and bridge within the causeway

2. **Basic Infrastructure, including:**
   - Highway on causeway and connection from shore
   - Internal main highways within the island
   - Extension of rail loop within island
   - Power, water, illumination and other utilities
   - Parks, public access and green areas
   - Main navigation channel to island
   - Dredging at berths and maneuvering areas

3. **Container Terminal Module, including:**
   - 850 m Berths
   - Paving
   - Utilities within terminal area
   - Buildings
   - Gantry cranes to service terminal at full capacity
   - Fencing and security

The phased capital costs for each sub-option of the P1 and P2 alternatives are summarized in Table 10-1 and Table 10-2.

Table 10-1: Summary of Investment Costs – Lock Option - P1

Island with Full Breakwater

Development Component	Phase 1	Phase 2	Phase 3	Total
Island Construction (unimproved)	541,824,037			$541,824,037
Infrastructure	88,507,230	$24,994,818	$39,709,525	$153,211,572
Container Terminal(s)	149,046,330	$149,046,330	$149,046,330	$447,138,990
Total Cost	**$779,377,597**	**$174,041,148**	**$188,755,855**	**$1,142,174,599**

Island with Short Breakwater

Development Component	Phase 1	Phase 2	Phase 3	Total
Island Construction (unimproved)	482,047,992			$482,047,992
Infrastructure	88,507,230	$24,994,818	$39,709,525	$153,211,572
Container Terminal(s)	149,046,330	$149,046,330	$149,046,330	$447,138,990
Total Cost	**$719,601,552**	**$174,041,148**	**$188,755,855**	**$1,082,398,554**

Table 10-2: Summary of Investment Costs – Lock Option - P2

Island with Full Breakwater

Development Component	Phase 1	Phase 2	Phase 3	Total
Island Construction (unimproved)	351,079,843			$351,079,843
Infrastructure	82,534,200	$25,579,918	$29,537,865	$137,651,982
Container Terminal(s)	149,046,330	$149,046,330	$149,046,330	$447,138,990
Total Cost	**$582,660,373**	**$174,626,248**	**$178,584,195**	**$935,870,816**

Island with Short Breakwater

Development Component	Phase 1	Phase 2	Phase 3	Total
Island Construction (unimproved)	315,786,821			$315,786,821
Infrastructure	82,534,200	$25,579,918	$29,537,865	$137,651,982
Container Terminal(s)	149,046,330	$149,046,330	$149,046,330	$447,138,990
Total Cost	**$547,367,351**	**$174,626,248**	**$178,584,195**	**$900,577,793**

10.1 Use of Designated Disposal Sites

In order to test the commercial viability of the island project, the costs of transportation and island construction were then compared with the cost of disposal to a number of ACP designated sites located within some 10 km of the Locks construction. The cost differential then represents the opportunity cost for commercial development of the island, assuming that no other cost effective locations exist for marine terminals development.

The designated ACP disposal sites and their capacity are indicated in Figure 10-1. Receiving locations are on both the east and west sides of the Canal, which could imply potential interference with Canal operations when the east side sites are being used.

According to the information on the drawing, the total capacity of the ACP sites is 59.60 million m3, which is considerably less than the volume of the P1 materials. However, it is possible that the stockpile heights could be increased to meet the project needs. Given the naturally hilly terrain in the area, it would not be difficult to construct artificial hills to maintain a natural look to the area after filling.

