3 CONSTRUCTION ISSUES

3.1 Introduction

Construction will involve reclamation from the sea and subsequent development of the port structure and container berths. An advanced works contract will provide land access to the CT10 and CT11 sites and the subsequent construction of the Terminals is assumed to proceed simultaneously. CT10 refers to the eastern terminal and CT11 the western terminal, a noise bund will be formed at the western end of each terminal. Fill material for the reclamation will be sourced from a marine borrow area, the source has still to be advised, and will not be addressed in this study. The land-based borrow area on the Tsing Chau Tsai peninsula identified in LAPH and assessed in the Stage I studies will not be developed as a source of reclamation material.

In the LAPH and Stage I studies it was assumed that the marine mud beneath the reclamation would, for the most part, be left in-situ. This study will investigate the environmental impact of removing marine mud and using marine sand for reclamation. The average finished level of the reclamation will be +5.6mPD and each terminal will incorporate a 25 metre high noise bund, which is required to shield sensitive receivers to the West.

CT10 and CT11 are each planned to have four berths, each berth being approximately 320 metres in length and 620 metres front to back. There will be 20 ha of container storage available for each berth. The completed Terminals will be in operation 24 hours a day with a projected maximum throughput of 2.0 Million TEU's (Twenty Foot Equivalent Units) for each Terminal.

3.2 Limited Borrowing from the TCT Peninsula

As part of the assignment for this study the Consultants have investigated the possibility of limited borrow activity on the south side of the Pa Tau Kwu headland to provide material for the CT reclamation[2]. Environmental assessment formed one strand of the report. During the previous LPD studies one of the environmental constraints was that multiple operators make environmental control problematic. The proposal investigated in this study was to operate a number of small borrow areas.

In addition, for the earlier LPD Stage I Preliminary Design, it was proposed in the EIA to permanently retain the southern headland of Pa Tau Kwu to give some screening to the noise generating activities and to provide visual shielding to the borrowing activity behind. It was also believed that retention of the headland would reduce the visual impacts in the area by providing screening to future developments within Pennys Bay. Ultimately, the consultants were directed to assume that the headland would be removed, though it was retained for as long as possible to minimise impact. At present the former West Kowloon Reclamation quarry site, immediately south of the CLP Power Station on the west end of the Pa Tau Kwu headland, offers a visual scar in the area and illustrates the problems of ensuring early rehabilitation of small quarry sites.

In this study the engineering team noted that each of the borrow areas proposed were small and the cost of development would make them unattractive to developers. Also,

[2] LPD Design of Reclamation and Edge Structures for Container Terminals 10 and 11 and Back-up Areas - Borrow Areas at Tsing Chau Tsai (draft March 1995)

there were potential conflicts with the future Sham Tseng Link. It was therefore concluded that the borrow areas on the south side of the TCT peninsula should not be used as a source of rock fill.

3.3 Terminal Construction Activity

3.3.1 Programme

The Engineering Design Team have prepared a preliminary construction programme for the drained and fully dredged reclamation options based on a start date in the first quarter of 1996 and completion in third quarter 1999. It is assumed that work on CT10 and CT11 would be carried on concurrently. The construction programmes with relevant equipment utilisation schedules are reproduced as drained option figures 3.1 and 3.2 (CT10 & 11 respectively) and dredged option in figures 3.3 and 3.4 (CT10 & 11 respectively). Work on CT10 will commence with formation of the noise bund platform at the western end of the terminal and proceed, berth by berth, west to east. CT11 will commence with the formation of the Noise bund followed by the northern platform which links the advance works reclamation to the noise bund at the western end of the terminal and forms the northern boundary to the terminal. Next the reclamation is formed berth by berth, west to east. Sketches showing the construction phasing are reproduced as figures 3.5 and 3.6 (CT10 & 11 respectively). The programme may be adjusted during the detailed design though dredging and filling rates presented here represent maximum intensity and any adjustment would reduce rates and therefore activity.

Commencement dates for both the drained or fully dredged options are assumed to be Q1 1996. The construction periods digress slightly, with the key dates identified as :

- **Drained Option** - The programme predicts that the reclamation for the first berth of CT10 would be completed in Q1 1998 and final(4th) berth reclamation in Q3 1999. Reclamation for the first berth of CT11 would be completed in Q2 1998 and the final (4th) reclamation in Q2 1999.

