The Republic of Iraq
General Company for Ports of Iraq (GCPI)

MASTER PLAN STUDY FOR PORT SECTOR IN THE REPUBLIC OF IRAQ

PRE-FEASIBILITY STUDY REPORT ON SERVICE BERTH

DECEMBER 2015

Japan International Cooperation Agency

Ides Inc.
Nippon Koei Co., Ltd. (NK)
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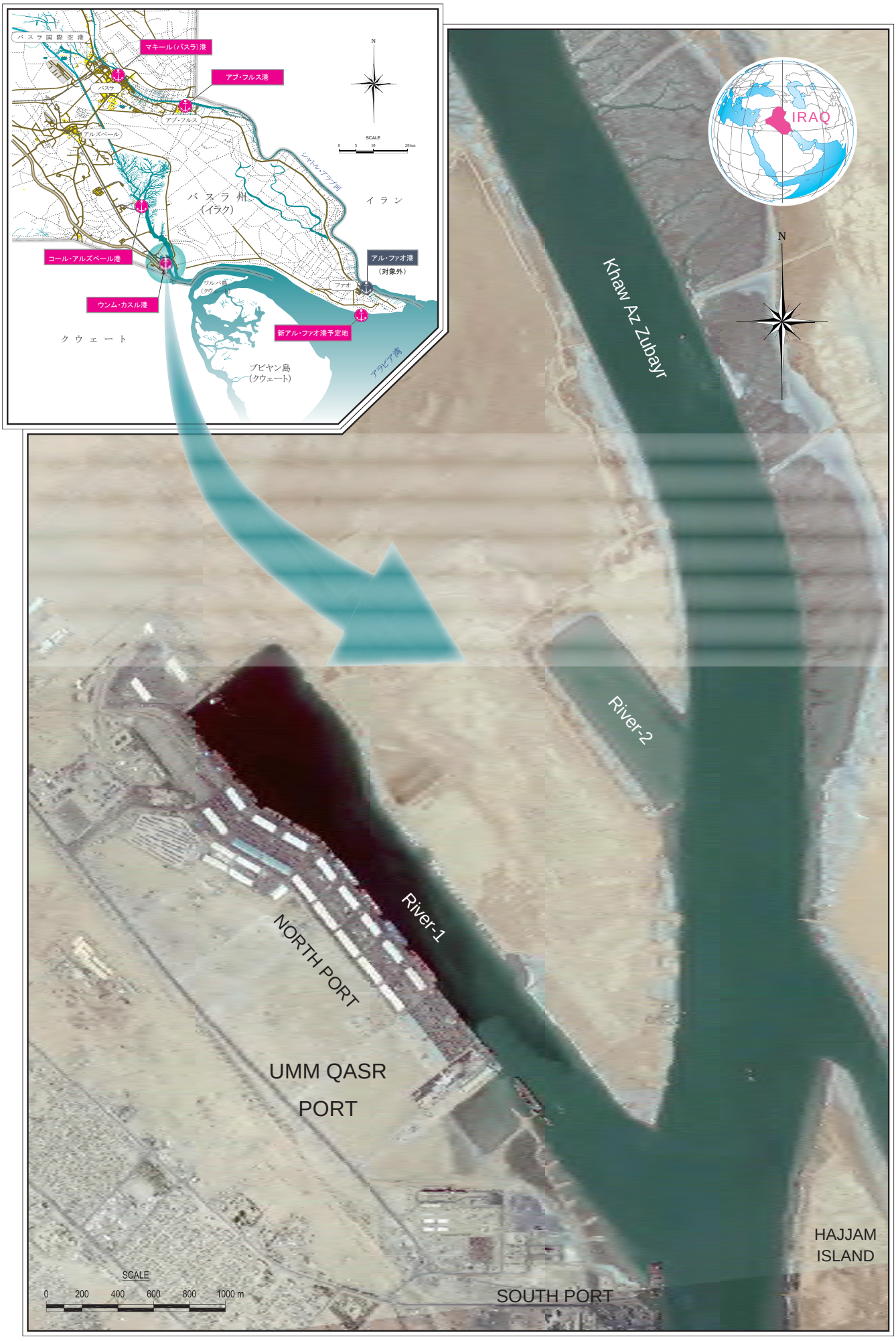

LOCATION MAP OF STUDY AREA

Abbreviation

AFGP	Al-Faw Grand Port
AIS	Automatic Identification System
C.I.I.T.I	Italan Consoutium of Iraq Transport Infrastructure
CMA-CGM	Compagnie Maritime D'affrètement - Compagnie Générale Maritime
CY	Container Yard
DANIDA	Danish International Development Agency
dB	decibel
D/D	Detail Design
DWT	Dead Weight Tonnage
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
F/S	Feasibility Study
GC	General Cargo
GCPI	General Company for Ports of Iraq
GDP	Gross Domestic Product
GT	Gross Tonnage
ICB	Inter Locking Concrete Block
IEE	Initial environmental Examination
IQ-P1	Iraq Project No.1
IP	Implementation Program
IQD	Iraqi Dinar
IRR	Iraqi Republic Railways Company
ISPS Code	International Ship and Port Facility Security Code
ITMP	Iraqi Transport Master Plan
JBIC	Japan Bank for International Cooperation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
KZP	Khor Al Zubayr Port
LOA	Length Overall
LPG	Liquefied Petroleum Gas
MOE	The Ministry of Environment
MOT	The Ministry of Trade
M/P	Master Plan
NDP	National Development Plan
NPV	Net Present Value
ODA	Official Development Assistance
PIANC	The World Association for Waterborne Transport Infrastructure
SEA	Strategic Environmental Assessment

STEP	Special Terms for Economic Partnership
SOLAS	International Convention for the Safety of Life at Sea
TEU	Twenty-foot Equivalent Units
UNDP	United Nations Development Programme
UQP	Umm Qasr Port
UQP-N	Umm Qasr Port North
UQP-S	Umm Qasr Port South

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CHAPTER 1

Chapter 1. Project Background and Necessity

1.1 Background

The General Company for Ports of Iraq (GCPI) owns and operates a large number of work vessels and port service boats such as dredgers, tugboats, survey boats, tankers, and floating cranes. It is however noted that neither designated service berths nor mooring areas, which are essential for smooth and efficient operations of the work vessels, have been provided. Under such situation, the work vessels and port service boats are currently using available commercial cargo berths, whenever such facilities are not used by cargo ships, in loading spare parts/water/food, crew changes, and/or other necessary preparation of the works.

However, it has been recognized recently that work vessels are not allowed easily to use cargo berths as cargo throughput has constantly been increasing based on the recovery of port function these days. Consequently, a lesser chance of finding vacant berths can be anticipated. As such trend may continue for a long while, it is recognized that the construction of service berth for work vessels and port service boats is important and urgently required.

Under the above circumstances, GCPI has requested the Japan International Cooperation Agency (JICA) to conduct a pre-feasibility study on service berth for work vessels and port service boats under the Port Master Plan Study, aiming at its earliest implementation.

1.2 Necessity of the Project

As mentioned above, GCPI operates many work vessels and service boats without appropriate handling facilities. Accordingly, GCPI is currently facing difficulty in the effective operations of the work vessels and service boats due to limited use of existing berths because of the increasing cargo traffic. This may cause unfavorable port operation and maintenance supported by such work vessels, and as a consequence, the calling cargo ships will suffer from inefficient cargo handling services at the ports or there will be draft restriction if maintenance dredging of channels and port basins is not properly done. On the other hand, if the work vessels are allowed to use the existing cargo berths whenever necessary, then this will cause unexpected waiting time of calling cargo ships.

Whichever is the case, a hampered cargo throughput increase in Iraqi ports may result.

It is therefore obvious that the requested service berth for work vessels and service boats, especially for the dredgers, is essentially important and necessary in order to cope with the projected cargo increase at the Iraqi ports at the earliest possible time.

1.3 Scope of the Pre-feasibility Study

The pre-feasibility study contains the following analysis and examination items:

a. Present status of objective work vessels and port service boats;
b. Necessary services to be provided at service berth;
c. Required facilities for the service berth;
d. Service berth location study;
e. Preliminary design of service berth facilities;
f. Preliminary project cost estimation and implementation plan;
g. Project evaluation by economic analysis; and
h. Initial environmental examination of the project.

1.4 Location of the Study Area

The working areas of work vessels and other port service boats include five existing ports, two main approach channels, and two offshore crude oil exporting terminals as shown in the following

location map below. Among the five existing ports, Umm Qasr Port (North and South) is the leading port in Iraq. It is therefore agreed that the location of the service berth is to be within or adjacent to Umm Qasr Port (UQP) as appropriate for the effective operation of work vessels and usage of the service berth.

Source: JICA Study Team

Figure 1.4-1 Location of Study Area

CHAPTER 2

Chapter 2. Present Status of Work Vessels and Service Boats Operation

2.1 Present Situation of Iraqi Ports

2.1.1 Trend of Cargo Throughput in Iraqi Ports

As shown in Table 2.1-1, the total cargo volume in Iraqi ports reached 10.12 million t in 2001. After that, the total cargo decreased in volume until 2003 with a handling volume of 1.81 million t. The total cargo volume then increased, after reaching its lowest value in 2003, and was recorded to be 12.63 million t in 2006. The latest cargo handling volume was 15.87 million t in 2014. It is noted that ship calls at the port of Iraq have decreased with the increase of the cargo volumes in recent trend.

Table 2.1-1 Trend of Cargo Volumes and Ship Calls in Iraqi Ports

Year	Umm Qasr Port		Khor Al Zubayr Port		Abu Flus Port		Al Maqil Port		Total	
	Cargo Volume (1,000 t)	Ship Calls	Cargo Volume (1,000 t)	Ship Calls	Cargo Volume (1,000 t)	Ship Calls	Cargo Volume (1,000 t)	Ship Calls	Cargo Volume (1,000 t)	Ship Calls
2001	7,001	533	3,114	4,319	-	-	-	-	10,115	4,852
2002	6,083	512	1,804	4,258	-	-	-	-	7,887	4,770
2003	1,682	512	129	44	-	-	-	-	1,811	556
2004	2,105	894	1,737	780	-	-	-	-	3,842	1,674
2005	4,362	763	1,200	1,262	480	2,025	44	108	6,087	4,158
2006	7,659	883	4,301	1,307	565	1,552	103	124	12,627	3,866
2007	5,984	1,028	4,416	1,069	693	3,020	42	47	11,135	5,164
2008	7,219	898	4,049	1,006	550	2,345	10	13	11,828	4,262
2009	7,445	1,146	3,297	900	551	2,469	47	66	11,340	4,581
2010	7,413	1,106	2,817	735	571	364	242	263	11,044	2,468
2011	8,622	992	3,513	516	497	194	644	618	13,276	2,320
2012	9,335	922	4,265	531	467	150	877	743	14,944	2,346
2013	10,058	945	4,273	632	530	198	908	795	15,769	2,570
2014	9,367	948	5059	670	460	180	983	808	15,869	2,606

Source: Prepared by the JICA Study Team based on GCPI's statistics data

Table 2.1-2shows the changes of average loaded volume per vessel in each port. According to this table, average sizes of vessel calling at UQP in 2001 and 2002 were rather bigger compared with vessels in 2003 after the Iraq War. They tended to enlarge the size of vessels, after recording a minimum average loaded volume of 2,355 t/vessel in 2004, and it reached 10,644 t/vessel in 2013. Average sizes of vessel calling at Khor Al Zubayr Port (KZP) from 2001 to 2005, especially, except those vessel sizes in 2003 and 2004, were rather smaller compared with vessels after 2006. They tended to enlarge the size of vessels, after recording an average loaded volume of 951 t/vessel in 2005, and it reached 8,032 t/vessel in 2012. It is considered that bigger vessels and smaller vessels like dhow ships mainly called at UQP and KZP, respectively, before the Iraq War in 2003. Relatively, small-scale vessels called at both ports due to difficulty of ship procurement during the Iraq War and vessel sizes have increased with the increase of cargo volumes at the ports of Iraq after the war.

Small vessels called at Abu Flus Port and Al Maqil Port up to 2009 and average vessel sizes calling at Abu Flus Port have enlarged with the increase of container cargoes since 2010.

Table 2.1-2 Changes of Average Loaded Volume per Vessel

Year	Umm Qasr	Khor Al Zubayr	Abu Flus	Al Maqil	All Ports
2001	13,135	721	-	-	2,085
2002	11,881	424	-	-	1,653
2003	3,285	2,932	-	-	3,257
2004	2,355	2,227	-	-	2,295
2005	5,717	951	237	407	1,464
2006	8,674	3,291	364	831	3,266
2007	5,821	4,131	229	894	2,156
2008	8,039	4,025	235	769	2,775
2009	6,497	3,663	223	712	2,475
2010	6,703	3,833	1,569	920	4,475
2011	8,692	6,808	2,562	1,042	5,722
2012	10,125	8,032	3,113	1,180	6,370
2013	10,644	6,761	2,679	1,142	6,136
2014	9,881	7,550	2,555	1,217	6,089

Source: Prepared by the JICA Study Team based on GCPI's statistics data

Finally, the average loaded volume per vessel in all ports has increased constantly since 2007. It is clear that enlargement of vessel sizes has been accelerated with the increase of cargo volumes.

2.1.2 Number of Arrival and Departure of Ships

The number of ship arrivals in UQP and KZP were 900 and 358 in 2011, respectively, while in 2012, the numbers were 834 and 416, respectively. The total number of arrivals in the said ports was 1,258 in 2011 and 1,250 in 2012. The number of arrivals of dhow ships has been decreasing remarkably from 147 in 2011 to 101 in 2012. The total number of arrivals and departures of ships doubled, i.e., 2,516 in 2011 and 2,500 in 2012, because the number of ship departures is the same with the number of arrivals. The average ships per day in the port are 6.9 and 6.8, in 2011 and 2012, respectively. The details are shown in Table 2.1-3 and Table 2.1-4.

Table 2.1-3 Number of Ship Arrivals and Departures in UQP

Unit: Number of ships

Year	Ship Size (DWT)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2011	0~9,999	22	32	26	27	29	23	18	8	12	11	13	9	230
	10,000~19,999	24	29	21	21	21	32	23	27	23	28	26	26	301
	20,000~29,999	20	19	16	17	22	11	17	18	22	13	19	19	213
	30,000~49,999	7	2	5	12	8	11	9	7	11	10	5	9	96
	50,000~80,000	1	5	6	8	7	7	8	7	5	3	1	2	60
	Total	74	87	74	85	87	84	75	67	73	65	64	65	900
2012	0~9,999	13	17	11	9	14	12	8	8	16	12	15	14	149
	10,000~19,999	30	28	23	21	19	28	21	25	29	24	22	30	300
	20,000~29,999	21	14	21	21	24	19	19	22	20	25	20	18	244
	30,000~49,999	8	5	5	7	3	6	7	5	11	7	7	12	83
	50,000~80,000	4	4	4	1	7	8	5	6	6	7	5	1	58
	Total	76	68	64	59	67	73	60	66	82	75	69	75	834

Source: Prepared by the JICA Study Team based on GCPI's statistics data

Based on the data in 2012 of ships calling at UQP, the number of container ship arrivals was 347 with a share of 41.6% of the total number of ship arrivals. The numbers of roll-on/roll-off (RORO) and PCTV ships are 87, with a share of 10.4%, and 44, with a share of 5.3%, respectively. The remainder are bulk and general cargo ships totalling to 356.

MSC gives a feeder service using 35,000~46,000 DWT container ship without a ship gear. The average load is about 600 TEU while the loading capacity of the ship is 3,000~4,000 TEU. Seven other shipping companies use container ships with ship gears. Maesk Line Shipping uses a small container ship with 13,700 DWT. Other shipping companies use container ships with 20,000~24,000 DWT. Majority of the container ships in the world are under load because these are considered surplus; and ships which cannot be scrapped or chartered for a long term are being used.

In 2012, the number of tanker arrivals and general cargo ship arrivals in KZP were 215 and 201, with shares of 52% and 48% of the total number of ship arrivals of 416, respectively. The number of small ships under 10,000 DWT was 193 with a share of 46%.

The number of small ships under 10,000 DWT in the ports (UQP and KZP) was 329 with a share of 26.3% of the total number of ship arrivals.

Table 2.1-4 Number of Ship Arrivals and Departures in KZP

Unit: Number of ships

Year	Ship Size (DWT)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2011	0~9,999	17	14	11	19	13	12	13	10	16	15	19	20	179
	10,000~19,999	11	5	7	7	8	9	4	6	4	10	7	5	83
	20,000~29,999	1	3	1	0	3	0	0	1	0	2	0	0	11
	30,000~39,999	1	1	3	2	2	2	5	5	3	2	2	1	29
	40,000~49,999	1	2	1	2	1	5	2	3	4	3	5	5	34
	50,000~59,999	0	0	1	1	2	1	2	1	3	4	2	3	20
	60,000~90,000	1	1	0	0	0	0	0	0	0	0	0	0	2
	Dhow Ships	28	27	7	16	7	3	1	0	3	21	24	10	147
	Total	32	26	24	31	29	29	26	26	30	36	35	34	358
2012	0~9,999	13	12	17	18	14	16	12	13	17	13	18	17	180
	10,000~19,999	6	10	9	9	8	5	6	7	6	9	6	8	89
	20,000~29,999	0	0	0	2	0	1	0	0	0	1	0	0	4
	30,000~39,999	2	2	2	3	0	0	2	3	4	3	4	3	28
	40,000~49,999	3	4	7	7	8	10	4	6	8	9	6	6	78
	50,000~59,999	5	4	3	0	2	3	5	4	3	3	2	3	37
	60,000~90,000	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dhow Ships	9	14	7	5	2	5	0	0	3	22	16	18	101
	Total	29	32	38	39	32	35	29	33	38	38	36	37	416

Source: Prepared by the JICA Study Team based on GCPI's statistics data

The maximum ship arrivals by cargo type from 2013 to 2014 are shown in Table 2.1-5.

Table 2.1-5 Maximum Ship Arrivals by Cargo Type from 2013 to 2014

Port Name	Ship Type	Name	Dread Weight Tonnage	Loaded Weight	Remarks
UQP	Container Ship	RANEE	24,378DWT	917 TEU	Max. loaded container: about 1,613 TEU
	Bulk Ship	BOTTI GLIERI	92,500 DWT	52,500 ton	Max. loaded tonnage: about 75,000 t/wheat
KZP	Tanker	SILVA	83,651 DWT	9,435 ton	Max. loaded tonnage: about 75,000 t/benzene

Source: Prepared by the JICA Study Team based on GCPI's statistics data

According to the above table, container ships and tankers are calling at the ports with a small load out of the possible loading capacity, while bulk and general cargo ships have nearly full loads. It is considered that there is no availability of small ship for the former; and ships with a nearly full draft are selected to call at the ports of Iraq for the latter.