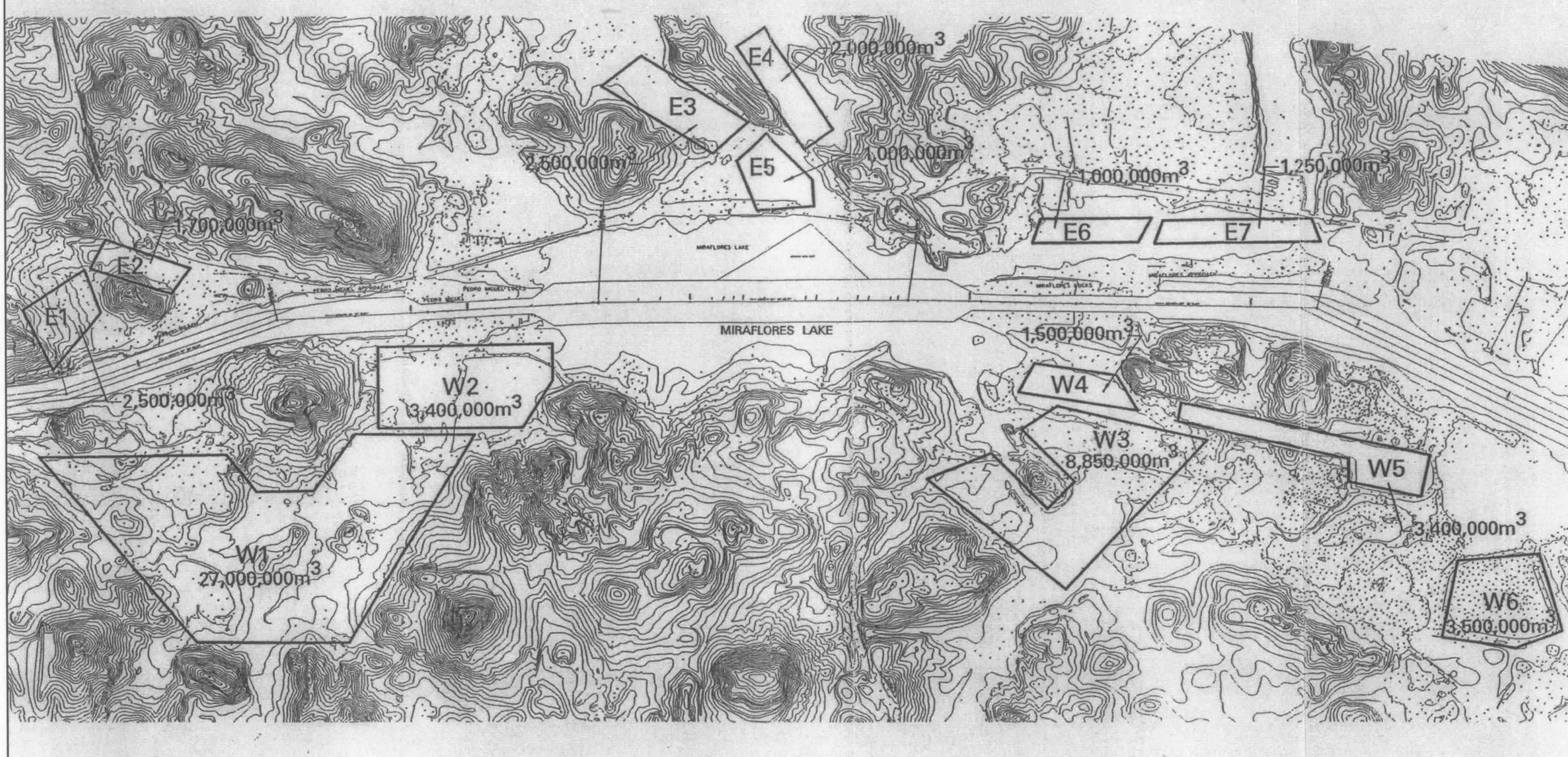
Table 10-3 indicates the estimated cost of disposal of the material to the ACP sites shown in Figure 10-1. The estimate also includes costs for construction of access roads, site restoration and contingencies, in order to provide a valid comparison with the cost of construction of the island.