- **Fully Dredged Option** - The programme predicts a faster programme for CT10 with the first reclamation for completed in Q2 1997 and the final reclamation in Q3 1998. The programme for (CT11) is slower and results in a similar opening schedule to the drained option with the first reclamation completed in Q1 1998 and the final reclamation completed in Q3 1999

3.3.2 Construction Methodology

For the fully dredged option it is assumed that the dredging and sand-filling by dredgers will be a 24 hour, 7 days per week operation. This is a departure from the LAPH and last LPD Stage I studies. Other construction activity, for both the fully dredged and drained option, is based on a 16 hour working day (0700 hrs to 23.00 hrs), 6 days per week (Monday to Saturday). It is noted that construction activities after 19.00hrs and before 0700 hrs and on Sundays or Public Holidays will require the issue of Construction Noise Permits (CNP).

3.3.3 Construction Activity

Activities identified include :

- dredging (*limited dredging in the drained option*);
- laying of geotextile (*drained option only*);
- laying of sand blanket (*drained option only*);
- driving of wick-drains (*drained option only*);
- placing of sandfill below sea water level;
- placing of sandfill above sea water level; and
- moving surcharge.

For the drained option the existing sediments must first be covered with a geotextile layer of matted plastic, to prevent migration of fine material. Due to the nature of these underlying sediments, the sand will initially be pumped into the area in 0.5m layers for a height of 2m to form a protective sand blanket. Wick drains will be drilled into the fill and underlying mud in a triangular grid over the whole area at distances of 1.3 metres. The wick drains will quickly remove interstitial water expelled from the sediments when fill is placed. Surcharge will speed the consolidation process. During the LPD Preliminary Design it was assumed that a 9 metre high surcharge would be needed. Further work carried out in this study suggests that a 12 metre surcharge is required. Equipment schedules have been modified to match this new assumption.

For the drained option, fill will have to be placed by rainbowing or using a barge spreader in order to ensure that fill is placed uniformly so as not to cause mud waves. Rainbowing and barge spreading are considered to be similar with respect to potential impact on water quality. Once fill has been placed for a depth of five or six metres, it may be possible to place fill above this by pumping. In fact, the Contractor will probably prefer the latter option from cost considerations, pumping being a quicker means for discharging the fill than rainbowing. As the reclamation advances from west to east however, the advancing edge will have to be formed by rainbowing or barge spreading in order to maintain an edge slope of about 1:20 (the edge will need to be maintained like a beach so as to avoid causing mud waves). This however, is not a requirement for the dredged scheme, where it would be possible to form the edge at a slope of 1:3. Modelling has been undertaken on the basis of sediment input at the sea surface and therefore is a fair representation of rainbowing.

For the fully dredged option fill will be placed by bottom dumping to a level of -7mPD. Above this level material will be placed by pumping.

The sand will be transported from the marine borrow area by Trailer Suction Dredgers and will be bottom dumped into rehandling basins. Cutter Suction Dredgers will carry out the final filling operation. They lower a suction head into the rehandling basin and pump sand into the reclamation area. Reclaimed areas will be surcharged to speed the consolidation process, a large fleet of trucks will be required to transfer this surcharge material.

The number of Trailer Suction Hopper Dredgers (TSHD) operating on each terminal will depend on the rate of dredging required to meet the identified programme. It is a basic assumption that only 1 TSHD will be dredging at each terminal site at any one time. The engineering design team have advised that the larger TSHD dredgers have a capacity of 8,000 m^3hr^{-1} and, if working continuously, could dredge 4.8 Mm^3 of material every month (25 working days). The cycle time for a TSHD will depend on the distance to the