2.1.3 Conditions of Port and Harbor Operation

(1) Umm Qasr Port South

Umm Qasr Port South is composed of 11 berths, i.e., No. 1 to No. 9 berths facing the Umm Qasr Channel and the rest facing the Umm Qasr Trench in greater UQP. The Iraqi Navy occupies No. 1 berth, and a generator ship is alongside No. 9 berth on a permanent basis for providing electricity to the area near the port. Other berths in the port are used for commercial purpose at present as described below.

1) No. 2 and No. 3 Berths

These berths are managed and operated by GCPI and are handling food products such as sugar, grain, and food-oils. There is a grain evacuator on the berths; however, there is no silo near the berths.

*GCPI has an idea to modify these berths, including the area behind the berths, into container terminals in the near future; however, it is not going to be mentioned in the plan or in this Study Report.

2) No. 4 Berth

The berth including a 70,000 m^2 container yard behind the berth is managed and operated by a joint operation company between GCPI and CMA-CGM, a French shipping company, as a dedicated container terminal of CMA-CGM. GCPI provides the berth and container yard; the actual operation of the container terminal is done by CMA-CGM alone. The joint operation contract of GCPI with CMA-CGM will expire at the end of 2015. Accordingly, GCPI needs to make a new contract with a terminal operating company (TOC). This will be done through an open bidding system soon. (GCPI is now in the process of doing this.)

CMA-CGM allocates a ship between Khor Fakkan Port in UAE and UQP (South) on a weekly basis, handling around 1,000 boxes per call at present (as of September 2013). TEU/box ratio at the port is about 1.55; thus, CMA-CGM can be said to be handling around 80,600 TEU per annum at the container terminal.

3) No. 5 Berth

The berth, including a 100,000 m^2 container yard behind the berth, is managed and operated by a joint operation company between GCPI and Gazal, which is a TOC serving three shipping lines, namely: Yangming, Simathec, and Evergreen. GCPI provides the berth, including two units of quay-side gantry cranes on the berth, and container yard; although, the actual operation at the container terminal is done by Gazal alone. The joint operation contract with Gazal will expire at the end of 2015, the same as for Berth No. 4. Accordingly, GCPI needs to make a new contract with a TOC. (GCPI is currently in the process of doing this.)

Gazal handles 2.23 ships a week (Evergreen's ship calls at the berth for discharging a part of the containers, and moves to ICT, No. 11a-b Berth for handling the rest of the containers which is calculated at 0.23 ship calls per week). The average handling volume is around 860 boxes per call at present (as of September 2013). Accordingly, Gazal can be said to be handling around 154,600 TEU per year at the container terminal as the TEU/box ratio at the port is about 1.55 (860 boxes x 2.23 x 52 weeks x 1.55 = 154,575 TEU).

4) No. 6 and No. 7 Berths

The concession contract of these berths is under negotiation. The candidate companies for the operation include a Bulgarian company, Gazal (Great Britain), Saba (APL), and Al Kamaal (Iraq).

The space behind No. 6 berth, however, had been operated by a joint operation company between GCPI and Saba as a storage yard for storing various cargoes handled at the port independently without activities related to the berth.

Table 2.1-6 Berth Details of Umm Qasr Port

UQP	Berth No.	Operator	Berth length (m)	Equipment		Current Commodities handled	Contract	Performance	GCPI Future Plan
				on Rail	Movable				
South	1	Navy	260	-	-	-	-	-	-
	2	GCPI	250	3 QC	7 unlorder(Sugar) 2 unloader (Cement)	Sugar, Grain, Edible oil, Food stuff	-	-	Container
	3		250						
	4	CMA-CGM	250	-	-	Container	GCPI JO till Dec. 2013	88,000 TEU/yr	
	5	Cazal	250	2 QGC	-	Container	GCPI JO till Dec. 2013	57,000 TEU/yr	
	6	GCPI	250	-	1 Unloader (Cement)	Cement, Pipe, Machine, GC	-	-	
	7		250						
	8	Gulftainer	250	-	2 Mobile Crane	Container	GCPI JO till Dec. 2013		
	9	GCPI	170	-	-	Power plant barge	-	-	-
	10	MOTr	285	2 Unloaders and Belt conveyer to Silo		Wheat	-	2.7 Mil.ton/yr	-
	11	MOI	190	-	-	Sugar	-	-	-
	11-a/b ICT	Gulftainer	375	2 QGC	-	Container	From Oct. 2013, 5+5 years	353,000 TEU/yr	Container
North	12	GCPI	200	2 QC	-	Wheat, Rice, Cement, Sugar Pipe, other GC	-	-	Back yard be converted to CY of 40 ha by Aloreen Co.
	13		200	1 QC	-		-	-	
	14	GCPI	200	5 QC	-		Yard is operated by Aloreen	-	
	15		200	1 QC	-				
	16	GCPI	200	5 QC	1 Mobile Crane		-	-	-
	17		200	4 QC			-	-	-
	18		200	12 QC			-	-	-
	19		200	5 QC	-		-	-	-
	20	ICTSI/ GCPI	350	2 QGC	1 Mobile Crane	Container	From 2014	-	-
	21								
	22	Aloreen/ GCPI	150			Ro/Ro, Car, GC, Container	From Oct. 2013, 5+5 years	-	-
	23		200						
	24		200						

Source: Prepared by the JICA Study Team based on GCPI interview

5) No. 8 and No. 8a Berths

The berth, including a 75,000 m^2 container yard behind the berth which is divided into three areas in total, is managed and operated by a joint operation company between GCPI and Gulftainer, a TOC serving for the Mediterranean Shipping Company (MSC) at the container terminal. GCPI offers the berth and container yard although the actual operation at the container terminal is performed by Gulftainer. The joint operation contract with Gulftainer will expire at the end of 2015.

Gulftainer handles one ship a week, and its handling volume is around 1,000 boxes per call at present (as of September 2013). Accordingly, Gulftainer can be said to be handling around 80,600 TEU per annum at the container terminal as the TEU/box ratio at the port is about 1.55 (1,000 boxes x 52 weeks x 1.55 = 80,600 TEU).

6) No. 10 Berth

This berth, which is actually a dolphin pier, including some silos behind the berth, is operated by the Ministry of Trade (MOT) in Iraq and handles grains, mainly wheat, at present.

7) No. 11 Berth

This berth is a dedicated terminal for handling sugar and is operated by the Ministry of Industry (MOI).

(2) Umm Qasr Port North

1) No. 11-a and No. 11-b Berths (Iraq Container Terminal)

The berths, including a 250,000 m^2 container yard (including an area of 100,000 m^2 which will be developed soon) behind the berths, is managed and operated by a joint operation company between GCPI and Gulftainer, the same as for No. 8 berth/container terminal in UQP North, serving four shipping lines, namely: UASC, Maersk, APL, and Evergreen at present (as of September 2013). GCPI provides the berth and container yards although the actual operation at the container terminal is done by Gulftainer. GCPI made a contract with Gulftainer in August 2012 which allows Gulftainer to use the terminal for ten years until July 2022, with an option to renew for ten more years.

Gulftainer handles 3.77 ships a week (Evergreen's ship will be counted as 0.77 calls per week, due to double calling at No. 5 berth), and its average handling volume is around 800 boxes per ship call at present (as of September 2013). Accordingly, Gulftainer can be said to be handling around 243,100 TEU per year at the container terminal as the TEU/box ratio at the port is about 1.55 (800 boxes x 3.77 ships x 52 weeks x 1.55 = 243,090 TEU).

2) No. 12~15 Berths

The characters of the cargoes and operation methods at the berths are the same as for No. 16~19 Berths in UQP North; however, these berths are operated and managed by a joint operation company between GCPI and Aloreen. Operational methods at the berths are the same as for other GC berths in UQP North, i.e., direct discharging system for major cargoes, while the rest of the cargoes are handled by indirect system.

Besides the GC operation at Berth Nos. 12~15, Aloreen is constructing a 40 ha container yard behind Berth Nos. 12, 13, 14, and 15, outside the fence of the UQP North and the road leading to UQP South. Another 5.5. ha container yard is also being constructed by Aloreen beside the Gulftainer's Umm Qasr Logistics Center in the northwest of UQP North, outside the fence of the North Port.

Part of the contract between GCPI and Aloreen is to remove the existing Jetty No. 22 and construct three berths in the northern part of River No. 1 (UQ Trench; Starting from Berth No. 21). Two of them are for handling container and/or GC cargoes with 200 m long berth each, and the third one is for RORO ships with a 150 m berth.

3) No. 16~19 Berths

These four berths are managed and operated by GCPI through 14 local stevedoring companies under GCPI, handling imported GC cargoes such as sugar, wheat, rice, and pipes, as the main GC berths of the port. Ship operations of major cargoes such as sugar, wheat, and rice at the berths are done by "direct discharging" system, i.e., cargoes are unloaded from ships to trucks dispatched by consignees directly using ship gears or unloaders; hence, the berths are basically congested due to the large number of trucks. Although, these cargoes are once stored into sheds behind the berths before delivering to consignees.

4) No. 20 Berth (No. 21 Berth: Ro-Ro Berth)

Berth No. 20, including a 116,000 m^2 container yard behind the berths, is managed and operated by a joint operation company between GCPI and ICTSI. However, due to the many rail Trucks in the container yard, the maximum storage capacity is only 4,500 TEU that can stack containers up to 3 containers high, which is too small to handle containers moving through two berths of the container terminal even at present (as of September 2013). Besides the abovementioned container yard, GCPI has an off-dock container yard, named Anham, which has maximum capacity of 3,500 TEU per time that can stack containers up to 2 containers high throughout its 90,000 m^2 space.

5) No. 22~24 Berths

As stated already, these berths (area of the port) are going to be rehabilitated to three berths by a joint operation company between GCPI and Aloreen. Two of them are modified for handling GC cargoes with a 200 m long berth each, and the third one is for RORO ships with 150 m long berth.

6) No. 25~27 Berths

These berths (area of the port) which handle container cargoes with a 200 m long berth each will be constructed newly by a joint operation company between GCPI and ICTSI.

(3) Khor Al Zubayr Port

Khor Al Zubayr Port (KZP) is the second largest port in Iraq, located about 20 km north of UQP. There are 13 berths and piers in the port; however, only nine of them are commercially used at present, i.e., No. 2 through No. 4 and No. 5 through No. 10 berths.

1) No. 2 through No. 4 Berths

These three berths are managed and operated by GCPI through local stevedoring companies under KZP-GCPI, handling cement mainly. Ship operations (basically discharging only) at the berths are done by "direct discharging" system, the same as that in UQP.

GCPI, however, made a contract with Martrade Logistic (Mar-Log) giving them the right of prior use of berths and storage yard behind the berths in April 2013 due to the expansion of their business at the port. Mar-Log plans to install a heavy mobile crane on the berths for handling containers, contained parts, and furnishings of oil-rigs and pipes. However, the cement handling operation at the berths should not be affected for a while because the total berth length is 540 m.

Mar-Log will start using the berths for eight years after the rehabilitation works of the berths are completed (estimated to take four years). Hence, most probably, Mar-Log has the right to use the berths until the end of March 2025.

2) No. 5 through No. 6 Berths

These berths were built for exporting bulk fertilizers but this function was shut down a long time ago. At present, a series of belt conveyers remains on the berths. Accordingly, GCPI uses the berths for dhow ships mainly handling sugar, beans, GCs, and dates (for export), because it is impossible to use heavy mobile cranes at the berths. GCPI also utilizes the berths for tanker ships for importing and/or exporting oil products by portable pumps.

3) No. 7 Berths

GCPI has allowed Mar-Log to use No. 7 Berth and the storage space (50,000 m^2) behind it under a concession contract since early 2012 while No. 8 Berth remains as a common berth for handling GCs. Mar-Log handles pipes, modules, and furnishings related to oil-rigs at No. 7 Berth; utilization rates of the berth reached 50% by the middle of 2013. Hence, as stated already, Mar-Log made a contract with GCPI to use Berth No. 2 through No. 4 preferentially as it prepares to expand its business in the near future.

4) No. 8, No. 9 and No. 10 Berths

No. 8 berth is a GC berth with two (2) warehouses behind the berth. No. 10 and 11 berths were built for importing iron ore; however, operations stopped a long time ago. Therefore, there are two units of quay-side gantry cranes and belt conveyers for handling ore. The Ministry of Oil (MOO) operates and manages the berths for importing oil products at present (as of September 2013) such as gasoil, benzene, and kerosene which are sent to Sheva through pipelines and stored in the tanks there.

The Ministry of Industry (MOI), primary owner of the berths, plans to re-use the berths for importing iron ore and/or exporting iron products soon after negotiating with a Turkish investor.

GCPI/MOO will develop three berths for handling oil products between UQP and KZP as the compensation facilities of these two berths.

A new electrical iron mill is also planned to be built near the existing one by a joint venture between Iraq and foreign investors.

5) No. 12 Berth

No. 12 Berth will soon handle oil products after it is repaired by a joint operation company between GCPI and private investors in Iraq.

Table 2.1-7 Berth Details of Khor Al Zubayr Port

Berth No.	Operator	Berth length (m)	Equipment		Current Commodities handled	Contract	GCPI Future Plan
			on Rail	Movable			
1	GCPI	-	-	-	-	-	-
2	Mar-Log	540	-	-	Cement	Prioroty usage is given to Mar-Log under a contract	Mar-Log plans to handle containers
3			8 QC	-			
4							
	No berth	-	-	-	Mooring Working vessels, FC	-	-
5	GCPI	740	Loader (Fertilizer) Belt conveyer		-	-	-
6	GCPI						
7	Mar-Log	250	-	-	-	-	-
8	MOO	800	8 QC	-	Oil Products	-	Exchange with Berths No.2-4
9							
10			Loader (Iron powder) Belt conveyer				
11	NAVY	90	-	-	Power Plant Ship	-	-
12	Mar-Log	To be developed		-	-	-	-

Source: Prepared by the JICA Study Team based on GCPI interview

(4) Al Maqil Port

Al Maqil Port was the first international port in Iraq built in 1919, located 135 km above the river mouth of Shatt al Arab River. The port has 15 berths in total on the right bank of the river with narrow aprons; thus, it is difficult to handle cargoes effectively. However, the area behind Berth Nos. 13 and 14 is around 200 m wide, which is more than sufficient to handle containers. In fact, GCPI in Al Maqil Port made a ten-year contract with NAWAH, a TOC in USA, to use berth No. 14 with the space behind for storing containers. NAWAH started its operation at the port after the construction of the container yard. NAWAH plans to extend its facilities to Berth No. 13 as well as No. 12 in the future as its business expands.

- GCPI in Al Maqil Port plans to utilize facilities in the port in the future as follows:

  - GC berths: No. 2, No. 6~9 and No. 12 berths (total six berths)
  - Container berths: No. 10~11, No. 13~15 berths (total five berths)
  - Ship yards: No. 3~5 berths (total three berths)

  (GCPI does not use No. 1 Berth at present, nor does it plan to use it in the future)

Iraqi government has no plan to dredge the river mouth at present due to residual unexploded bombs and sea mines from the Iraq-Iran War.

Table 2.1-8 Berth Details of Al Maqil Port

Berth No.	Operator	Berth Length (m)	Equipment		Current Commodities	Contract	GCPI Future Usage Plan
			on Rail	Moveable			
		510		not in use (Sunken Vessel)			
1	GCPI	350	11 QC	1 MC	GC		
2					GC		
3		460	no wharves (revetment only)				
4							
5							
6		610	19 QC		GC		
7					GC		
8					GC		
9					Moored Training Ship		
10		550			GC		
11					GC		
12					GC		Container Berth
13	NAWAH	350			Container	10 years from Dec. 2012	Future plan for No.13 berth
14							Future plan for No.13 berth
15	GCPI	180			not in use		

Source: Prepared by the JICA Study Team based on GCPI interview

(5) Abu Flus Port

Abu Flus Port is located about 110 km upstream from the river mouth of Shatt al Arab River (or around 25 km downstream of Al Maqil Port), on the right bank of the river. The port has three 175 m long berths with 18 m wide aprons constructed by iron structured plates. The plates are not strong enough to tolerate heavy container handling equipment (CHE). Accordingly, stevedore laborers of the port use two units of lighter MC together as a pair when discharging and/or loading a container for spreading the weight of the MC and the container at Berth No. 3.

No. 1 and No. 2 Berths of the port are used for handling GC and cement cargoes by direct discharging system; the cargoes are discharged from ship-sides onto trucks prepared by consignees the same as for other ports in Iraq. The apron of the berths is made of iron structured plates also; however, they are all in good condition having been recently renewed.

Table 2.1-9 Berth Details of Abu Flus Port

Berth No.	Operator	Berth Length (m)	Equipment		Current Commodities	GCPI Future Usage Plan
			on Rail	Moveable		
1	GCPI	170	2 QC		Genral Cargo	
2		170	3 QC		Genral Cargo	
3		170			Container	

Source: Prepared by the JICA Study Team based on GCPI interview

2.1.4 Necessity of Small Craft Basins

In general, small craft basins for service boats and work vessels are needed in the port and the performance criteria for small craft basins shall be such that the basins have the shape, area, and calmness necessary for the safe and smooth use of ships.

In the ports of Iraq, there are a lot of service boats for supporting various cargo vessels and work vessels for maintenance dredging; and it is expected that more vessels will be needed from now on with the increase of cargo volumes and enlargement of cargo vessels calling at the port. As a result, no small craft basin in the port brings unsafe conditions due to no anchoring facility. It is considered that the development of small craft basins in the port is indispensable in terms of the safe and smooth use of service boats and work vessels.

Table 2.1-10 shows small crafts necessary for supporting various cargo vessels.

Table 2.1-10 Small Crafts Necessary for Supporting Cargo Vessels

Small Craft Type	Utilization
Tugboat	Berthing assistance especially for large-scale vessels
Security Boat	Port security
Plying Boat	Customs, quarantine's and immigration's use
Pilot Boat	Pilotage
Service Boat	Water and fuel supply
Mooring Boat	Mooring assistance for cargo vessels
Others	Survey boat, lightening boat, fire fighting boat, anti pollution boat, etc.

Source: Prepared by the JICA Study Team

In addition, a repairing facility for service boats and work vessels should be constructed for safe and smooth operations of small crafts.