Table 10-3: Estimated Costs - Disposal to ACP Sites

Item	Quantity	Units	Unit Cost	Total
Costs Using Material Quantities from Channel Alignment P1				
General				
Mobilization and Demobilization	1	LS	$1,250,000	$1,250,000
Material Haulage				
Truck Transportation	87,381,000	m^3	$4.19	$366,102,640
Site Rehabilitation and Erosion Control				
Site Preparation & Restoration	87,381,000	m^3	$0.21	$18,332,944
Total Cost - Haulage & Site Restoration				***$385,685,584***
Engineering & Disposal Site Administration			1.50%	$5,785,284
Contingencies			12.50%	$48,933,858
Grand Total - P1				***$434,619,442***
Cost per cu. metre for Disposal				***$5.00***

Item	Quantity	Units	Unit Cost	Total
Costs Using Material Quantities from Channel Alignment P2				
General				
Mobilization and Demobilization	1	LS	$1,250,000	$1,250,000
Material Haulage				
Truck Transportation	47,136,500	m^3	$4.18	$197,260,790
Site Rehabilitation and Erosion Control				
Site Preparation & Restoration	47,136,500	m^3	$0.39	$18,332,944
Total Cost - Haulage & Site Restoration				***$216,843,734***
Engineering & Disposal Site Administration			1.50%	$3,252,656
Contingencies			12.50%	$27,512,049
Grand Total - P2				***$244,355,783***
Cost per cu. metre for Disposal				***$5.20***

NOT TO SCALE



TOTAL CAPACITY = 59.6 MILLION m3

Designed by: D.J.Mac	Date: NOV, 2001	Rev.
Dwn by: D.J.Mac / Ckd by: M.G.H.	Design file no.	
Reviewed by: T.J.S.		
Submitted by: M.G.H.	Drawing Scale: AS SHOWN / Plot scale: 1 = 1	

MOFFATT & NICHOL ENGINEERS
SKIDMORE, OWINGS AND MERRILL LLP
LOUIS BERGER INTERNATIONAL

ACP
AUTORIDAD DEL CANAL DE PANAMÁ

PRE-FEASIBILITY STUDY FOR ARTIFICIAL ISLAND DEVELOPMENT
ACP DESIGNATED MATERIAL DISPOSAL SITES

FIG 10-1

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11 FINANCIAL INDICATORS

11.1 Capital Costs

The expected costs of island construction for the P1 and P2 alternatives and placement of the materials at the ACP designated sites are summarized in Table 11-1.

The full development cost of the island, without container or value added installations, will vary from a low of $274.01/m2 to a high of $451.03/m2 depending on the Locks and breakwater options selected. If the cost of disposal to the ACP sites is discounted from the development costs, the range of values falls to a low of $86.54/m2 and a high of $225.52/m2.

Table 11-1: Summary of Island Investment Costs

	Locks Alternative			
	P1		P2	
	Long BW	Short BW	Long BW	Short BW
Land Base				
Island Area from Locks Excavation (ha)	350	368	172	183
Marketable Land Area (ha)	**221**	**232**	**108**	**115**
Development Costs ($millions)				
Unimproved island Construction	$541.82	$482.05	$351.08	$315.79
Infrastructure (3 phases)	$153.21	$153.21	$137.65	$137.65
Total Development Cost for the Island /1	***$695.04***	***$635.26***	***$488.73***	***$453.44***
Cost of Using ACP Disposal sites	**$434.62**	**$434.62**	**$244.36**	**$244.36**
Discounted Island Cost	***$260.42***	***$200.64***	***$244.38***	***$209.08***
Equivalent Development Costs ($/m2)				
Full Cost	**$315.21**	**$274.01**	**$451.03**	**$393.30**
Discounted (ACP disposal) Cost	**$118.10**	**$86.54**	**$225.52**	**$181.35**

11.2 Container Terminals

The investment cost of a fully developed 32 ha terminal module with eight gantry cranes, is on the order of $149 million. This then converts to an added unit cost of $466/m2, over and above the improved island construction costs presented in Table 11-1.

Throughput, size and revenue potential for Container Terminals will vary considerably depending on location, market and labor agreements. In order to compare construction costs with other container terminals, it is therefore useful to use a cost per teu of annual throughput capacity as a baseline.