dumping site, travelling time, and the duration of the dumping operation. The number of dredgers involved will depend on the dredging rate requirement. For the water quality assessment the impacts are assessed against an assumed dredging rate which is independent of the number of dredgers. For the noise impact assessment it is assumed that 3 TSHD are operating though only one TSHD is operating at each terminal site at any one time, the others would be travelling to and from the dump site or be engaged in dumping. The findings of this assessment may be altered if increased dredging rates are assumed [the assumptions are 1.0 Mm^3 for the drained option and 3.4 Mm^3 for the drained option]. For the filling operation 2 Cutter Suction Dredgers (CSD) and 3 TSHD will be operating on each terminal. The TSHD supply sand from the borrow site and the same assumptions apply as to the dredging operation, namely that there will only be one TSHD at each terminal site at one time. The CSD are permanently on-station at the reclamation site, their role is to take the material from the rehandling basin and transfer it, by pump, to the required area. The dredging specialist, DEMAS, retained by the Consultants have advised that CSD can pump sand for a distance of up to two kilometres and that the need for booster pumps, identified in earlier studies, is unlikely at the Terminal reclamation.

The engineering team have developed three summaries of the construction activities which are directly relevant to the impact assessment. They are :

- dredging and sandfill quantities (berth by berth);
- maximum rates of dredging and placing (by quarter); and
- equipment requirements.

The equipment requirements are reproduced as figure 3.7 for the drained and dredged options.

Figure No 3.1 : Construction Programme CT10 (Drained)

Equipment Requirement

Activities	Equipment	1996 Q1	1996 Q2	1996 Q3	1996 Q4	1997 Q1	1997 Q2	1997 Q3	1997 Q4	1998 Q1	1998 Q2	1998 Q3	1998 Q4	1999 Q1	1999 Q2	1999 Q3	1999 Q4	2000 Q1	2000 Q2	2000 Q3	2000 Q4
Geotextile	Barge	2	2	1	1	1	1														
Wick drain	Barge		10	7	7	7	7	7	7	7	7										
Dredging, sandfill	Barge	1	1	1	1	2	2	2	2	2	2	2	2	1							
Sand Blaket, Bund	Cutter Suction Dredger	1	1	2	2	3	3	3	3	3	3	3	3	1							
Surcharge	Trailer Suction Dredger	1	1	1	1	2	2	2	2	2	2	2	2	1							
Surcharge Removal	Dump Truck (25m³)							24	24	25	25	25	25	25	25	32	32	32			
	Dozer							8	8	8	8	8	8	8	8	8	8	8			
	Loader							8	8	9	9	9	9	9	9	11	11	11			