2.2 Present Situation of Approach Channel

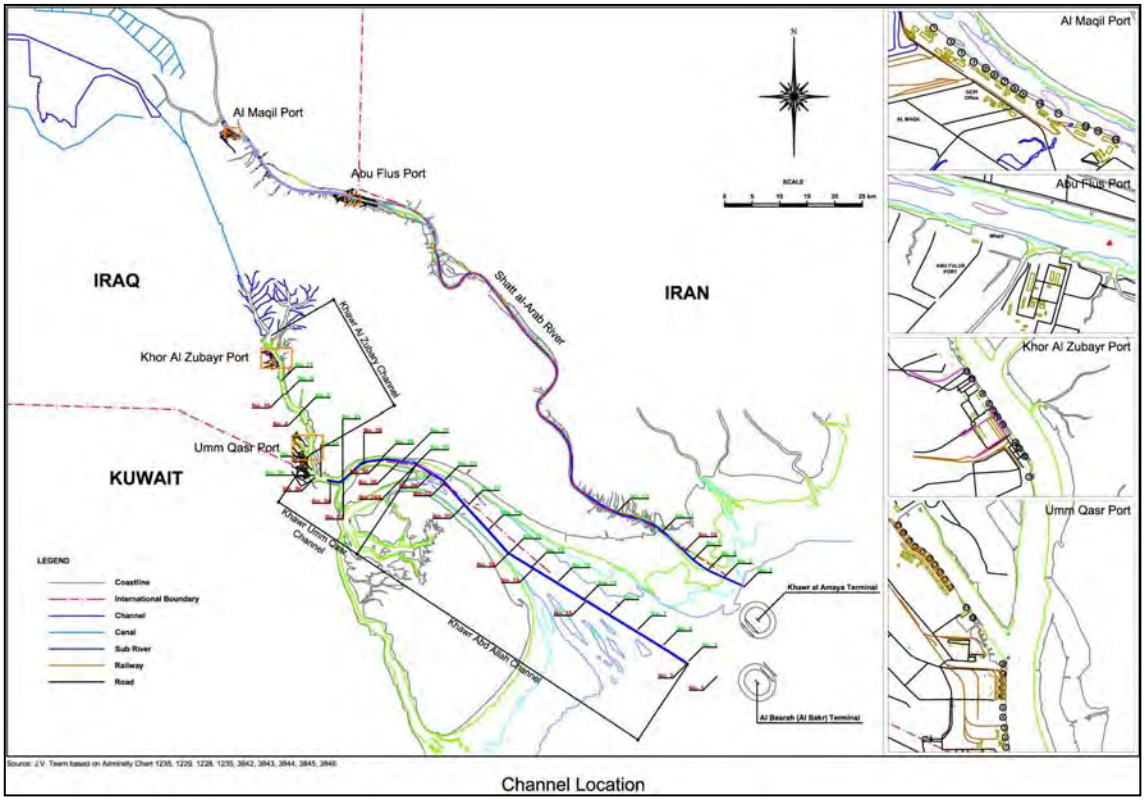
(1) Outline of Approach Channel

The existing channel system is composed of two routes. One route is Shatt al Arab Channel being established along the Shatt al Arab River that leads to Abu Flus Port and Al Maqil Port. The other route is an approach to Umm Qasr Port and Khor Al Zubayr Port, and called as Khawr Abdallah Channel (the name "Khor Al Zubayr Channel" is also used).

In spite of previous cooperative efforts, the following issues are still to be resolved in order for the approach channel to be fully operational and attain its intended design capacity:

- Restoration of the necessary sections in terms of depth and width throughout the respective channels.
  (Except for the route to the Umm Qasr Port in the Khawr Abdallah Channel, the restoration works have not progressed well in which some restricted ship draft is required in many places. It is therefore far from the maximum design for expected ship calls at the existing ports.)
- Removal of shipwrecks obstructing safe ship navigation along the channels.
- Restoration and installation of necessary navigation aids throughout both channels.

- Border issues settlement with the neighboring countries where the channels are passing or shared.
  (Most parts of the Shatt al Arab Channel route are forming a border and shared with Iran while part of Khawr Abdallah Channel is passing through the territory of Kuwait.)
- Continued maintenance dredging works in order to maintain sufficient water depths.



Source: JICA Study Team

Figure 2.2-1 Location of Channels

(2) Conditions of Existing Channels

The present conditions of the existing channels are indicated in the following tables.

1) Shatt al Arab Channel

Table 2.2-1 Summary of Water Depth and Width of Each Channel Section

Channel Section	Length (km)	Water Depth (CD m)	Width (m)	Remarks
River Mouth	12.0	-2.5~-4.0	150	Buoy No. 1~No. 7
Shared Use with Iran	94.5	-4.5~-16.0	100～200	Buoy No. 10～Border Post
Border Post near Abu Flus Port ~ Al Maqil Port	37.4	-5.0~-16.0	Unknown	Water depth survey done under the Study

Source: JICA Study Team

2) Khawr Abdallah Channel

Table 2.2-2 Summary of Channel Depth and Width

Channel Segment	Length (km)	Depth (CD m)	Width (m)	Remarks
Khawr Abdallah	60.7	11.0~12.5	200	Buoy No. 3~No. 25
Khawr Umm Qasr	25.1	12.0~13.2	125~250	Buoy No. 25~UQP
Khor Al Zubayr	17.6	9.0~15.0	150~400	UQP~KZP

Source: JICA Study Team

(3) Volume of Maintenance Dredging

According to the Iraq Transport Corridor Study (ITCS) made by the Danish International Development Agency (DANIDA) in February 2008, which is a part of the Iraqi Transport Master Plan (ITMP) and has conducted a sedimentation study along the Khawr Abdallah Channel up to KZP, the estimated sedimentation by the hydrodynamic modeling is in the magnitude of 7.6 million m3/year under the original design depths of the channel and ports. Among the analyzed areas along the channel, the area of UQP River-1 is a special concern, as the detailed analysis result of this area has indicated that the maintenance dredging volume required is 2.3 million m3/year.

The above study results have been taken into consideration in GCPI's maintenance dredging plan, and according to a hearing with GCPI, the planned maintenance dredging volume in 2012 was 8.0 million m3 and the actual dredged volume was 6.0 million m3 in the Khawr Abdallah Channel and UQP-KZP Channel.

No maintenance dredging has been conducted along the Shatt al Arab River (up to Al Maqil Port) since the war between Iraq and Iran began. However, it is said that most of the areas along the Shatt al Arab River will not suffer from significant sedimentation, except for the river mouth area. The water depth survey conducted under the Port Master Plan Study (between Al Maqil Port and Abu Flus Port) has also revealed mostly agreeable results except for the Abu Flus Port area, where considerable sedimentation has been observed as a result of no maintenance dredging for a long time.

2.3 Present Status of Work Vessels and Service Boats Operation

(1) Work Vessels and Service Boats Operated by GCPI

The work vessels and service boats owned and operated by GCPI are indicated in the following tables:

Table 2.3-1 Objective Work Vessels and Service Boats Data (Dreders)

DREDGERS					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
1	BASRAH DREDGER	T.S.H.D 2000	82X15X6	5.37	WORKING
2	KARBALA DREDGER	T.S.H.D 3500	90.65X17X7.90	6.32	WORKING
3	UMM QASR DREDGER	T.S.H.D 8000	132.44X22X9.20	8.20	WORKING
4	TIBA DREDGER	T.S.H.D 4500	99.60X17X8.90	6.45	WORKING
5	ALZUBAIR DREDGER	T.S.H.D 3500	98X16X7.40	6.10	UNDER REPAIR
6	ALMIRBAD DREDGER	T.S.H.D 3500	98X16X7.40	6.10	UNDER REPAIR
7	ALTAHRIR DREDGER	T.S.H.D 3500	98X16X7.40	6.10	UNDER REPAIR
8	DOHUK DREDGER	G.H.D 500	57X12.50X4.90	3.90	WORKING
9	SAIF ALKARAR DREDGER	C.S.D 1500	69X14X4.03	3	WORKING
10	ALNASRIA DREDGER	C.S.D 750	46X7.03X1.08	1.08	UNDER REPAIR
11	RAMALAH DREDGER	C.S.D 1500	67X14X3	3	WORKING

Source: Prepared by the JICA Study Team based on available GCPI data

Table 2.3-2 Objective Work Vessels and Service Boats Data (Boats)

BOATS					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
12	ALKAHR BOAT	WORK SHOP BOAT	12X6X1.8	1.5	NDDE TO REPAIR
13	HOLLAND BOAT 362	MOORING BOAT	10X3X1	0.75	WORKING
14	HOLLAND BOAT SURVY1	MOORING BOAT	10X3X1	1	WORKING
15	IRAQ 1	MOORING BOAT	10X3X1	1	WORKING
16	MALAYSIAN BOAT 364	MOORING BOAT	10X3X1	0.75	WORKING
17	HOLLAND BOAT 363	MOORING BOAT	10X3X1	0.75	NDDE TO REPAIR
18	HOLLAND BOAT 314	MOORING BOAT	10X3X1	0.75	NDDE TO REPAIR
19	HOLLAND BOAT 361	MOORING BOAT	10X3X1	0.75	NDDE TO REPAIR
20	HOLLAND BOAT 312	MOORING BOAT	10X3X1	0.75	NDDE TO REPAIR

Source: Prepared by the JICA Study Team based on available GCPI data

Table 2.3-3 Objective Work Vessels and Service Boats Data (Lighting Vessel)

LIGHTING VESSEL					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
21	ALNASR LIGTING VESSEL	LIGHTING VESSEL	54X15X3.5	4.20	WORKING

Source: Prepared by the JICA Study Team based on available GCPI data

Table 2.3-4 Objective Work Vessels and Service Boats Data (Survey Boats)

SURVEY BOATS					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
22	MALK ALASHTER SURVY-TUG	SURVEY-TUG BOAT	22.40X6.80X3.10	4	WORKING
23	ALBARAKE	SURVEY BOAT	22.25X5.5X2.55	3	WORKING
24	ALSALAM	SURVEY BOAT	10.14X3.15X0.85	1.50	WORKING
25	ALABILLAH	SURVEY BOAT			UNDER CONSTRUCTION

Source: Prepared by the JICA Study Team based on available GCPI data

Table 2.3-5 Objective Work Vessels and Service Boats Data (Tug Boats)

TUG BOATS					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
26	MHAIJRAN	TUG BOAT (40 TON BOLLARD PULL)	41X4.60X11.2	4.60	WORKING & NEED TO REPIAR
27	ALRAYA	TUG BOAT (42 TON BOLLARD PULL)	32.10X10X3.71	3.71	WORKING
28	ALFATH ALMOBEN	TUG BOAT (42 TON BOLLARD PULL)	32.10X10X3.71	3.71	WORKING
29	IBN BATOTA	TUG BOAT (42 TON BOLLARD PULL)	32.10X10X3.71	3.71	WORKING
30	ALYERMOOK	TUG BOAT (42 TON BOLLARD PULL)	32.10X10X3.71	3.71	WORKING
31	OMARAH	TUG BOAT (25 TON BOLLARD PULL)	41X10X4	4	WORKING & NEED TO REPIAR
32	ALAMEEN	TUG BOAT (25 TON BOLLARD PULL)	41X10X4	4	WORKING & NEED TO REPIAR
33	ALJAMHORIAH	TUG BOAT (25 TON BOLLARD PULL)	41X10X4	4	WORKING & NEED TO REPIAR
34	URROBAH	TUG BOAT (25 TON BOLLARD PULL)	41X10X4	4	WORKING & NEED TO REPIAR
35	ALSHAIMA	TUG BOAT (36 TON BOLLARD PULL)	30X9.5X4.5	4.5	WORKING & NEED TO REPIAR
36	ALBETOOL	TUG BOAT (36 TON BOLLARD PULL)	30X9.5X4.5	4.5	WORKING & NEED TO REPIAR
37	KIRKOOK	TUG BOAT (52 TON BOLLARD PULL)	34X10.5X4	4	WORKING
38	NAINAWAH	TUG BOAT (52 TON BOLLARD PULL)	34X10.5X4	4	WORKING
39	AL-FAIHAA	TUG BOAT (52 TON BOLLARD PULL)	34X10.5X4	4	WORKING
40	AL-ASHAAR	TUG BOAT (52 TON BOLLARD PULL)	34X10.5X4	4	WORKING
41	ALWAHDA	TUG BOAT (32 TON BOLLARD PULL)	32.5X9.60X4	4	WORKING & NEED REPIAR
42	DAWOODIAH	TUG BOAT (55 TON BOLLARD PULL)	36X11X4.50	4.5	WORKING
43	WASILIAH	TUG BOAT (55 TON BOLLARD PULL)	36X11X4.50	4.5	WORKING
44	SALIHIAH	TUG BOAT (55 TON BOLLARD PULL)	36X11X4.50	4.5	WORKING
45	SINDBAD	TUG BOAT (40 TON BOLLARD PULL)	36X11X4	4.60	WORKING
46	ALMUTHANA	TUG BOAT (55 TON BOLLARD PULL)	36X12X5	5.5	UNDER SHIPPING
47	WASIT	TUG BOAT (55 TON BOLLARD PULL)	36X12X5	5.5	UNDER SHIPPING
48	SAMARA	TUG BOAT (55 TON BOLLARD PULL)	36X12X5	5.5	UNDER SHIPPING

Source: Prepared by the JICA Study Team based on available GCPI data

Table 2.3-6 Objective Work Vessels and Service Boats Data (Other Vessels)

OTHER VESSELS					
#	Vessel type and name	Particular type and capacity (M3)	Dimensions (LxBxD) (m)	Max. draft at berth (m)	Remarks
49	ALSHOROOK	PILOT SHIP	57X10.5X3.4	3.4	WORKING & NEED REPIAR
50	SHAMAS	CARGO			WORKING & NEED REPIAR
51	ALSEEBA	TANKER	60X11X4	4.4	WORKING
52	SEEBA-1	OIL POLLUTION PREVENT ION BOAT			WORKING
53	SEEBA-2	OIL POLLUTION PREVENT ION BOAT			WORKING

Source: Prepared by the JICA Study Team based on available GCPI data

In addition to the above-listed work vessels, the following dredgers have already been purchased or under a purchase plan:

1) TSHD 6,000 m^3 class: 3 ships (already purchased and some are operational)

2) GHD 1,500~2,000 m^3: 1 ship (under future plan)

Further, a 2,000 t lifting capacity floating crane with flat verges is currently being operated by the Salvage Department of GCPI, although these fleets are excluded from the list of the objective vessels.

(2) Present Status of Work Vessels and Service Boats Operation

Since no designated service berths are available in the ports controlled by GCPI, any vacant commercial cargo berth is being used as a service berth without a well-scheduled plan when the work vessels require crew change, spare parts and consumable loading, minor repairs, bunkering and other preparatory works necessary for the work vessels operation.

Under the above situation, the main work vessels and service boats are currently managed and operated by concerned departments of GCPI in the following manner:

1) Dredgers

Total of 14 dredgers are to be operated, including one dredger under construction, by the Dredging Department.

-The typical working shift of dredgers is ten days on/ four days off pattern, and average working days and hours are 240 days/year and 9-10 h/day, respectively.
-Fuel bunkering is either at berth transported by truck tankers or by using a tanker at the working sites.
-Crew change and other services to be rendered are being done at available berths.

2) Survey boats

Total of four survey boats are working or under construction and managed by the Survey Department.

-Mainly working for the dredging works, and typical working days per year of each survey boat are 250 days.

3) Tugboats

Total number of tugboat at present is 23.

-Managed and operated by the Marine Department.
-Average working days of tugboats are 240 days/year, without any fixed working hours as 24 h on duty or stand-by.

4) Other work vessels or service boats

A floating crane (2,000 t) and related boats/barges belong to the Salvage Department, and other service boats such as mooring boats, tankers, and buoy tendering boats belong to either the Marine Department or other departments depending on their use. The typical working day is 240~250 days/year, but no fixed working hours except for working together with other work vessels.

(3) Objective Work Vessels and Service Boats

Considering the abovementioned conditions and status of the work vessels and service boats operated by GCPI, the following work vessels and service boats shown in Table 2.3-7 have been considered in the Study**.**

Table 2.3-7 Objective Work Vessels and Service Boats

Category and Type		Nrs.	LOA (m)	Breadth (m)	Depth (m)	Draft (m)	Remarks
1 Dredger							
TSHD (1)	8,000m^3	1	132.4	22.0	9.2	8.2	
TSHD (2)	6,000m^3	3	114	19.2	7.3	6.6	
TSHD (3)	3,500-4,500m^3	5	90-100	16.0-17.0	7.4-8.9	5.5-6.0	2 nrs. Under repair
TSHD (4)	less 3,000m^3	1	less 90	15.0	6.0	less 5.5	
CSD	750-1,500m^3/hr	3	46-70	7.0-14.0	2.5-4.0	1.5-3.0	1 nr. Under repair
GHD (1)	2,000 m^3 class	1	100-120	18.0-20.0	8.0-9.0	6.0-7.0	Future plan
GHD (2)	500 m^3	1	57	12.5	4.9	3.9	
Sub-total		**15**					Total TSHD: 10 nrs. (+ 1 GHD planned) Smaller Dredgers (CSD, GHD (2): 4 nrs.
2 Survey Boat		4	10.0-25.0	3.0-6.8	1.5-4.0	1.0-3.0	1 nr. Under building
Sub-total		**4**					(Dredger Berth area be used)
3 Tug-boat							
	50-55t bollard pull	10	34.0-36.0	10.5-12.0	4.0-5.5	3.5-5.0	
	25-40t bollard pull	13	30.0-41.0	9.5-11.2	3.7-4.6	3.0-4.0	
Sub-total		**23**					
4 Other Service Boat							
	Mooring boat	9	10.0-12.0	3.0-6.0	1.0-1.8	0.75-1.5	
	Others	6	50.0-60.0	10.0-15.0	3.4-4.5	3.0-4.0	Lighting boat, tanker, Ro/Ro ship
Sub-total		**15**					(-6.0m, L=180~200m x 1 berth)
5 Floating Crane & Barge							
	2,000t lifting	1					Not considered.
	Flat barge	2					

Source: Prepared by the JICA Study Team based on available GCPI data

CHAPTER 3

Chapter 3. Service Berth Location Study

3.1 Description of the Examined Locations

As possible candidate sites for the service berth location, the following three sites were initially proposed based on the requirements and recommendations of the concerned departments:

Site-1: UQP North, between Berth No.9 and No.10, with available site length of approximately 930 m, as Option-1.

Site-2: Midpoint between UQP and LPG Terminal along Khawr Al Zubayr Channel, as Option-2.

Site-3: Hijam Island, northeastern side facing UQP (River-1) as Option-3.

During the course of the Study, however, the following two options have been further discussed and examined, under an idea that it might be appropriate and advantageous for its utilization to divide the service berth into two locations, one for dredgers and the other for tugboats and other relatively small service boats, as these target ships/boats range considerably in sizes and working conditions:

Option-4: An alternative of Option-1, in which a part of the service berth complex (dredgers berth part) is shifted to opposite side of UQP North.

Option-5: Further alternative of Option-4, by moving the dredgers berth to the location of Option-2. (Tugboats berth remains the same as with Option-4)

Brief conditions of the above sites are described as follows:

(1) Option-1 (Site-1)

Site-1 is recommended by the Project Department as this location will have the following advantages;

- This area is not fully developed yet due to the anticipated severe sedimentation at the entrance of the River-1 (UQP North), thus it is possible to make use of this idling area.
- Further, a private terminal operator (Aloreen) plans to construct a 200m long berth for GCPI use, at the location adjacent to Berth No.10, and therefore this berth can be utilized as a part of the service berth, through which the total project cost may be reduced.