On this basis, the 950,000 teu capacity Container Terminal module will cost approximately $157 per teu of annual throughput. Construction of the land and infrastructure to support the terminal will cost $40 per teu, indicating a total cost, including cranes, of $197 per teu of annual throughput, assuming that the cost of disposal to the ACP sites can be discounted from the estimate. If the full cost of the island construction is included, the cost per teu increases to $263 per teu of annual throughput.

A typical west US coast terminal on a developed site will cost on the order of $165 per teu of throughput, and land costs will vary from $30 to $95 per teu of annual throughput depending on location and demand. Asian and Far East terminal construction costs are some 15 to 20% higher than the US counterparts, with land costs varying considerably depending on location.

This rough comparison indicates that the Panama island container termina is at the high end of new terminal cost, if full cost recovery is required. If the cost of disposal to the ACP sites is discounted from the computations, the Panama island terminal cost is within an acceptable range when compared with US or international container terminal construction costs.

12 IMPLEMENTATION PROGRAM

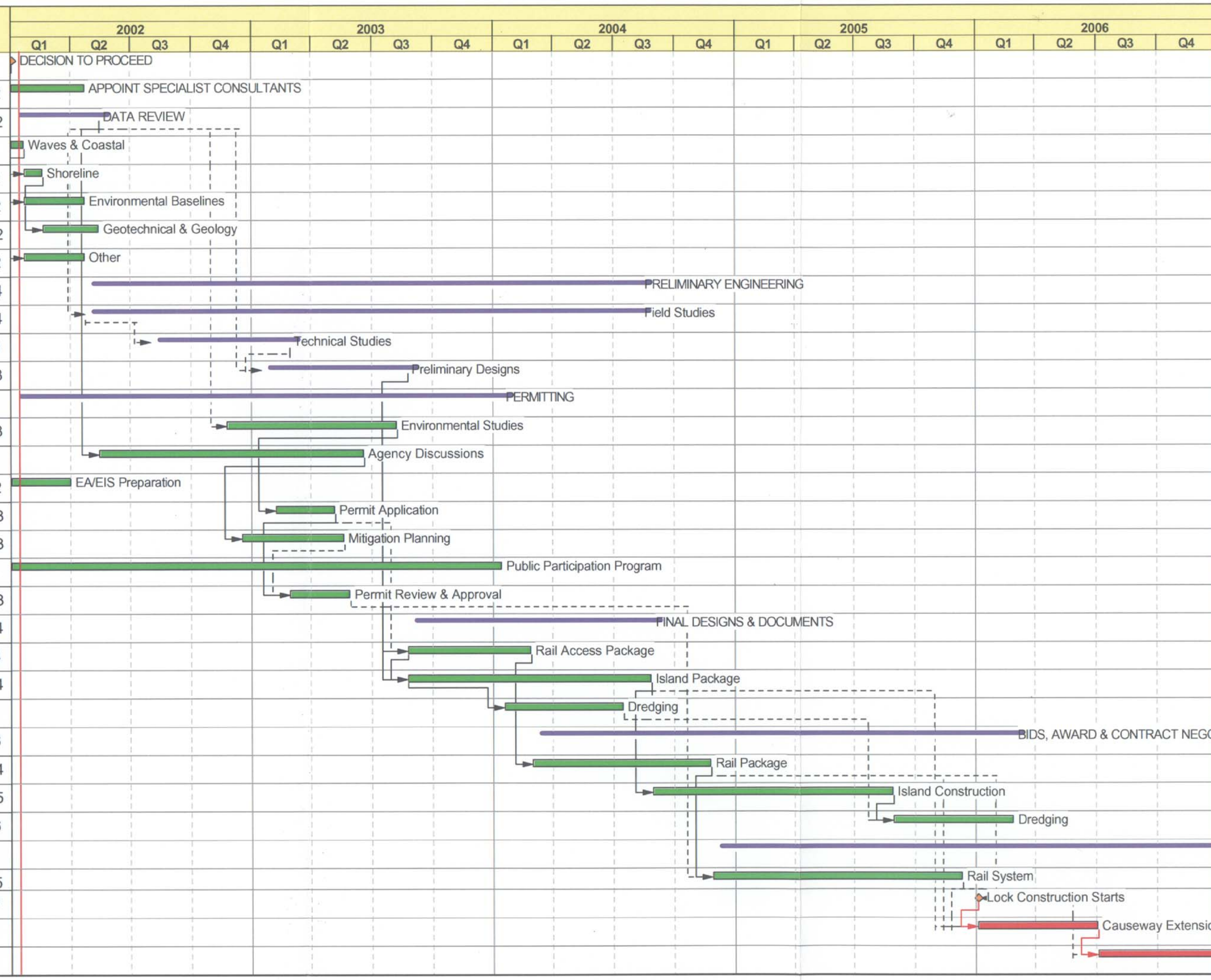
The rail system for the island must be ready to receive materials in time for the Locks construction start up at year-end 2005. Prior to commencement of any work on the island or land connections, the requisite permits must be obtained. The permitting and contracting process will be based on engineering and technical studies, which will include a significant number of field investigations.