Programme - CT10 Drained

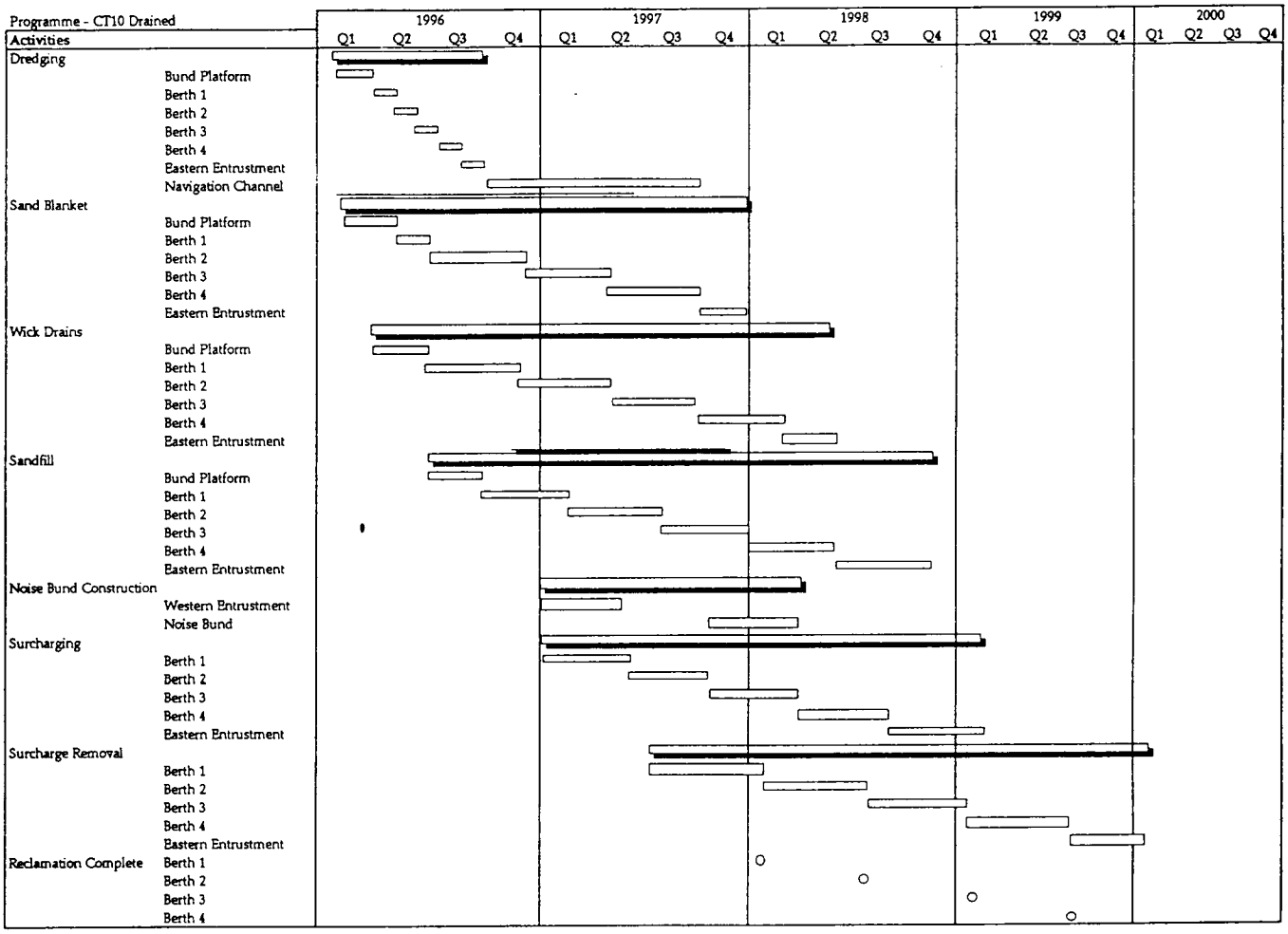

Figure No 3.2 : Construction Programme CT11 (Drained)

Equipment Requirement		1996				1997				1998				1999				2000			
Activities	Equipment	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Geotextile	Barge	2	1	1	1																
Wick drain	Barge		10	10	8	4	4	4	4												
Total Sandfill	Cutter Suction Dredger	1	1	1	1	1	1	1	1	2	1	1	1								
Sand Blanket, Bund	Trailer Suction Dredger	1	1	2	2	2	2	2	2	2	1	1	1								
Surcharging	Booster	1	1	1	1	1	1	1	1	2	1	1	1								
Surcharge Removal	Dump Truck ($25m^3$)								17	17	17	17	17	17	17						
	Dozer								5	5	5	5	5	5	5						
	Loader								7	7	7	7	7	7	7						

Programme - CT11 Drained		1996				1997				1998				1999				2000			
Activities		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Dredging																					
	Northern Entrustmmt																				
	Bund Platform																				
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
Sand Blanket																					
	Northern Entrustment																				
	Bund Platform																				
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
Wick Drains																					
	Northern Entrustment																				
	Bund Platform																				
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
	Navigation Channel																				
Sandfill																					
	Northern Entrustment																				
	Bund Platform																				
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
Noise Bund Construction																					
	Western Entrustment																				
	Noise Bund																				
Surcharging																					
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
Surcharge Removal																					
	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				
Reclamation Completed	Berth 1																				
	Berth 2																				
	Berth 3																				
	Berth 4																				

Figure No 3.3 : Construction Programme CT10 (Dredged)