(2) Option-2 (Site-2)

Site-2 is suggested by the Dredging Department. Although this area is not within the existing UQP area, it was recently used as dredged material disposal site in the previous Port Sector Rehabilitation Project (IQ-P1). Therefore, an access to the site is possible by rehabilitating the existing road and constructing a new connecting way to the site. It is however necessary to conduct further survey and investigate the topographic and soil conditions of the area since no data on the natural conditions are available.

(3) Option-3 (Site-3)

Site-3 is a recommendation of the Marine Department with an idea to make use of Hijam Island, which has a very good potential in the future being located between UQP and the planned Al Faw Grand Port. It is however noticed that at present land access is possible from neither Al Faw side nor UQP side.

(4) Option-4

A modified plan of Option-1 by shifting Dredgers berth to the north corner of the River-1. This plan will have the following advantages and improvement of Option-1:

- By locating the dredgers berth at a deeper area, no maintenance dredging is required for the service berth operation.
- It will not cause ship traffic congestion issues, which might be seriously affected when Option-1 is selected.

On the other hand, the following disadvantageous conditions of this site should be noted:

- At the location planned for the dredgers berth, there exists an office building used by the Coastal Guard whose available area is limited.
- Further, this area may overlap with the planned future commercial port development zones, if this area is fully developed.
- As this site is facing the Khor Al Zubayr channel directly, strong river flows may cause serious impact to the dredgers berthing, de-berthing and mooring activities.

(5) Option-5 (Combination of Option-1 and Option-2)

This option is a combination of Site-1 and Site-2, thus both site conditions are to be considered.

As a summary of the above discussions, the following five options shown in Table 3.1-1 have been finally examined, and the locations of the respective options are indicated in

Figure **3.1-1**.

Table 3.1-1 Examined Locations for the Service Berth

Option No.	Description of Location	Remarks
OPTION-1	UQP North, Between Berth No.9 and No.10	200m berth is to be built by Aloreen.
OPTION-2	Along Khawr Al Zubayr Channel (between UQP and LPG Terminal)	New connecting access is needed.
OPTION-3	Hijam Island, in front of UQP	No land access is available.
OPTION-4	Dredger berth on River-1 North-side Entrance Tug berth at UQP North (Option-1 location)	Service berth is divided into two locations.
OPTION-5	Dredger berth at Option-2 location Tug berth: same location with Option-4	Ditto, but Dredger Berth location is changed.

Source: Study Team

Source: JICA Study Team

Figure 3.1-1 Location of Options

3.2 Examination of Location Options

(1) Examination Conditions

The following facility arrangements are tentatively applied to examine the layout plans of the options;

a. Service berth: Piled RC structure, design water depth -9.0 ~ -10.0 m

Total length of 650 m berth is to be provided, which is composed of

- 300 m for dredgers, 200 m for tugboats, and 150 m of bunkering berth.

b. Small boat basin:

For other small boats mooring, a minimum length of 200 m and 60 m wide water area with a water depth of -3.0 m is to be provided.

c. Buildings:

The following buildings are to be provided:

- Administration office: two- to three-storey RC building, 30 x 40 m

(two storey building is applied for Options 1, 4 and 5; three-storey for Options 2 and 3)

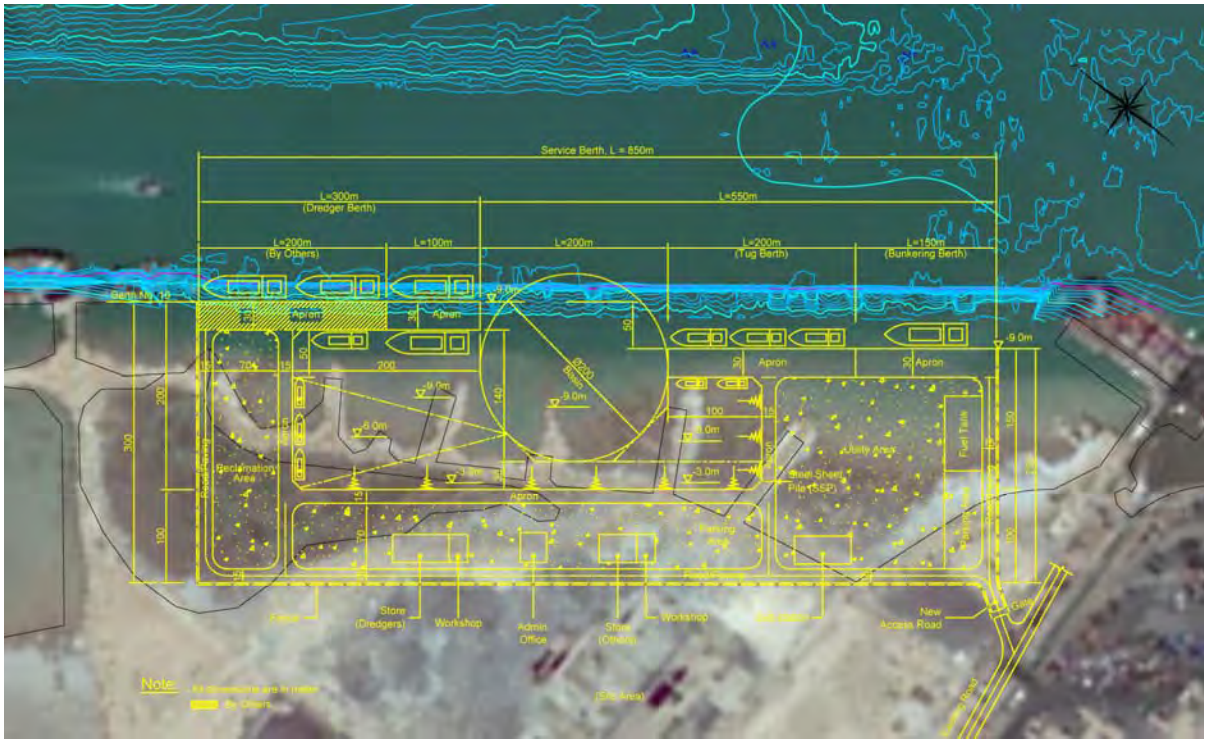
- Warehouse for spare parts: 30 x 60 m for dredgers, 30 x 40 m for other service boats.
- Workshop: 30 x 20 m wide steel-framed construction x two sets: one for dredgers and one for other service boats.

d. Utilities: Water supply system and power supply facilities will be considered where necessary.

e. Other facilities: Access road, gate and fencing are to be provided according to the respective site conditions.

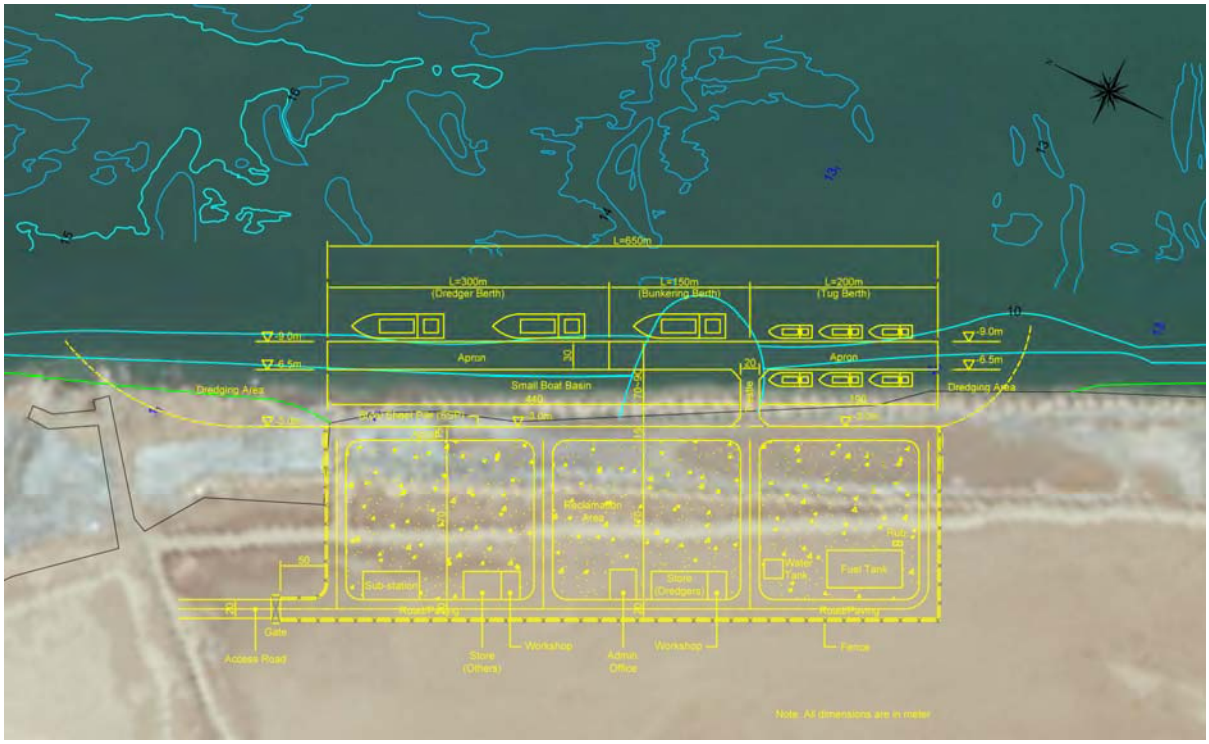
(2) Layout Plan of Each Option

The layout plans of the Service Berth for each option prepared based on the abovementioned conditions are shown in Figure 3.2-1 to Figure 3.2-6.