If it is assumed that permitting and engineering for the project will take approximately 18 months, with construction of the rail link taking a similar time, it is clear that the technical and environmental studies must begin no later than the beginning of 2002 if the overall project deadlines are to be met.

Figure 12-1 shows a general schedule of pre-construction and construction tasks considered critical to meet the established deadlines for the Locks project.

Figure 121: Island Construction Schedule

Description	Orig Dur	Early Start	Early Finish
DECISION TO PROCEED	0	02JAN02	
APPOINT SPECIALIST CONSULTANTS	16w	02JAN02	23APR02
DATA REVIEW	19w *	02JAN02	14MAY02
Waves & Coastal	3w	02JAN02	22JAN02
Shoreline	4w	23JAN02	19FEB02
Environmental Baselines	13w	23JAN02	23APR02
Geotechnical & Geology	12w	20FEB02	14MAY02
Other	13w	23JAN02	23APR02
PRELIMINARY ENGINEERING	118w *	24APR02	12AUG04
+ Field Studies	118w *	24APR02	12AUG04
+ Technical Studies	29w1d	02AUG02	27FEB03
+ Preliminary Designs	31w *	17JAN03	25AUG03
PERMITTING	104w *	02JAN02	15JAN04
Environmental Studies	36w	25NOV02	08AUG03
Agency Discussions	56w	15MAY02	19JUN03
EA/EIS Preparation	13w	02JAN02	02APR02
Permit Application	13w	06FEB03	07MAY03
Mitigation Planning	22w	17DEC02	21MAY03
Public Participation Program	104w	02JAN02	15JAN04
Permit Review & Approval	13w	27FEB03	29MAY03
FINAL DESIGNS & DOCUMENTS	52w *	26AUG03	27AUG04
Rail Access Package	26w	26AUG03	27FEB04
Island Package	52w	26AUG03	27AUG04
Dredging	26w	19JAN04	16JUL04
BIDS, AWARD & CONTRACT NEGOTIATION	104w *	01MAR04	27FEB06
Rail Package	39w	01MAR04	26NOV04
Island Construction	52w	30AUG04	29AUG05
Dredging	26w	30AUG05	27FEB06
CONSTRUCTION	603w1d	29NOV04	25JUL16
Rail System	54w	29NOV04	12DEC05
Lock Construction Starts	0		03JAN06
Causeway Extension to Island	26w	04JAN06	05JUL06
Island Construction	520w	06JUL06	25JUL16



Start date	01JAN02
Finish date	25JUL16
Data date	01JAN02
Run date	06DEC01
Page number	1A

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Early bar
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Start milestone point
Finish milestone point