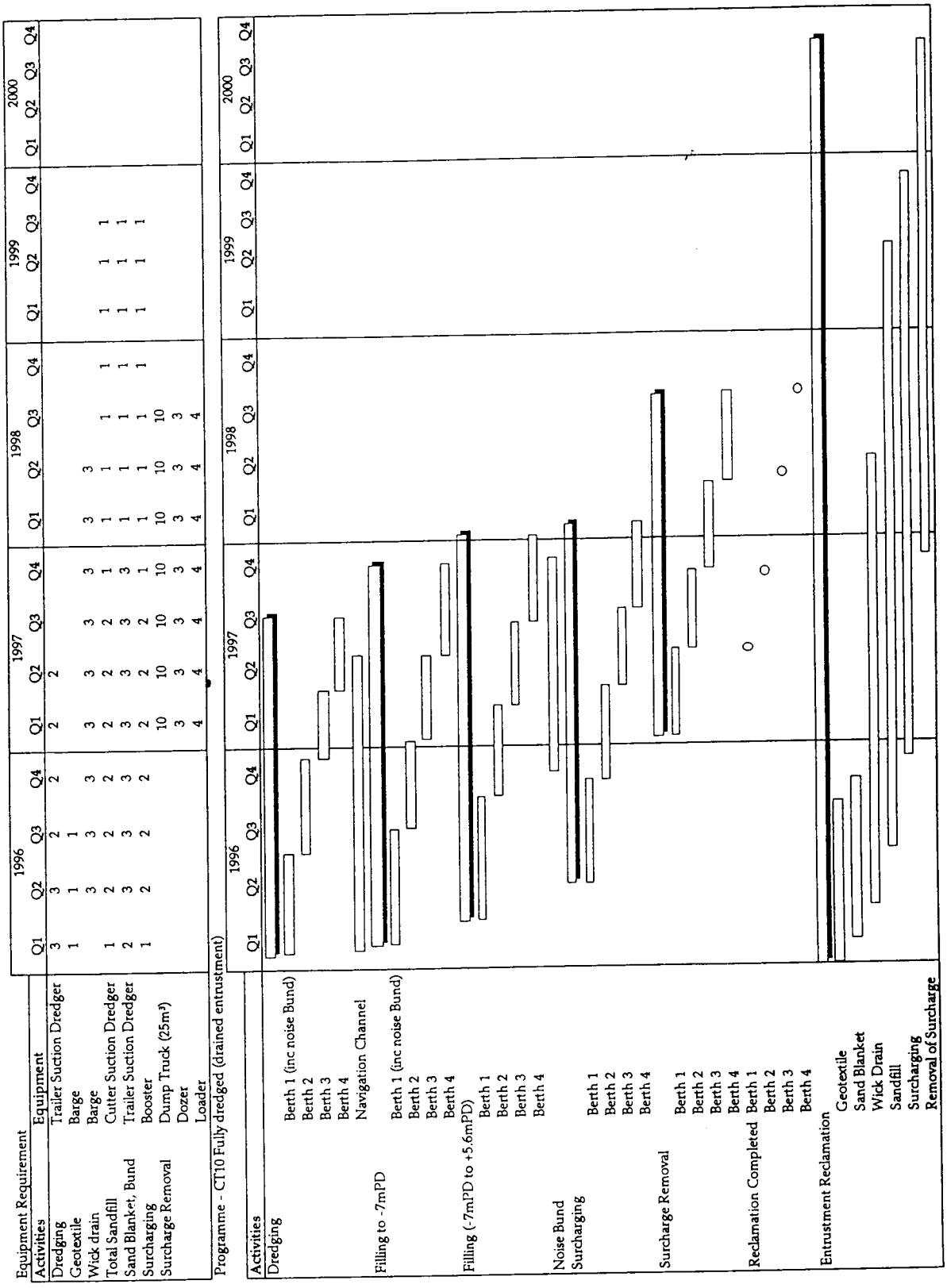

Figure No 3.4 : Construction Programme CT11 (Dredged)