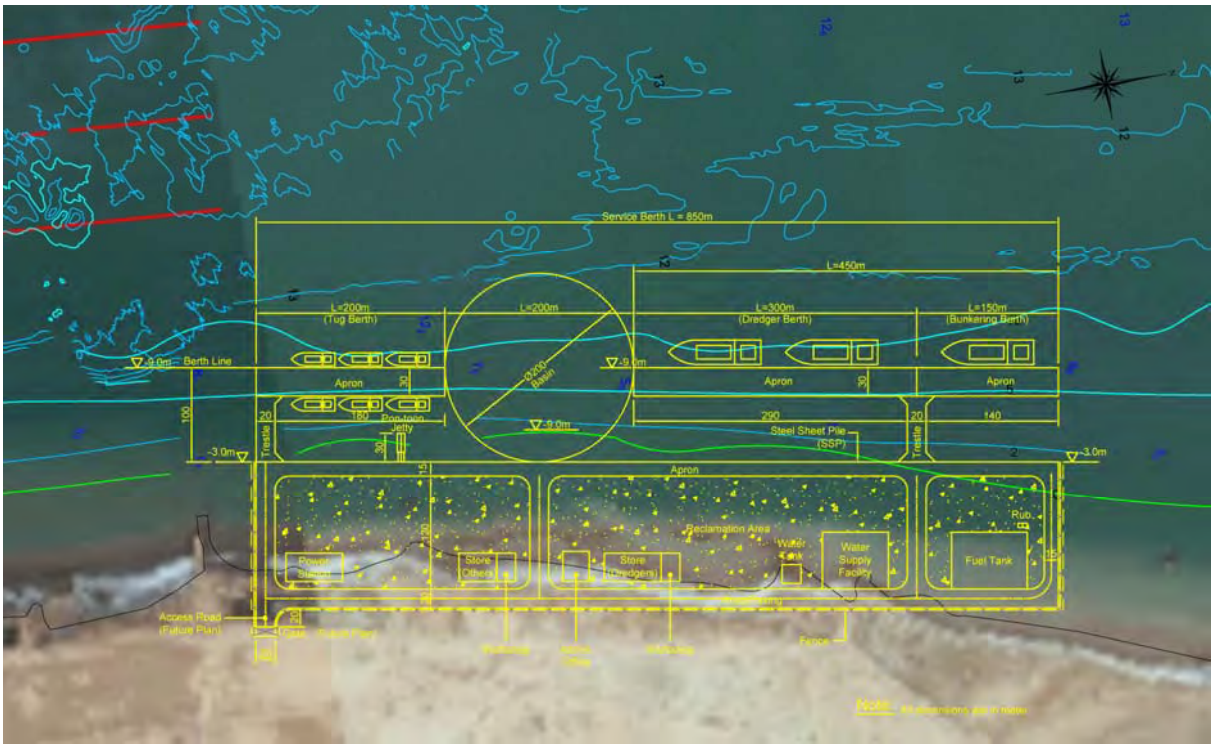
Source: JICA Study Team

Figure 3.2-1 Option-1



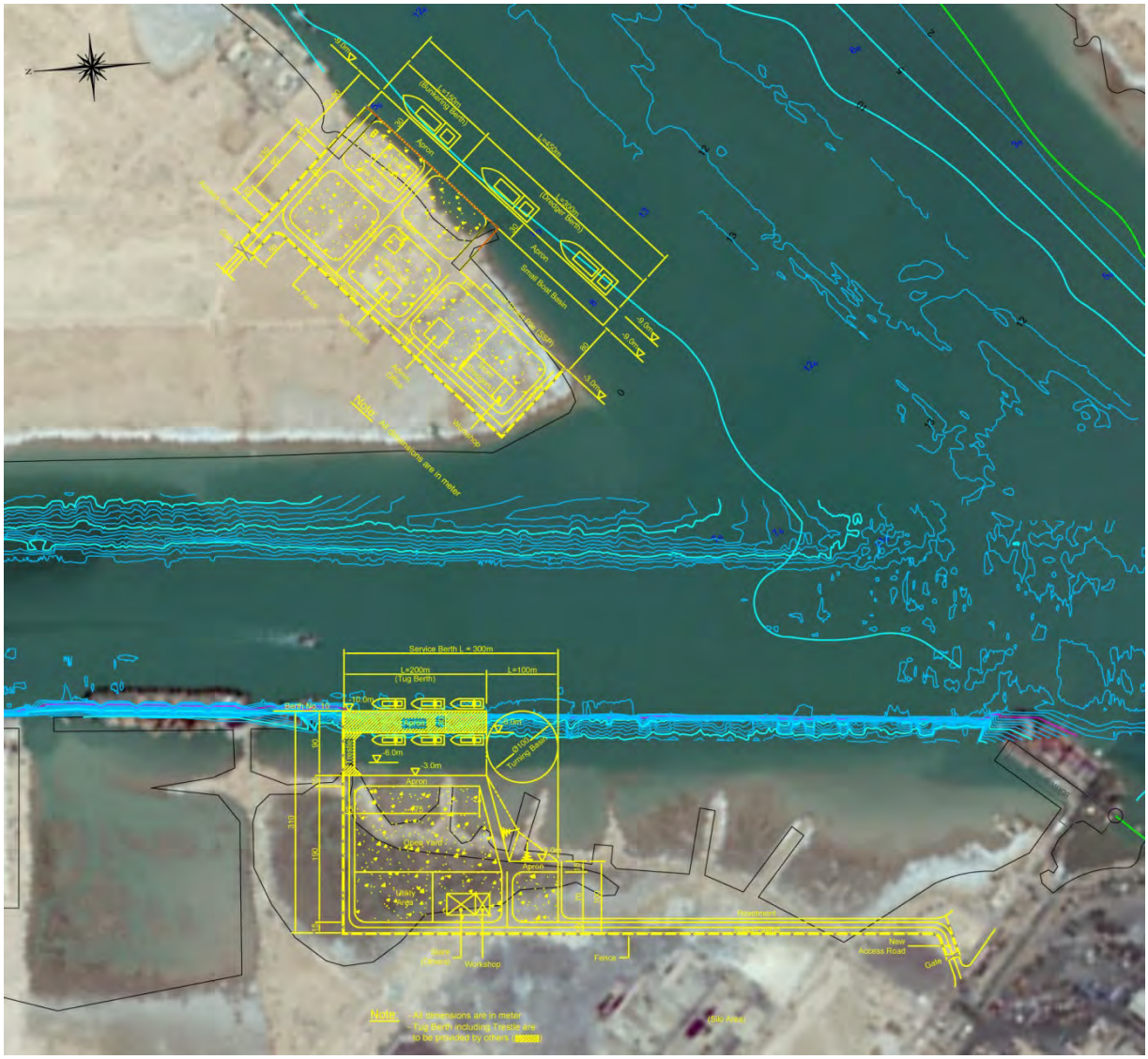
Source: JICA Study Team

Figure 3.2-2 Option-2



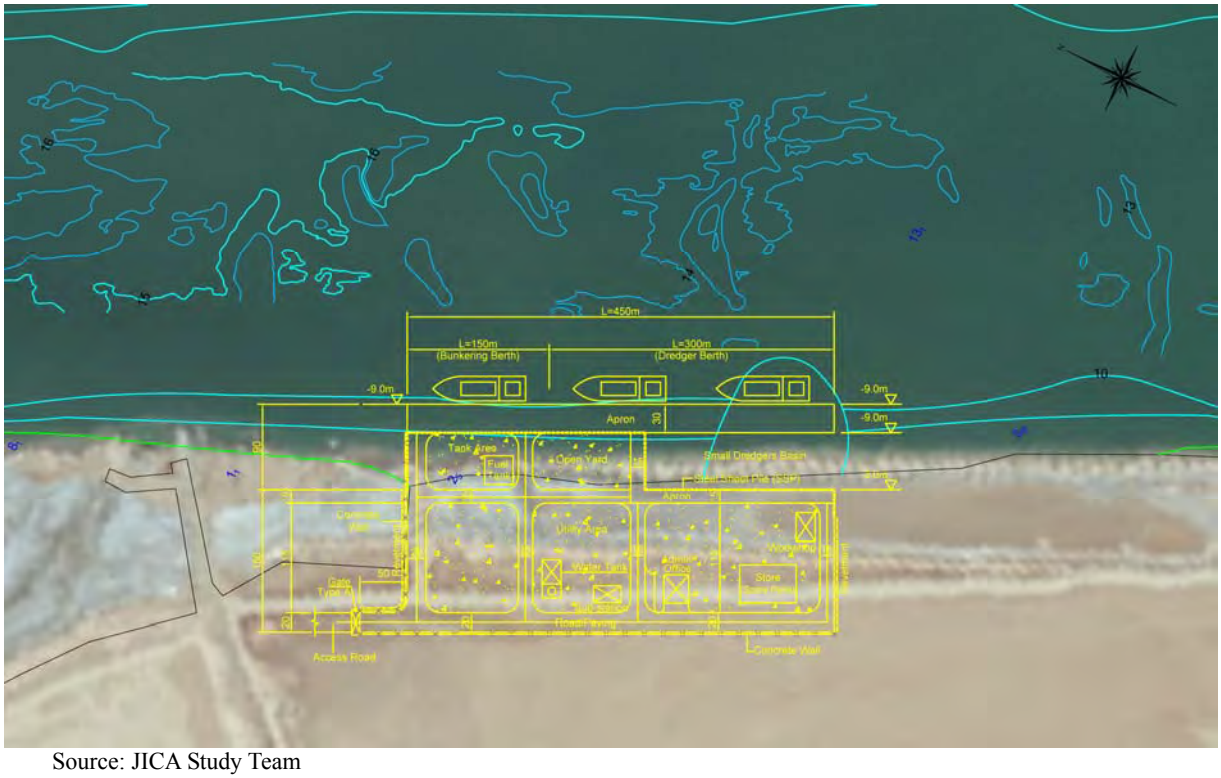
Source: JICA Study Team

Figure 3.2-3 Option-3



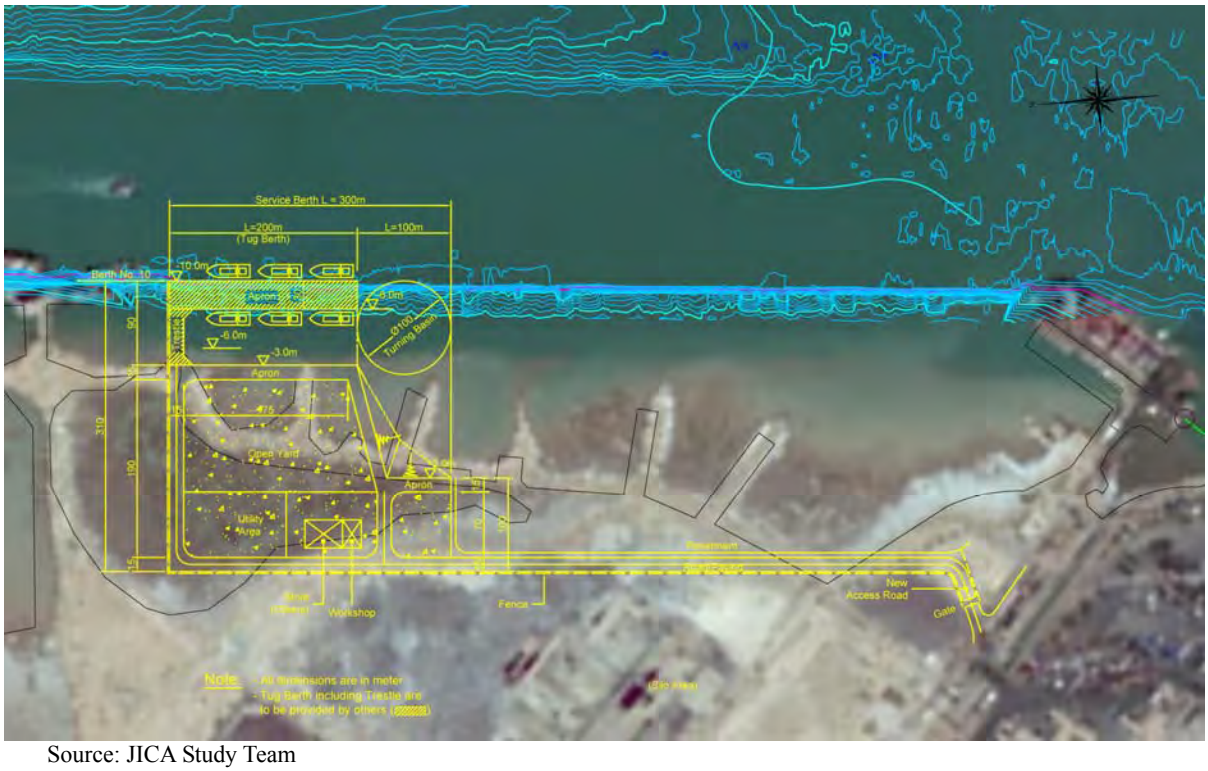
Source: JICA Study Team

Figure 3.2-4 Option-4



Source: JICA Study Team

Figure 3.2-5 Option 5 (Part 1) : Service Berth for Dredgers



Source: JICA Study Team

Figure 3.2-6 Option 5 (Part 2): Service Berth for Tugboats

(3) Construction Cost Comparison

A preliminary cost estimate for each option has been made for relative cost comparison purpose only, using a relative index based on the following conditions;

- Cost estimates include direct construction cost only.
- Exchange rate: USD 1 = JPY 120.
- Base cost is Option-1 as its Index = 1.00

Table 3.2-1 Construction Cost Comparison

Options	Option-1	Option-2	Option-3	Option-4	Option-5
Cost Index	1.00	1.04	1.28	0.98	1.02

Source: Estimation of JICA Study Team

3.3 Selection of the Service Berth Location

Among the examined five options for the service berth location, Option-5 was selected as appropriate under the following reasons, as summarized in Table 3.3-1;

- Due to different functions and sizes of the respective work vessels, separated locations, one for dredgers (including Survey boats) and the other for other service boats which may require relatively shallower water depth, are convenient in terms of usage and economy.
- Although the construction cost of Option-5 may not be least, no significant difference in the cost estimates is found when compared with Options-1 and Option-4.
- Option-1 and Option-4 may have the following disadvantages, by which their operation costs may be increased compared with Option-5:
  - For Option-1, continued maintenance dredging is necessary due to serious sedimentation, and safety risks or inefficient use of dredgers are anticipated due to ship traffic congestion as the location is at the entrance of UQP North.
  - Option-4 has a very limited available area, and there is uncertainty for future use as GCPI plans to develop this area for private sector investment purpose. Further, this location may suffer from strong river flow during the handling of dredgers in which the operational efficiency may be decreased.

Table 3.3-1 Evaluation of Each Option

Option	Option-1	Option-2	Option-3	Option-4	Option-5
Comparison -Cost Index -Issues & disadvantage anticipated	1.00 -Heavy sedimentation	1.04 -Outside of UQP -Long access and connection	1.28 -Isolated -No land access possible	0.98 -Strong flow -Area limitation	1.02 -Similar issues with Option-2 for dredgers berth.
Evaluation	Not recommended	Not recommended	Not recommended	Not recommended	**Recommended**

Source: JICA Study Team

CHAPTER 4

Chapter 4. Scope of the Project

4.1 Requested Facilities for the Service Berth

The following facilities are requested from the concerned departments of GCPI to be provided under the Project:

- Service berth for dredgers: 5~6 dredgers berthing at the same time;
- Service berth for tugboats and other relatively small service boats;
- Administration building with capacity of approximately 50 persons;
- Workshop;
- Warehouse for spare parts;
- Utilities, such as power supply, water supply, and sewerage, as necessary; and
- Equipment such as quay crane (or mobile crane), forklift, and truck/trailer.

4.2 Conceptual Plan of Main Facilities

With due consideration of the abovementioned requirements of GCPI and functions/ship specifications, the conceptual plans of the main facilities for service berths are carried out.

4.2.1 Berth Arrangement

(1) Service Berth for Dredgers

1) Berth Length

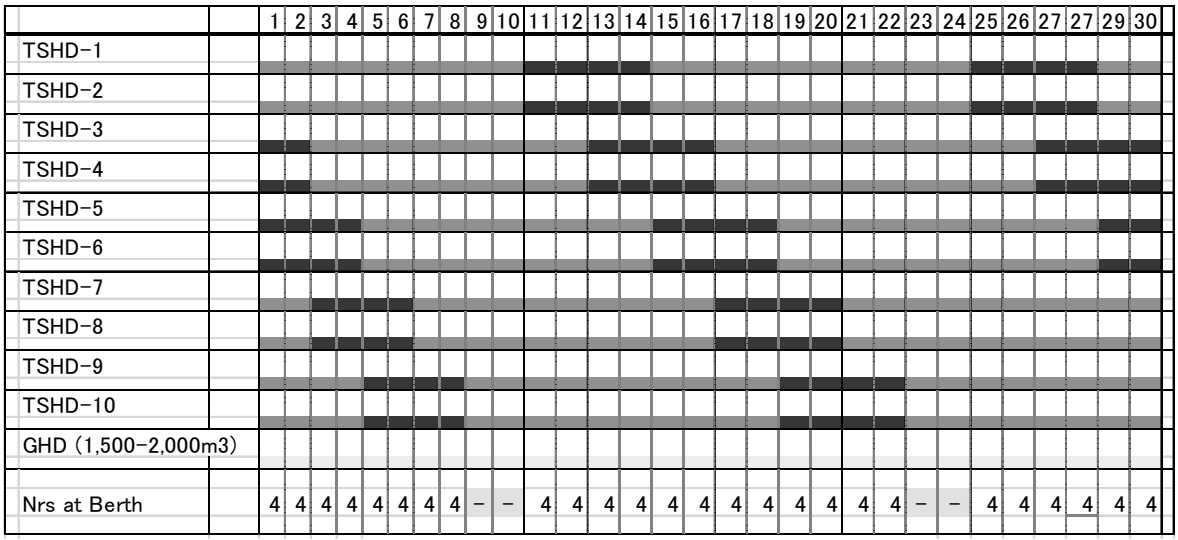
The total number of dredgers to be considered is 15 including future procurement plan (one dredger), and considering that the maximum length is 132.4 m long (TSHD 8,000 m3) as shown in Table 2.3-7. Further, about 1/3 of the total 15 dredgers exceed 100 m in length, and the average LOA of all dredgers is around 100 m. This means that the minimum size of 150 m is required in case of one berth, and 100~120 m per berth for continuous case.

Considering the typical work shift of each dredger, which is a two-week pattern (10 days working and 4 days off) according to the Dredging Department, the necessary number of berth will be around four as explained in Figure 4.2-1. (This also explained the requested berth numbers of 5~6, when 1~2 dredgers are considered under repair at stand-by).

Further, it is recommended that a bunkering berth is to be provided for exclusive use for the effective use of service berth, with a length of 150 m.

From the above, the necessary berth length is estimated as follows:

- Use front side to accommodate 4 dredgers: 110 x 4= 440 m (say 450 m)
- 150 m of total berth length (450 m) can be used as Bunkering berth.
- Rear side (200 m) is also used for the dredgers under repair and/or relatively small dredgers. As a result, a total of five dredgers can be accommodated (or six dredgers, if the bunkering berth is used).



Source: JICA Study Team

Figure 4.2-1 Typical Pattern of Work Shift (Two-week pattern)

2) Berth Width and Design Water Depth

- Berth width is 30 m, considering use of its rear side.
- From the maximum draft of TSHD (8.2 m), water depth of the berth is -9.0 m.

(2) Service Berth for Tugboats and Other Service Boats

GCPI owns and operates 23 tugboats at present. The capacity of the tugboats ranges from 25 t ~ 55 t bollard pull, and LOA is between 30~41 m with max. draft between 1.5 m ~ 3.0 m.

Since the tugboats are working widely in all the ports and water areas, it is said that around 1/3 of the total tugboats which is around eight tugboats, may require to use the service berth. In order to berth eight tugboats, the required berth length should be at least:

Average LOA = 35 m x 1.2 x 8 nos. = 336 m

If both sides of the service berth are used or double parked, the planned 200 m long berth (by Aloreen) would be sufficient. It is therefore reasonable to utilize this planned berth for tugboats together with other relatively small service boats.

(3) Small boat basin

In addition to the abovementioned work vessels, GCPI operates about 20 other port service boats such as survey boats (4 nos.), mooring boats (9 nos.), tankers and other boats, excluding salvage works fleet.

These service boats are relatively small sized as LOA generally ranges between 10.0~25.0m (except tankers), and the draft is mostly less than 3.0 m.

From the above, it is recommended to provide a small boat basin for each location, with a mooring facility at a water depth of -3.0 m. In this connection, it is also recommendable that the small boat basin for survey boat is to be provided at the service berth for dredgers, and other boats basin is attached to the tug oat berth.

4.2.2 Buildings and Utilities

For both service berths, an administration office, a warehouse for spare parts, and workshop will be provided.

(1) Administration Office

In order to accommodate 50 persons in the working office as requested for Dredgers Service Berth, a total office area of 500~750 m^2 is required, assuming normal unit space per person is 10~15 m^2 (for engineer class). In addition, a management office, meeting rooms, stores, prayer room, corridor, and toilets are to be provided. Taking these into consideration, approximately 30 x 30 m x 2-storey office building is suggested. The office building will be of reinforced concrete (RC) structure.

At the tugboat service berth, no concrete office building is requested as the site is located within the UQP area, but a small control office may be provided.

(2) Warehouse and Workshop

Since the area required for the facilities is yet uncertain, the following specifications are to be used in the Study referring to other project cases:

- Warehouse
  A steel-framed RC wall structure with size of 40 x 60 m for dredgers berth and 40 x 30 m for tugboats berth.
- Workshop
  For both berths, 30 x 20 m of steel-framed RC wall construction.

(3) Power supply system

A substation (30 x 20 m) similar to the existing substation of UQP will be constructed at the dredgers berth, while the power supply to the tugboats berth will be through cabling connected to the existing power supply system of UQP.

(4) Water supply system

At the Dredgers berth area, no water supply system exists, it is therefore necessary to provide an elevated water tank and reservoir tank of 100~150 m3 capacity, with a proper pumping facility.

On the other hand, the water supply to the tugboats berth area is to be made through a new pipeline or transported by water supply trucks.

4.2.3 Bunkering Facility

It is important for work vessels to supply fuel stably and sufficiently. At present, bunkering for the work vessels is being done mostly from the landside by fuel truck tankers. Generally, work vessels like dredgers are equipped with fuel tank of sufficient capacity working for 3~4 weeks without refueling.

According to a hearing survey with the Dredging Department, the fuel type used for dredgers (and for other service boats as well) is single type diesel fuel oil, and weekly consumption is around 650 t.

It is therefore planned that two sets of 350 m3 oil tank are to be provided, with a total tank capacity of 700 m3. It should however be noted that estimated daily average consumption of fuel might be around 180 m3 (about 1,260 m3 weekly), if all the work vessels and service boats are fully operated at 8-10 hours working shift.

In addition to the fuel tanks, lubricant tanks of 6,000 L x 4 sets which is sufficient for more than one month consumption, are also provided, as generally, lubricant consumption is less than one percent of fuel consumption.

4.2.4 Other Facilities

Land preparation works, gates and fencing for security, preparation of access road and service road, and paving are also needed in order for service berths to function well.

Further, the following equipment to handle supply materials including transport to the berth are to be provided;

- Mobile crane 50 t for dredgers berth: 1 unit for loading and unloading at the berth.
- Mobile crane 15~20 t: 1 unit for each service berth mainly working at the yard.
- Fork lift: 3 t and 20 t each at each service berth location (for warehouses and workshop works)
- Truck or Trailer: 1 unit at each service berth

The conceptual design drawings prepared based on the above facilities plan are shown in APPENDIX-II.

4.3 Project Component

From the above facilities plan, the following project components for the respective service berths are recommended as necessary:

4.3.1 Service Berth for Dredgers

(1) Main Berth

- Total Length:450 m including a 150 m long bunkering berth
- Apron width: 30 m
- Water depth: -9.0 m related to CD.

  In addition, a small boat berth will be provided for relatively small dredgers and survey boats.

(2) Buildings and Utilities

- Administration building: For 50 staffs, approximately 30 m x 30 m of two-storey building.
- Warehouse for spare parts: 40 m x 60 m
- Workshop: 30 m x 20 m
- Water supply facility: Water tank and Tower
- Substation : 30 m x 15 m
- Bunkering facility: Fuel tank 350 kl x 2 nos.
- Others: sewerage facility, drainage

(3) On-land Civil Works

- Security fencing and gates
- Landfill and leveling
- Revetment
- Access road and service roads with paving

4.3.2 Service Berth for Tugboats

(1) Main Berth

- Main berth for Tugboats (to be provided by others): Min.-6.0 m, Length 200 m, width 30 m
- Small boats berth and basin with water depth of -3.0 m CD.

(2) Buildings and Utilities

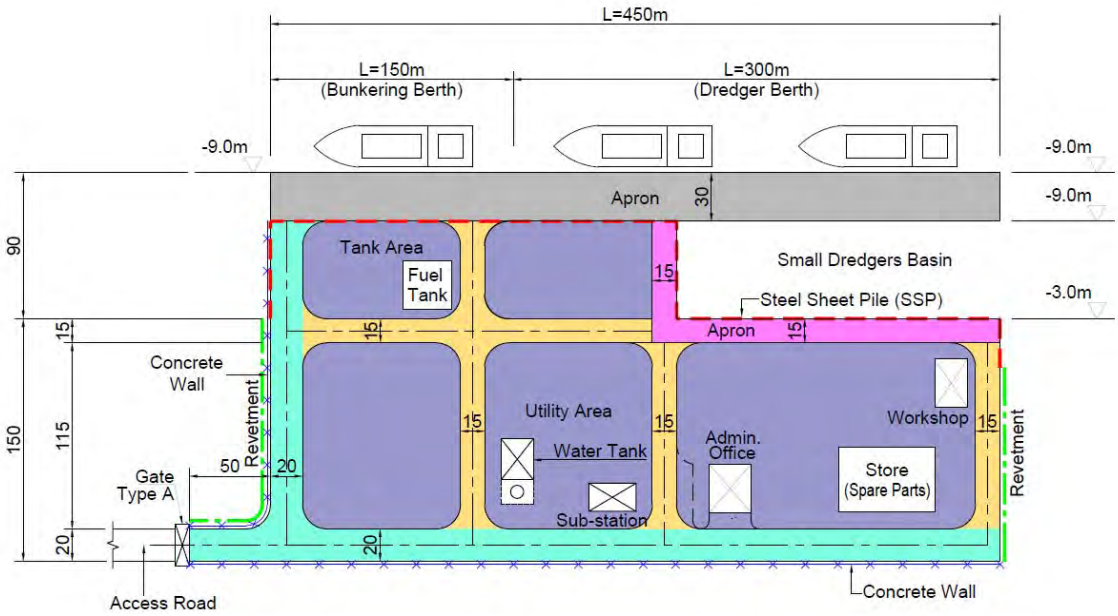
- Warehouse for spare parts: 40 m x 30 m
- Workshop: 30 m x 20 m
- Water supply system (by pipelines or water tank)
- Power supply system by cabling
- Others: Sewerage system, drainage

(3) On-land Civil Works

- Security fencing and gates
- Land preparation including land leveling and revetment
- Access road and paving

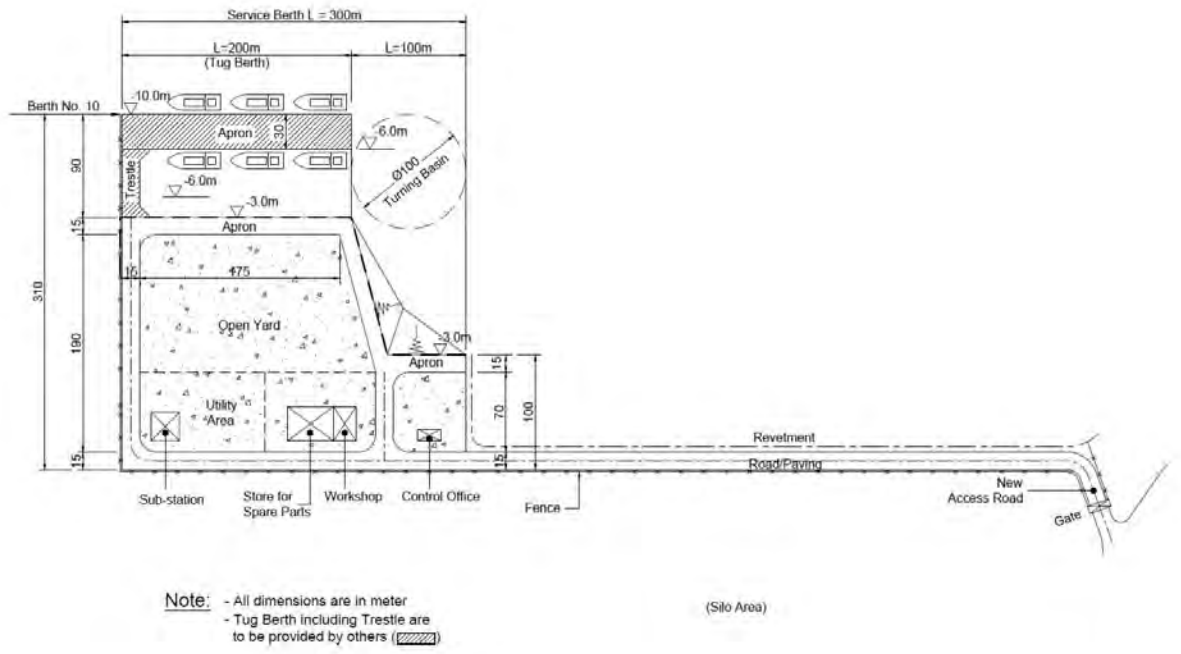
4.3.3 Layout Plan of Service Berth

According to the Project Component described in the previous section, the layout plans of the service berths are drawn as shown in Figure 4.3-1 and Figure 4.3-2.



Source: JICA Study Team

Figure 4.3-1 Layout Plan of Service Berth for Dredgers



Source: JICA Study Team

Figure 4.3-2 Layout Plan of Service Berth for Tugboats

4.4 Alternative Arrangement

In the previous sections, a preferable service berth facilities plan has been made based on the requirements of GCPI. It is however found that the estimated project cost may exceed the budget allocation under the Port Sector Rehabilitation Project (II) if this project is intended to be implemented under the said Project (II).

To this end, an alternative arrangement plan has been conducted in this section, aiming at minimizing this service berth construction project cost in order to meet the budget constraint.

4.4.1 Essential Project Component Selection

In order to minimize the project cost, the following considerations on the project components have been made:

(1) Berth Arrangement

Service berth for dredgers is only provided with a shortened length from 450 m to 250 m as initial construction under the Phase-II project, since the construction of service berth for the tugboats and other service boats depends on the contracted investor's investment plan and schedule.

It is however necessary that a mooring structure is to be provided for minimum function as service berth, and the bunkering for dredgers will be carried out through truck tankers.

(2) Building and Utilities

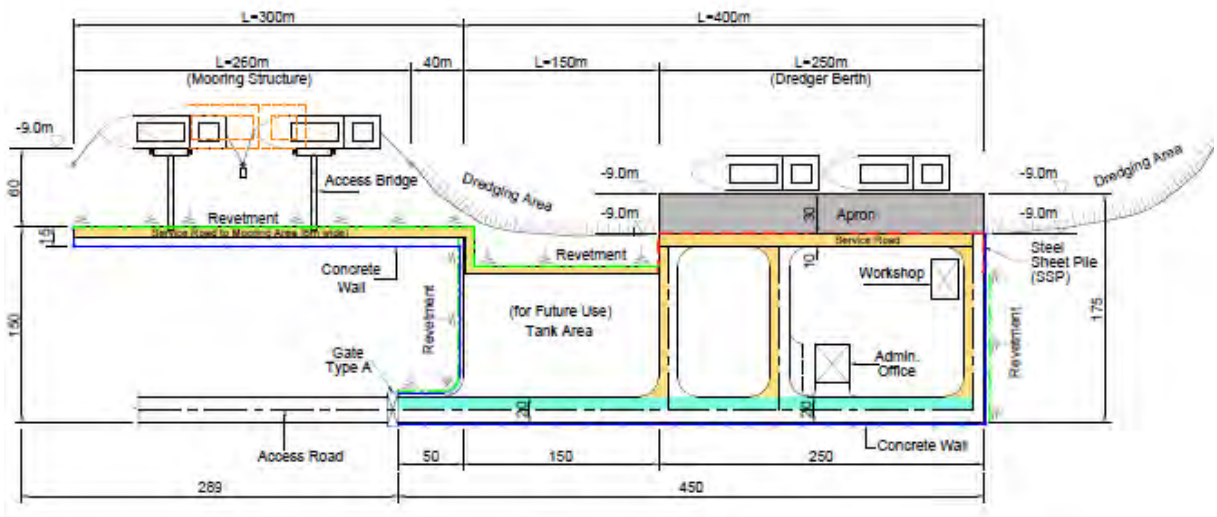
Only the administration building and Workshop building are provided since these are the most essential. Bunkering facility, water supply facility and other buildings and utilities are constructed at the later stages.

(3) On-land Civil Works

On-land civil works such as land preparation, roads, and paving can also be reduced to almost half scale according to the abovementioned facilities reduction.

4.4.2 Layout Plan of the Alternative

The minimized layout plan, as Alternative-A, is shown in Figure 4.4-1.



Source: JICA Study Team

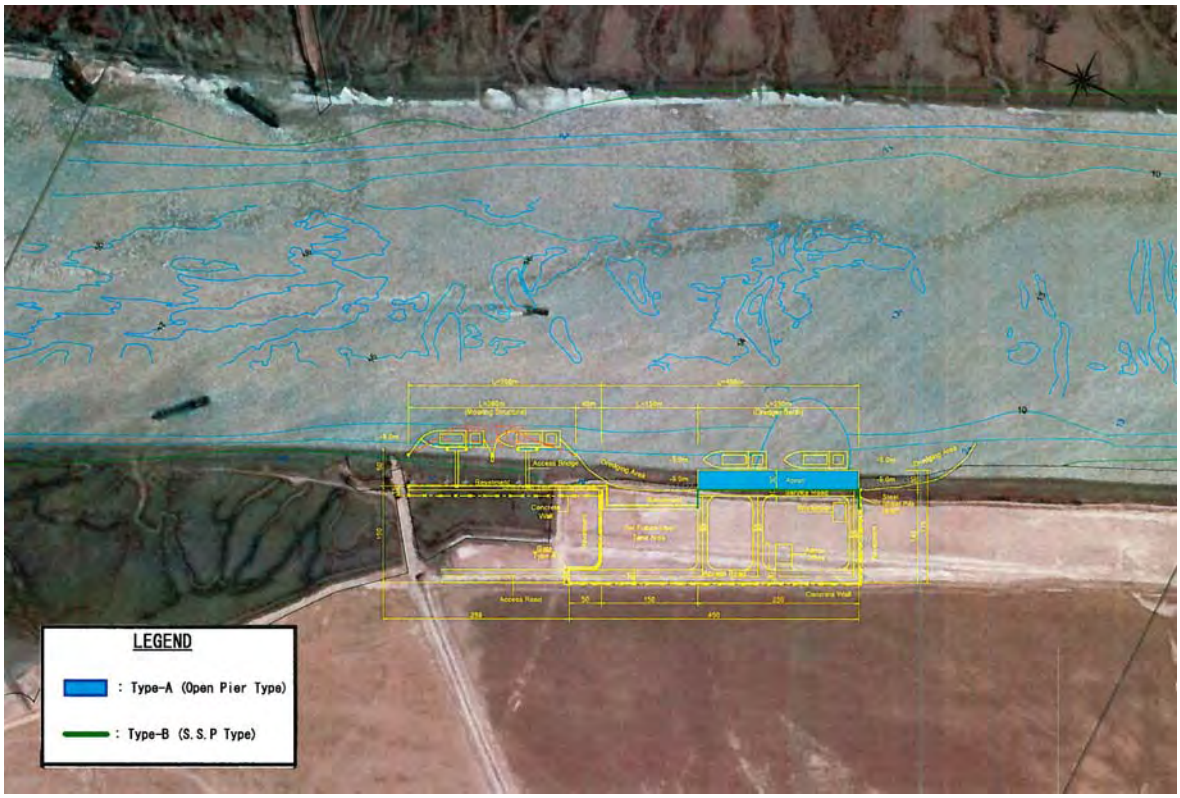
Figure 4.4-1 Layout Plan of Service Berth for Dredgers (Alternative A)

CHAPTER 5

Chapter 5. Preliminary Design

5.1 Introduction

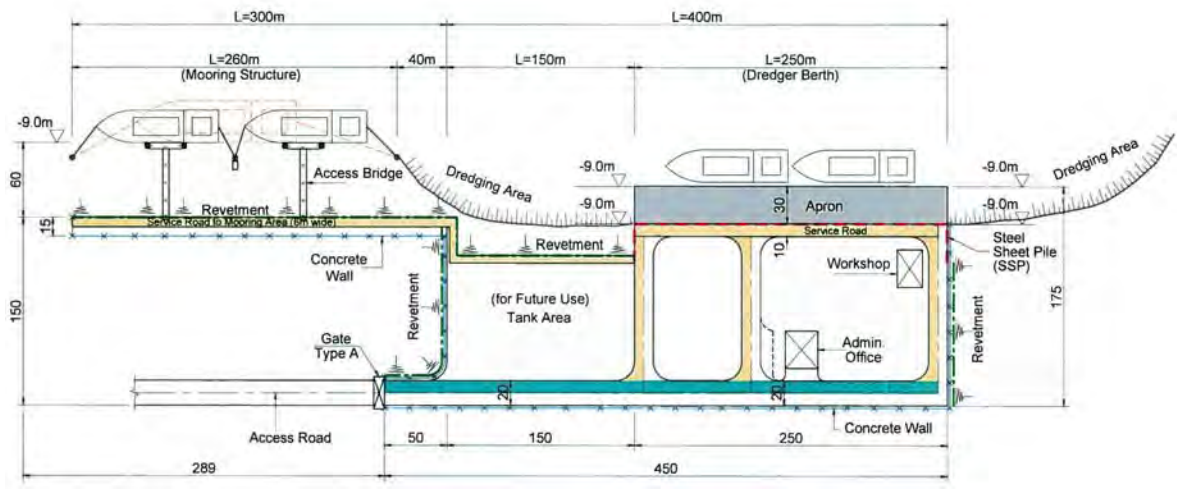
This chapter describes the preliminary designs for the service berths. The location and scope of the service berths are studied in Chapters 3 and 4, respectively. The selected alternatives for the service berths are shown in Figure 5.1-1, but the detailed arrangement of the service berths will be reviewed and modified during the Phase-2 design.



Source: JICA Study Team

Figure 5.1-1 Location of Service Berths

The service berths, providing bunkering and maintenance operations for dredgers, tugboats, and other marine vessels, are to be constructed along the Al-Zubair Channel so as to get rid of maintenance dredging and provide easy and safe access. The berth for the dredgers is 250 m in length and 30 m in width, with a 260 m long mooring structure. The small boat basin is planned at a location between the mooring structure and land area. The land area (450 m in length and 150 m in width, 6.8 ha) will provide aprons (30 m in width), an administration building, a substation, a store for dredgers, workshop, and water tank. The depth of water provided for the dredger will be -9.0 m related to the draft requirements of the intended ships. The layout plan of the service berths is shown in Figure 5.1-2.



Source: JICA Study Team

Figure 5.1-2 Layout Plan of Service Berths

5.2 Design Criteria

The design criteria are determined for the purpose of executing the preliminary design works for the Project. In the process of determining the design criteria, the primary design criteria proposed by the previous studies are reviewed. Based on the collected data and information, the study on such design code of practice such as the Japanese Standards (e.g., "Technical Standards and Commentaries for Port and Harbour Facilities in Japan" by OCDI, 2009), natural conditions such as meteorological, oceanographic, and subsoil conditions, and usage conditions are interpreted to produce key and common parameters intended for the design of port facility components of the Project.

5.2.1 Natural Conditions

(1) Tides

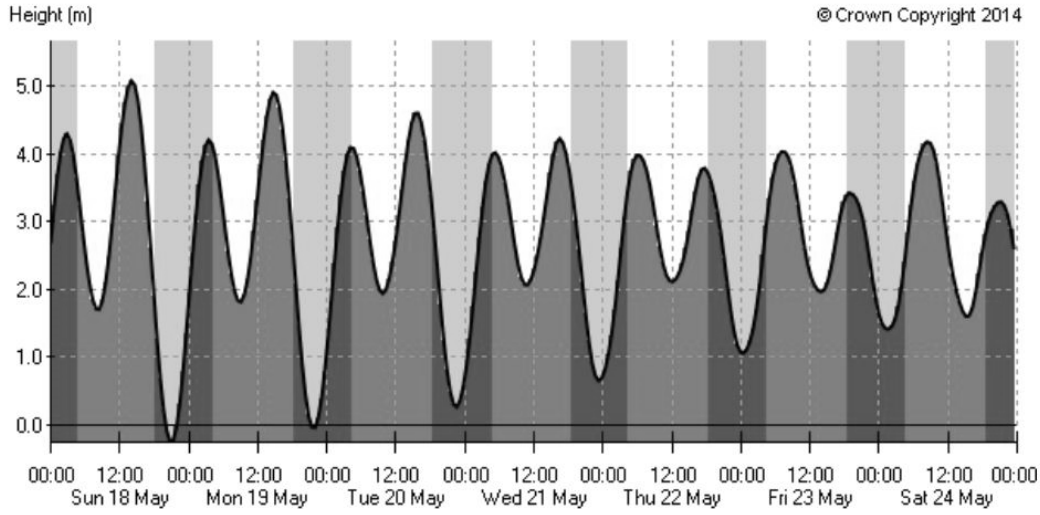
Based on the following tidal table in 2013 published by GCPI, the flood and ebb tide at four points including Umm Qasr are described.

Table 5.2-1 Monthly Highest and Lowest Tide in 2013

	Shatt al-Arab (Outer Bar)		Umm Qasr		Al Faw		Al Maqil	
	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
January	3.2	-0.4	5.1	-0.3	3.3	0.2	2.0	0.5
February	3.1	-0.2	5.2	-0.2	3.1	0.3	1.9	0.6
March	3.3	0.1	5.2	0.2	3.4	0.4	2.6	0.9
April	3.4	0.0	5.1	0.1	3.6	0.5	3.0	1.4
May	3.5	-0.1	5.2	-0.1	3.7	0.5	3.1	1.7
June	3.5	-0.2	5.4	-0.1	3.4	0.4	2.9	1.5
July	3.4	-0.1	5.4	-0.1	3.6	0.4	2.5	1.1
August	3.3	0.1	5.4	0.1	3.4	0.5	2.1	0.7
September	3.3	0.3	5.3	0.4	3.4	0.6	1.9	0.6
October	3.3	0.2	5.2	0.2	3.4	0.5	1.9	0.5
November	3.3	0.0	5.1	0.1	3.5	0.3	2.0	0.5
December	3.1	-0.3	5.2	-0.1	3.5	0.3	2.1	0.4
Year 2013	**3.5**	**-0.4**	**5.4**	**-0.3**	**3.7**	**0.2**	**3.1**	**0.4**

Source: Tide Table in 2013, GCPI

The highest tide and lowest tide in Umm Qasr in 2013 were +5.4 m and -0.3 m, respectively. Based on the "Preliminary Studies of Um Qasr Container Terminal (1971)", it is reported that tide levels show about 15 cm variations associated with prolonged northwest winds for lower levels and southeast winds for higher levels. Moreover, in 2006, the lowest tide recorded was -1.0 m. The consultant from England applied +5.5 m for HHWL and -0.50 m for LLWL as the design conditions in Umm Qasr Port, therefore, these existing tide standards are applied as the preliminary design condition of the Project. The following graph shows the estimation of tidal variation in one week. The tide in Umm Qasr is semi-diurnal (two high tides and two low tides each day) as follows:



Source: Hydrographic Office, Admiralty Easytide, UK

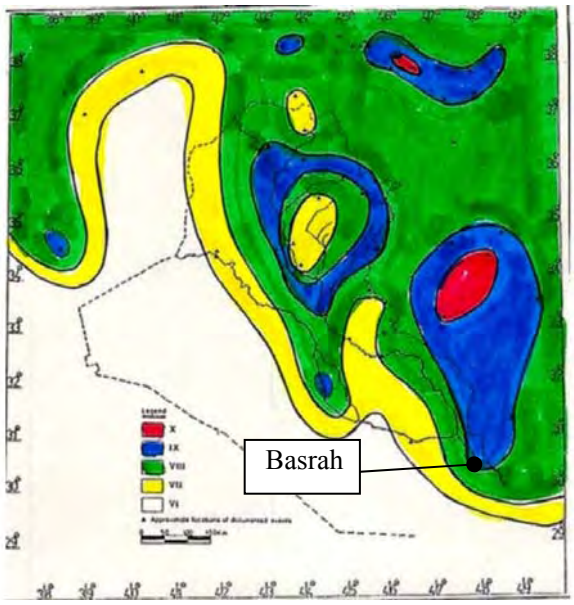
Figure 5.2-1 Estimation of Tidal Variation (18 May 2014 to 24 May 2014) in Umm Qasr

(2) Waves

Based on the "Preliminary Studies of Um Qasr Container Terminal (1971)", it is reported that the maximum wave height observed in Umm Qasr was about 0.7 m.

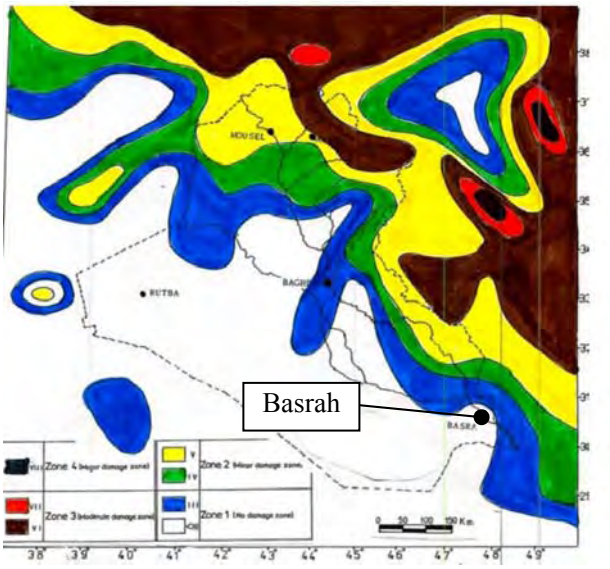
(3) Design Seismic Coefficient

The following Figure 5.2-2 shows the historical seismic iso-intensity map from 1,260 B.C. to 1,900 A.D. Figure 5.2-3 shows the seismic iso-intensity map, while Figure 5.2-4 shows the geological hazard map of earthquake.