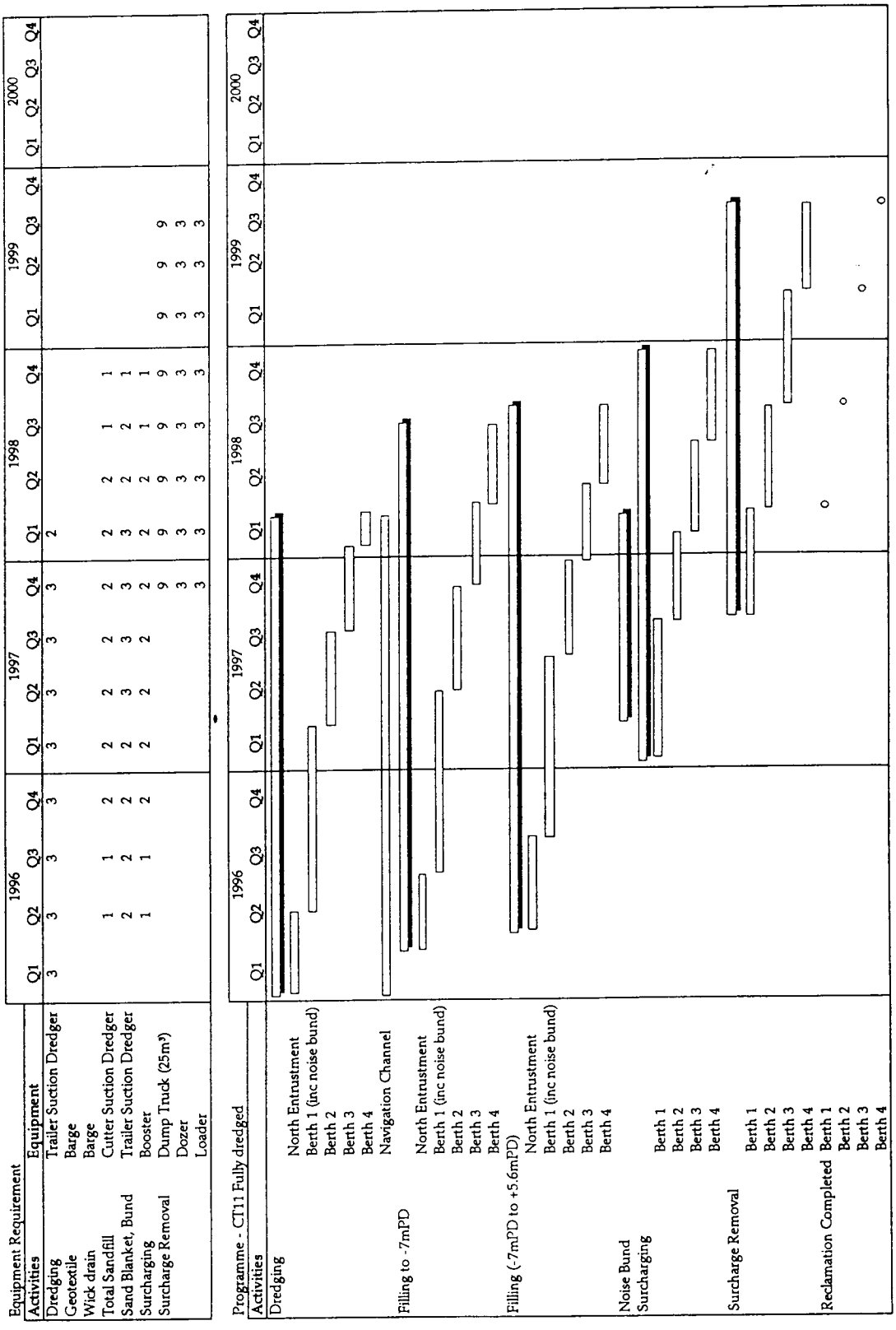

Figure No 3.5 : Construction Phasing Plan for CT10

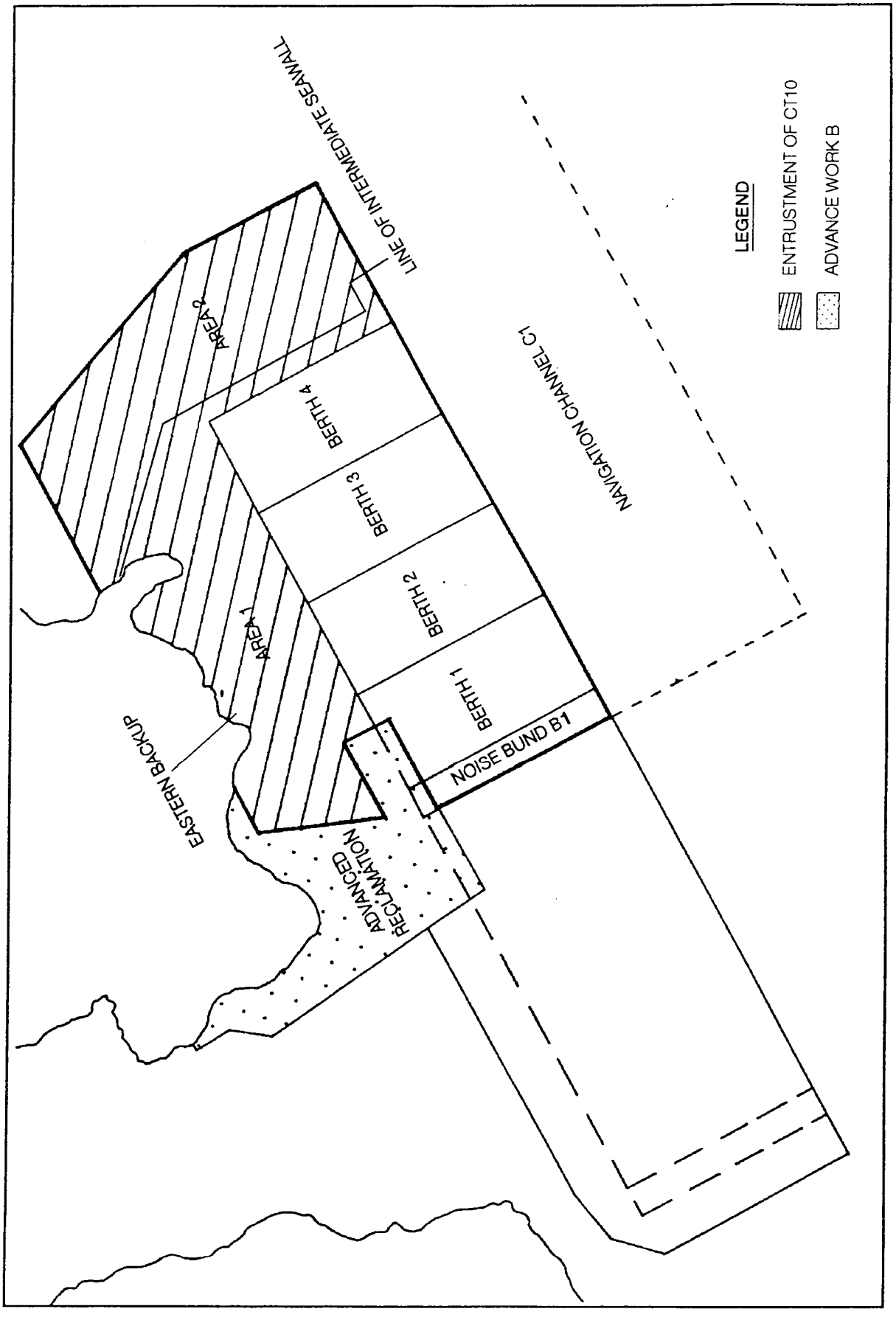

Figure No 3.6 : Construction Phasing Plan for CT11

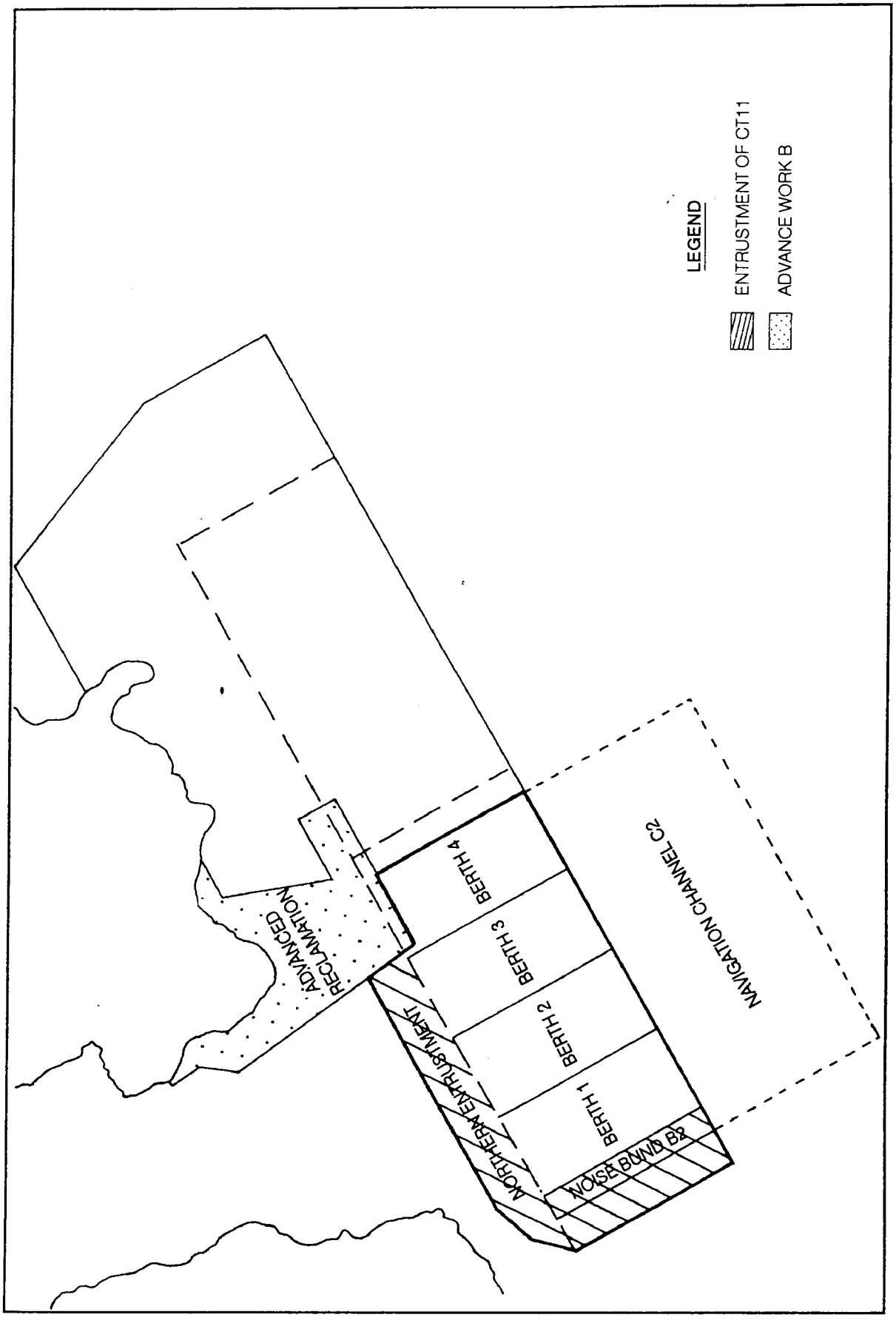

Figure No 3.7 : Maximum Equipment Requirements (The equipment requirements are for CT10 & 11 construction combined)

Drained Programme

		1996				1997				1998				1999				2000	
ACTIVITIES	EQUIPMENT	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Geotextile	Barge	4	3	2	2	1	1												