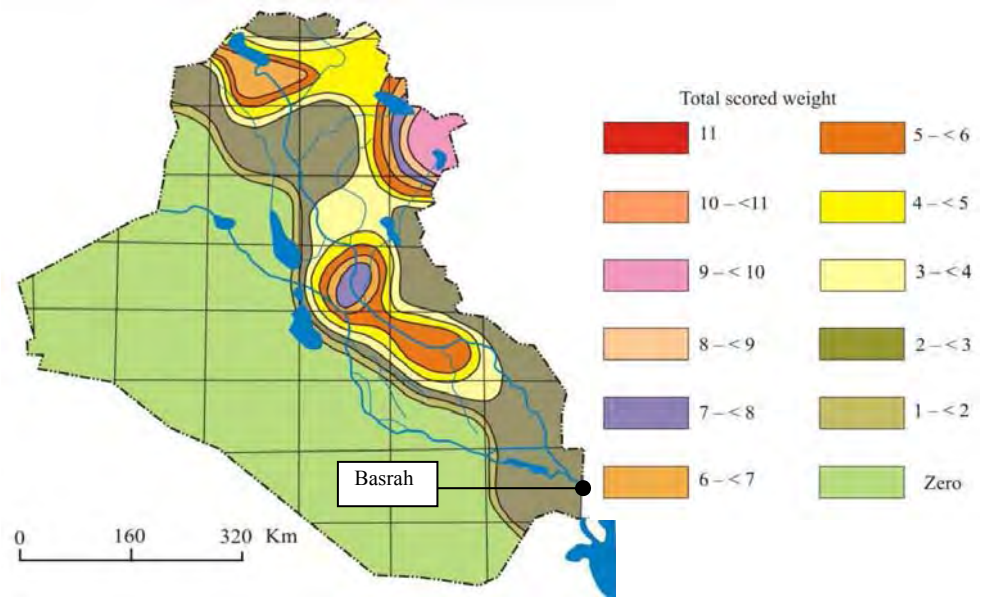
Source: Earthquake Hazards Considerations for Iraq, Fourth International Conference of Earthquake Engineering and Seismology, 2003

Figure 5.2-2 Historical Seismic Iso-intensity Map (1260 B.C.-1900 A.D., 165 events)



Source: Earthquake Hazards Considerations for Iraq, Fourth International Conference of Earthquake Engineering and Seismology, 2003

Figure 5.2-3 Seismic Iso-intensity Map (1900-1988, Zone 1-4)



Source: Classification and Geographical Distribution, Iraqi Bulletin of Geology and Mining, Vol. 7, No. 1, 2011

Figure 5.2-4 Geological Hazard Map of Earthquake

Seismic intensity of Basrah area based on the historical seismic iso-intensity map from 1260 B.C. to 1900 A.D. with 165 events is medium level. And the seismic intensity based on the iso-intensity map from 1988 to 1900 is the lowest (no damage zone) in the four zones. Moreover, the Basrah area is under low level 3 zone among the 12 zones based on the geographical hazard map of earthquake (2011).

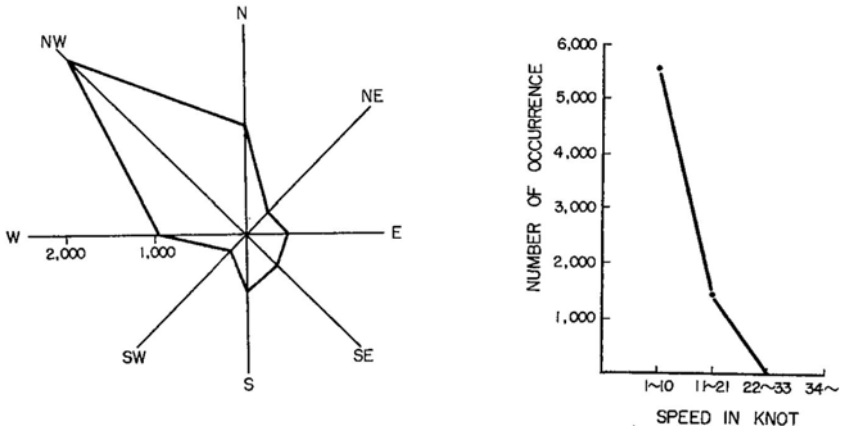
Based on the above information, the design seismic coefficient is determined as follows:

- Horizontal Design Coefficient kh=0.05 g
- Vertical Design Coefficient kv=0.00 g

(4) Wind Velocity

Majority of winds come from the northwest direction as shown in the wind rose figure below. Wind speed with less than 10 kt is the majority in terms of number of occurrence as shown in Source: Preliminary Studies of Um Qasr Container Terminal (1971), PCKK

Figure 5.2-5. The maximum wind speed which occurred on the same period was 34 kt, which has been taken as the wind speed for the design.



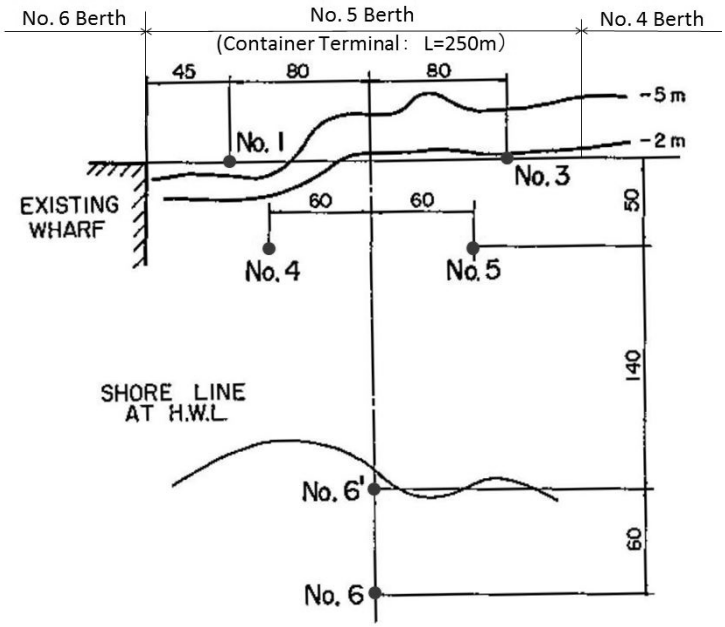
Note: Based on the data taken four times a day in Basrah from 1966 to 1970

Source: Preliminary Studies of Um Qasr Container Terminal (1971), PCKK

Figure 5.2-5 Wind Rose and Wind Velocity in Basrah

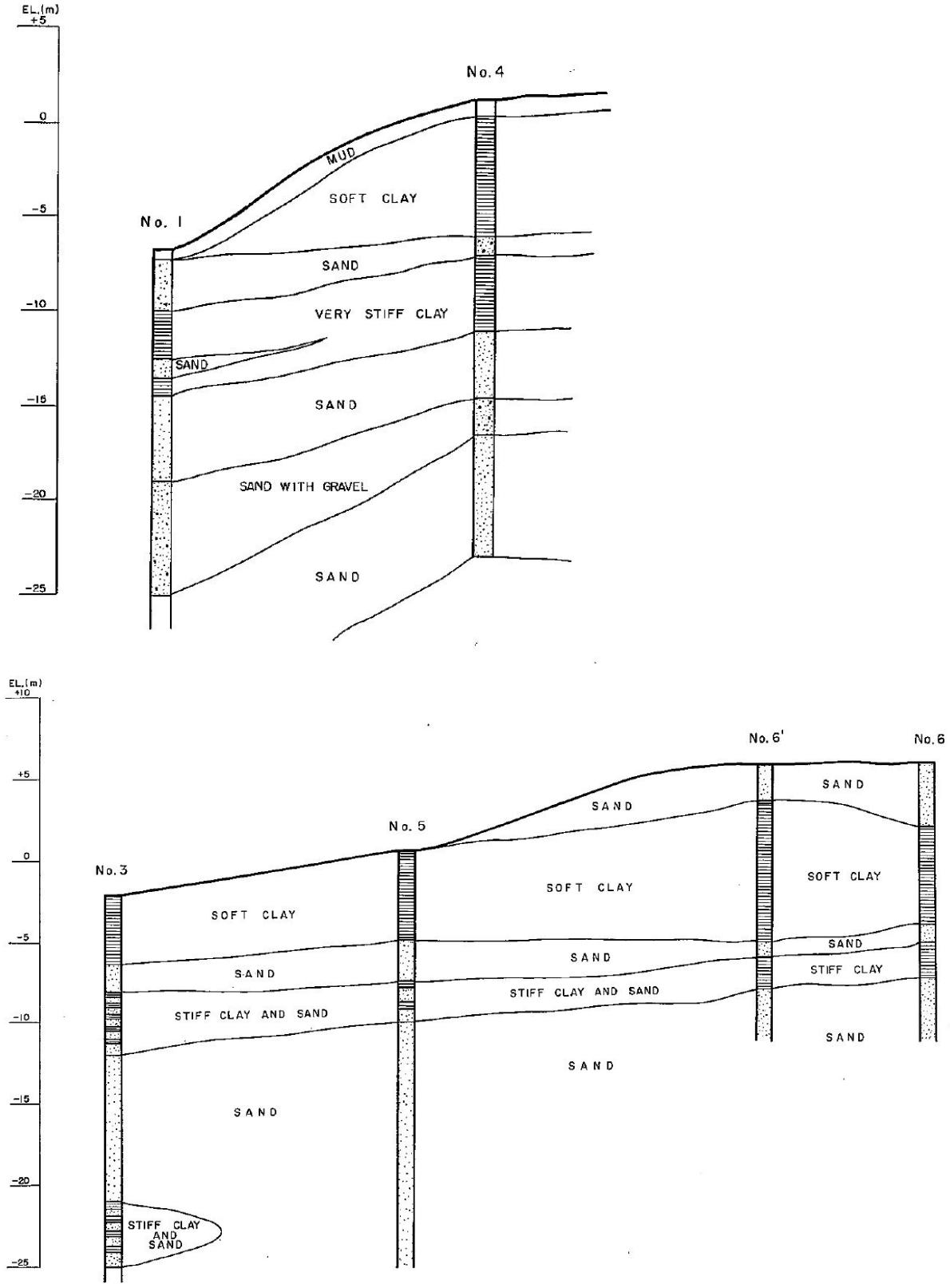
(5) Subsoil Conditions

According to the tender drawings of "Um Qasr Container Terminal" (1972) and "Preliminary Studies of Um Qasr Container Terminal (1971)", subsoil investigation was conducted for the four soil borings in the wharf planning area and two soil borings in the yard planning area as shown in Figure 5.2-6.



Source: Preliminary Studies of Um Qasr Container Terminal (1971), PCKK

Figure 5.2-6 Location of Soil Boring at No. 5 Berth in UQP South



Source: Preliminary Studies of Um Qasr Container Terminal (1971), PCKK

Figure 5.2-7 Soil Profile at No. 5 Berth in UQP South

In view of the above soil profile, the soil layer composition and soil properties at No.5 Berth in UQP South are summarized in Table 5.2-2. As for the service berths, the same soil conditions as

shown in Table 5.2-2 are to be used for the preliminary design since no soil data were found around the planned location area along the Al-Zubair Channel.

Table 5.2-2 Soil Layer Composition and Properties at No. 5 Berth in UQP South

Soil Layer	Depth	Property
Upper soft clay layer	-2.2 m to -6.5 m	Cohesion: 24.5 kN/m^2
Sand layer	-6.5 m to -10.0 m	30 to 40 N-value, 35°φ
Clay/clay-sand layer	-10 m to -15 m	40 to 50 N-value, 35°φ
Sand/sand-gravel layer	-15 m to -22 m	30 to 50 N-value, 35°φ
Sand-gravel bearing layer	-22 m and below	50 and more N-value, 40°φ

Source: Preliminary Studies of Um Qasr Container Terminal (1971), PCKK

(6) Tidal Current

The maximum tidal current is about 3.1 kt for ebb tide and 3.0 kt for flood tide.

5.2.2 Usage Conditions

(1) Design Working Life

The design working life of the main port structure is 50 years in accordance with Table 5.2-3.

Table 5.2-3 Concept of Classification of Design Working Life

Class	Expected design working life (year)	Example
1	1 - 5	Temporary structures
2	25	Replaceable structural elements such as bridge abutment beams and bearings
3	50	Buildings and other public structures, structures other than the below
4	100 or longer	Memorial buildings, special or important structures, large-scale bridges

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

(2) Design Ships

The specifications of design ships for preliminary design are shown in Table 5.2-4.

Table 5.2-4 List and Specifications of Design Ships

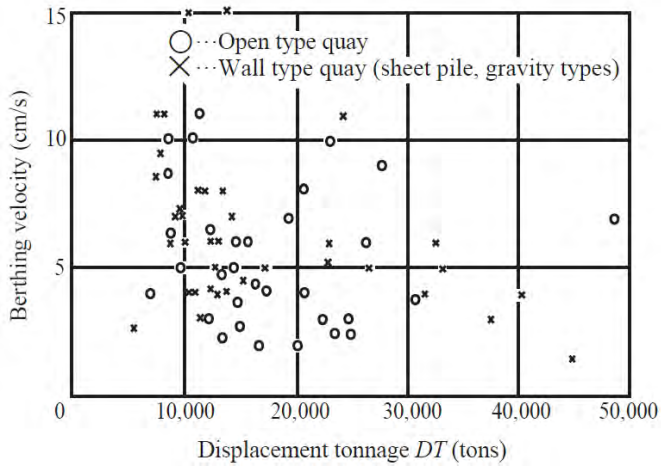
Type	LOA (m)	Breadth (m)	Depth (m)	Draft (m)	Remarks
T.S.H.D. 8,000 m^3	132.4	22.0	9.2	8.2	GT 9,760 t, DWT 14,599 t
C.S.D. 1,500 m^3/hr	70.0	14.0	4.0	3.0	
Survey Boat	25.0	6.8	4.0	3.0	GT 50 t
Mooring Boat	12.0	6.0	1.8	1.5	

Source: JICA Study Team

(3) External Forces by Ships

1) Berthing Velocity

The berthing velocity for the service berths is 10 cm/s. According to the Japanese Standards, the berthing velocity is usually less than 10 cm/s for general cargo ships. Only in a few cases, it is over 10 cm/s (see Figure 5.2-8).



Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

Figure 5.2-8 Berthing Velocity and Displacement Tonnage for General Cargo Ship

As for small boats, the berthing velocity is provided in Table 5.2-5 according to the Japanese Standards.

Table 5.2-5 Berthing Velocity for Small Boats

Gross Tonnage (t)	Berthing Velocity (m/s)
less than 20	0.50
20 or more and less than 40	0.40
40 or more and less than 90	0.35
90 or more	0.30

Source: Design Manual for Fishing Port and Fishing Ground in Japan

2) Traction

The traction force on bollard by the design ship for service berths is 500 kN as shown in Table 5.2-6.

Table 5.2-6 Standard Values of Tractive Force by Ships

Gross tonnage of ship (t)	Tractive force acting on mooring post (kN)	Tractive force acting on bollard (kN)
Over 200 and not more than 500	150	150
Over 500 and not more than 1,000	250	250
Over 1,000 and not more than 2,000	350	250
Over 2,000 and not more than 3,000	350	350
Over 3,000 and not more than 5,000	500	350
Over 5,000 and not more than 10,000	700	500
Over 10,000 and not more than 20,000	1,000	700
Over 20,000 and not more than 50,000	1,500	1,000
Over 50,000 and not more than 100,000	2,000	1,000

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

Regarding small boats, the traction force acting on bollard is 50 kN as shown in Table 5.2-7.

Table 5.2-7 Standard Values of Tractive Force by Small Boats

Gross Tonnage (t)	Tractive Force (kN)
less than 10	10
10 or more and less than 50	30
50 or more and less than 100	50
100 or more and less than 200	70
200 or more and less than 500	100
500 or more and less than 2,000	150

Source: Design Manual for Fishing Port and Fishing Ground in Japan

(4) Surcharge

The values of static loads acting on aprons are 10 kN/m^2 for the permanent condition and 5 kN/m^2 for other conditions.

(5) Corrosion Protection

1) Corrosion Rates of Steel

The corrosion rate of steel, which is generally determined by referring to the standard values listed in Table 5.2-8, has been complied on the basis of the survey results on the existing steel structure.

Table 5.2-8 Standard Values of Corrosion Rates of Steel

Corrosive environment		Corrosion rate (mm/year)
Seaside	HWL or higher	0.3
	HWL – LWL -1 m	0.1–0.3
	LWL -1 m – seabed	0.1–0.2
	Under seabed	0.03
Land side	Above ground and exposed to air	0.1
	Underground (residual water level and above)	0.03
	Underground (residual water level and below)	0.02

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

2) Corrosion Protection Method

For the most effective actual corrosion protection, the covering/coating method is used for sections above -1.5 m (1.0 m below LLWL). The cathodic protection method is employed below the covering/coating area.

5.3 Quay Walls

5.3.1 Service Berths for Dredger

(1) Preliminary Design Conditions

Table 5.3-1 shows the preliminary design conditions of the quay wall for service berths along the Al-Zubair Channel.

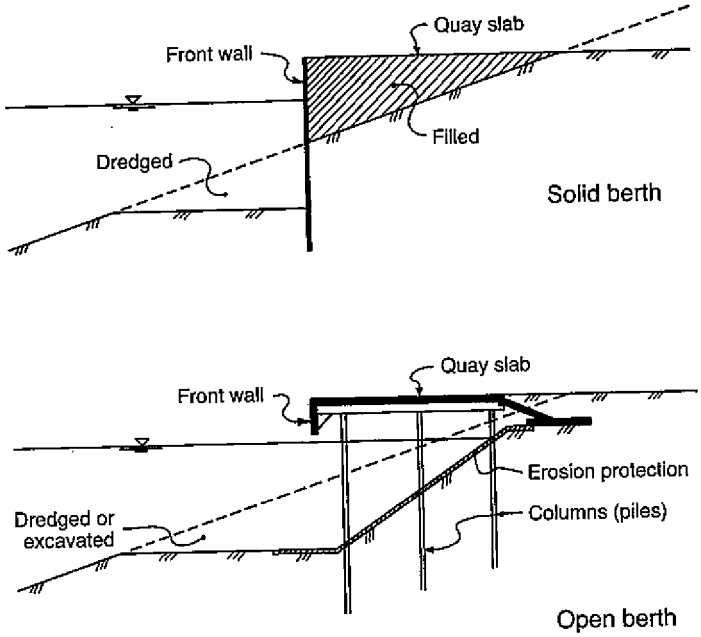
Table 5.3-1 Preliminary Design Conditions of Service Berths

1. Berth Specifications	Crown Height	+7.0 m
	Design Depth	-10.0 m
2. Design Conditions	Maximum Design Ship (Dredger T.S.H.D. 8,000 m^3)	LOA: 132.4 m
		Maximum Draft: 8.0 m
		DWT: 14,599 t, GT: 9,760 t
	Berthing Velocity	10 cm/s
	Seismic Coefficient	kh=0.05, kv=0.00
	Design Working Life	50 years
	Surcharge	Permanent Condition: 10 kN/m^2 Other Conditions: 5 kN/m^2
3. Natural Conditions	Tide	HHWL: +5.5 m, LLWL: -0.5 m
	Wave Height	0.7 m
	Tidal Current	1.6 m/s (3.1 kt)
	Maximum Wind Velocity	17.5 m/s (34.0 kt)

Source: JICA Study Team

(2) Structural Type of Berth

The purpose of a berth structure is mainly to provide a vertical front where ships can berth safely. The berth fronts are constructed according to one of the two main principles such as “solid berth structure” (e.g., gravity type, sheet pile type, cellular type) and “open berth structure” (e.g., pier type). The typical illustrations of each structure are shown in Figure 5.3-1.