Wick Drain	Barge		20	17	15	11	11	11	11	7	7								
Dredge, Sandfill, Bund	Cutter Suction Dredger	2	2	2	2	3	3	3	3	4	3	3	3	1					
Sand Blanket, Surcharge	Trailer Suction Dredger	2	2	4	4	5	5	5	5	5	4	4	4	1					
Surcharge Removal	Dump Truck (25m³)							24	41	43	43	43	43	43	43	32	32	32	
	Dozer							8	13	13	13	13	13	13	13	8	8	8	
	Loader							8	15	16	16	16	16	16	16	11	11	11	

Fully Dredged Programme

		1996				1997				1998				1999				2000	
ACTIVITIES	EQUIPMENT	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Dredging	Trailer Suction Dredge	6	6	5	5	5	5	3	3	2									
Geotextile	Barge	1	1	1															
Wick Drain	Barge		3	3	3	3	3	3	3	3	3								
Sandfill, Bund	Cutter Suction Dredger	1	3	3	4	4	4	4	3	3	3	2	2	1	1	1			
Sand Blanket, Surcharge	Trailer Suction Dredger	2	5	5	5	5	6	6	6	4	3	3	2	1	1	1			
Surcharge Removal	Dump Truck (25m³)					10	10	10	19	19	19	19	9	9	9	9			
	Dozer					3	3	3	6	6	6	6	3	3	3	3			
	Loader					4	4	4	7	7	7	7	3	3	3	3			