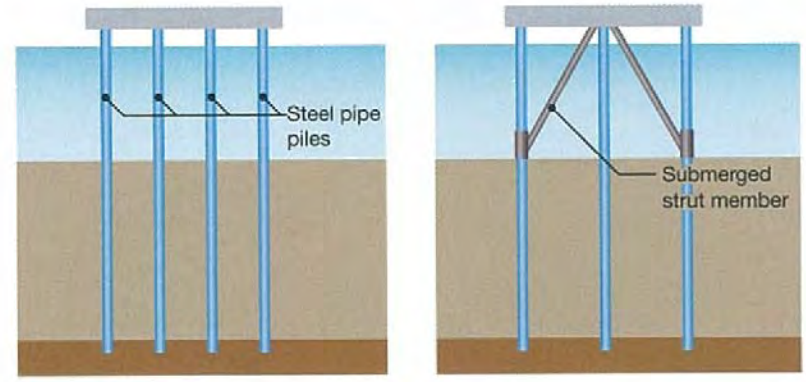


Source: Port Designer's Handbook

Figure 5.3-1 Typical Illustrations of Berth Structure

The service berths are located inside the channel area. A solid berth structure will affect the tidal currents in the channel and cause siltation, which is the invasion and/or accumulation of littoral drift mainly due to currents. Therefore, an open berth structure is preferable for the service berths since tidal currents are lightly affected and the potential to cause siltation is lower compared with the solid berth structure.

Three alternatives for an open berth structure are studied in this report. These are "open type on vertical piles", "open type on coupled raking piles", and "open type with submerged strut method". Figure 5.3-2 shows the typical illustrations of the vertical pile type and submerged strut method. The submerged strut method can possibly reduce the number of piles to be used. Furthermore, using prefabricated structural members can possibly result in speedy and space-saving construction.

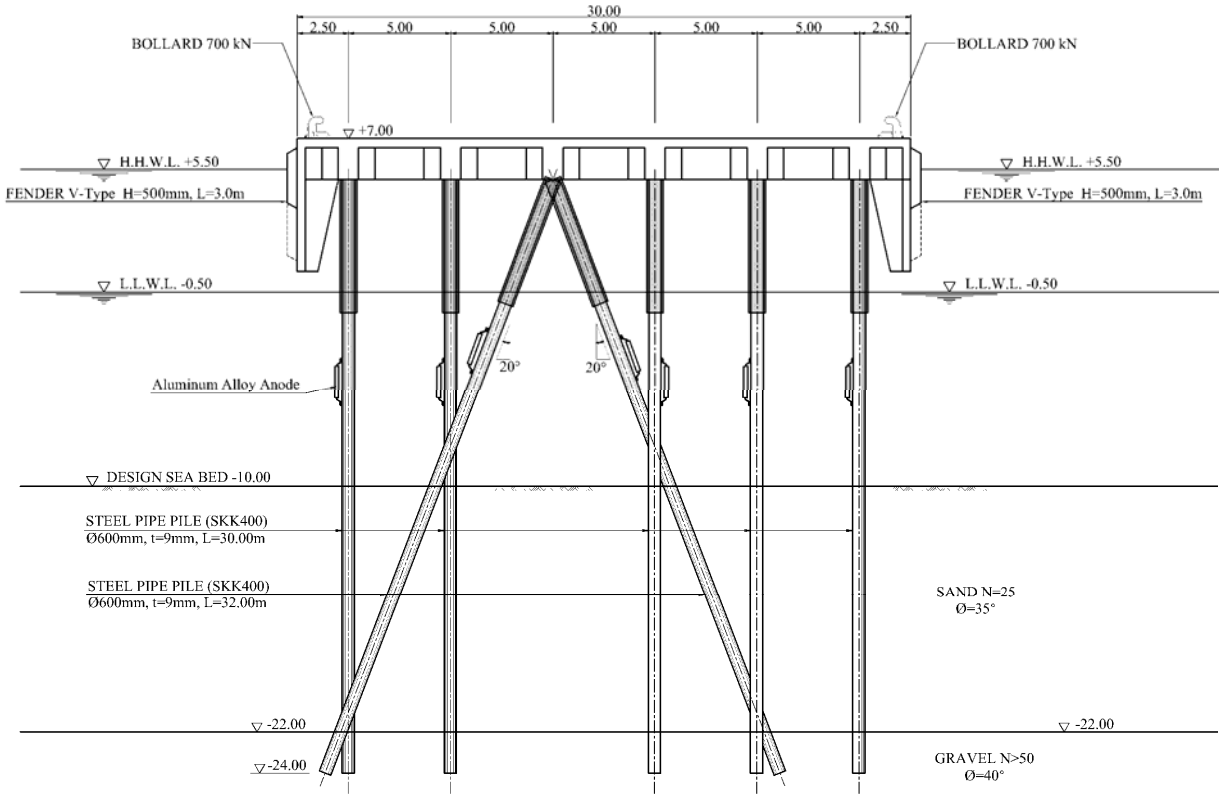


Source: Nippon Steel and Sumitomo Metal

Figure 5.3-2 Typical Illustrations of Vertical Piles and Submerged Strut Method

Table 5.3-2 shows the comparison of berth structure for service berths. The alternatives are: Case 1 for Vertical Steel Pipe Piles, Case 2 for Coupled Raking Steel Pipe Piles, and Case 3 for Submerged Strut Method. In conclusion, the most recommendable structure type is Case 2: Coupled Raking Steel Pipe Piles. Regarding the number of steel pipe piles, Case 3 has the smallest among the three, and the workability (working days) of Case 3 is the shortest. But Case 2 is the most cost-effective among the three alternatives since the unit mass of steel structures is the smallest.

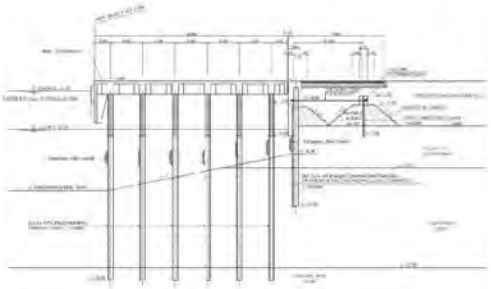
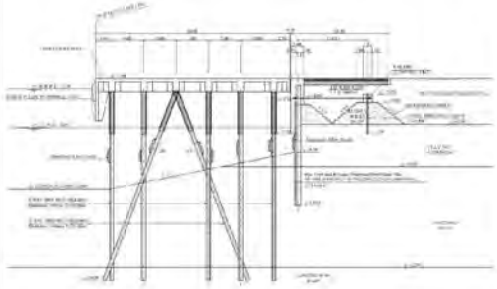
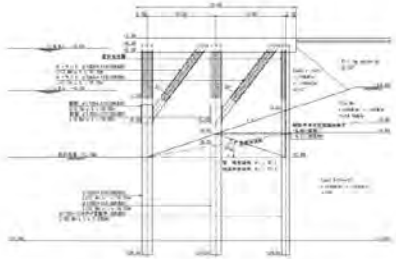
The typical standard section for service berths is described in Figure 5.3-3.



Source：JICA Study Team

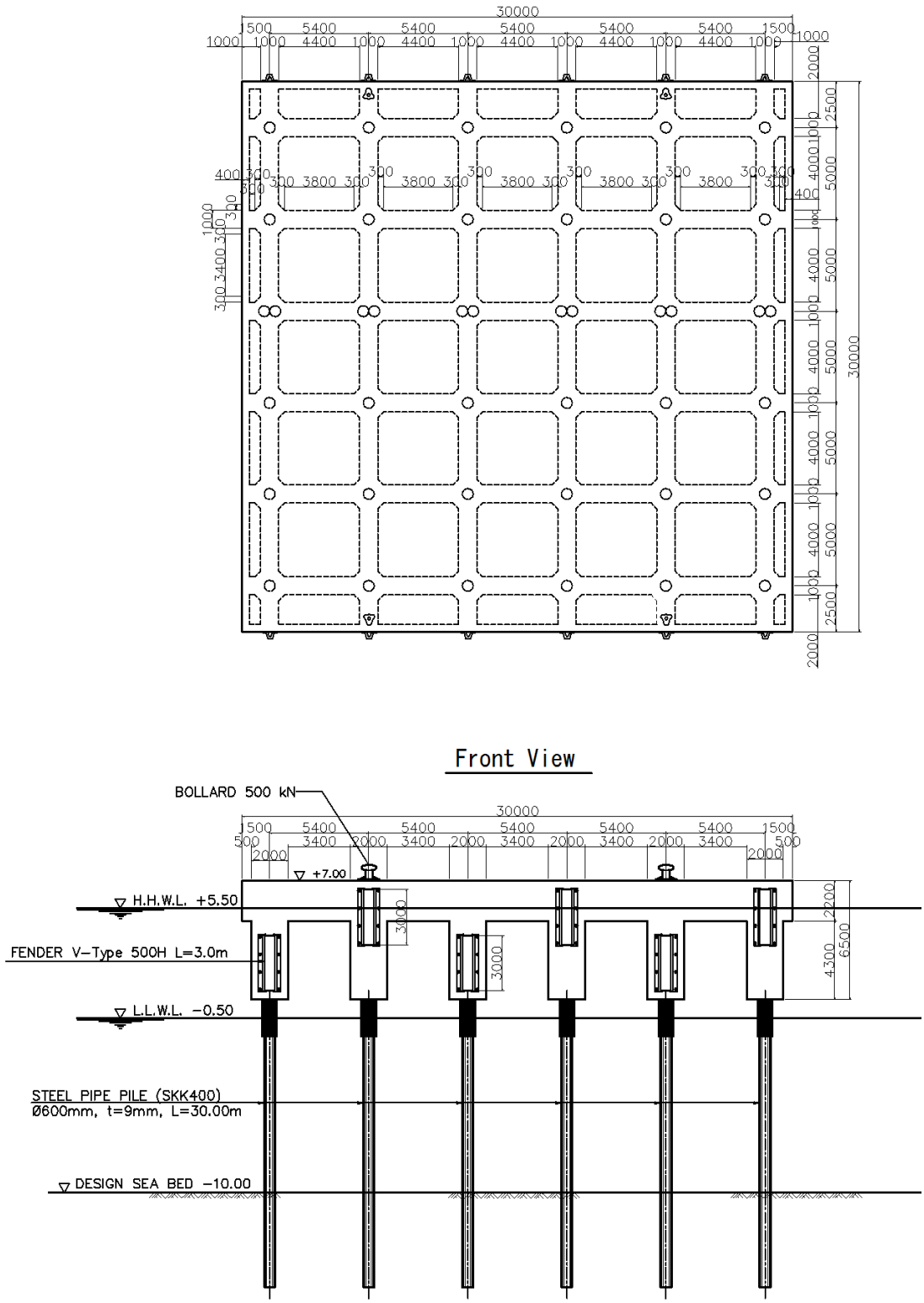
Figure 5.3-3 Typical Standard Section of Service Berths

Table 5.3-2 Comparison of Berth Structure of Service Berths

	Case 1: Vertical Steel Pipe Piles		Case 2: Coupled Raking Steel Pipe Piles		Case 3: Submerged Strut Method	
Standard Section						
Features of Structural Design	• Concrete deck is supported with vertical piles. • The number of piles is less than Case 2, but pile size is bigger than Case 2. • This type is very common and easy to drive piles.		• Concrete deck is supported with vertical piles and coupled raking piles. • The number of piles is more than Case 1, but pile size is the smallest of the three. • This type is effective to resist the horizontal forces. • The piling barge is required to be able to drive raking piles.		• Concrete deck is supported with vertical piles connected by submerged strut beams. • The number of piles is the smallest, but pile size is the biggest of the three. • Speedy construction is possible due to a reduction of piles. • Technical methods, such as underwater injecting grout, are required.	
Main Members per block (30m x 30m)	S.P.P.: ϕ 800 x t9 x L30m x 36 nos. S.S.P.: (10H+H-750x250)x L18.5m x 33.3 nos. Anchor Pile: S.S.P. Type-Ⅱ x L6.0m x 75 nos.		S.P.P.: ϕ 600 x t9 x L30m x 30 nos. ϕ 600 x t9 x L32m x 12 nos. S.S.P.: (10H+H-750x250)x L18.5m x 33.3 nos. Anchor Pile: S.S.P. Type-Ⅱ x L6.0m x 75 nos.		S.P.P.: ϕ 1200 x t12 x L29.5m x 12 nos. S.S.P.P.: ϕ 1100 x t11 x L29.5m x 25.4 nos. Strut: ϕ 600 x t10 x L15.0m x 12 nos. ϕ 1400 x t25 x L2.0m x 12 nos.	
Total Weight per block (30m x 30m)	353 tons	2 pts	331 tons	3 pts	381 tons	1 pts
Freight Tonnage per block (30m x 30m)	706 F.T.	2 pts	526 F.T.	3 pts	1,257 F.T.	1 pts
Direct Cost per block	242 million JPY	2 pts	229 million JPY	3 pts	328 million JPY	1 pts
Workability per block	55 days	1 pts	54 days	2 pts	52 days	3 pts
Evaluation	Not Recommendable (7 pts)		**Recommendable** (11 pts)		Not Recommendable (6 pts)	

Source: JICA Study Team

The general plan and front view of service berths are described in Figure 5.3-4.

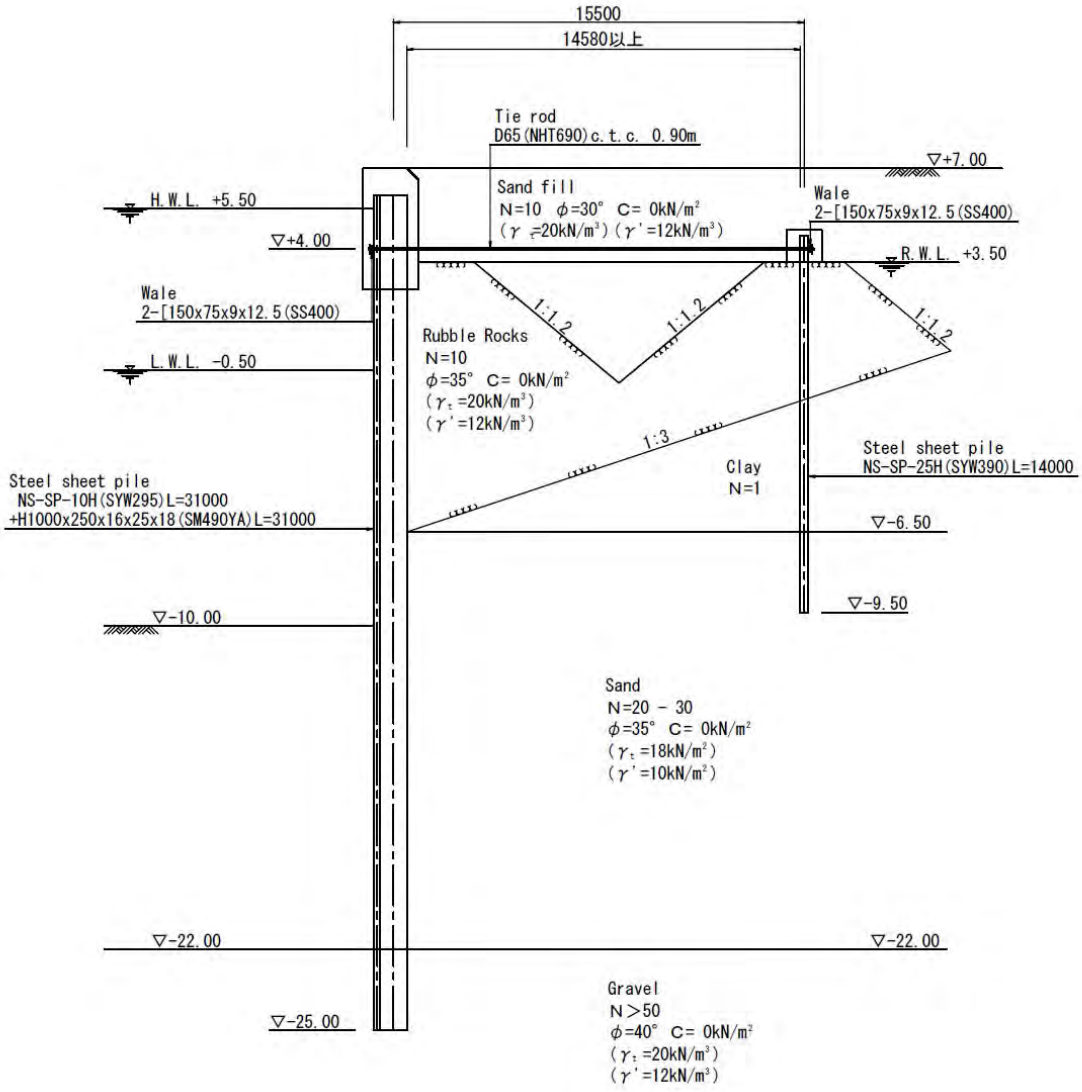


Source：JICA Study Team

Figure 5.3-4 General Plan and Front View of Service Berths

The preliminary design of service berths will be reviewed and amended in the Phase-2 stage since the construction costs of service berths will unexpectedly increase and it is required to considerably minimize the costs due to limited budget. One of the most effective options to reduce the

costs will be to revise the berth structure and shorten the berth length. For example, if the berth line of dredger berth can be shifted toward the land side, a trestle bridge connecting the berth structure and land area would not be necessary and the steel sheet pile structure would be selected for the quay wall of the service berths. The typical section of sheet pile structure for service berths is shown in Figure 5.3-5 for reference. However, further study and discussions with GCPI are needed to fix the final detailed design of the service berths.



Source: JICA Study Team

Figure 5.3-5 Typical Section of Steel Sheet Pile Structure of Service Berths

5.3.2 Revetment and Structure behind the Berth

(1) Preliminary Design Conditions

Based on the consideration of accommodation for small boats in the long-term plan, the preliminary design conditions for revetment and structure behind the berth were adopted as quay wall for small boats. Table 5.3-3 shows the preliminary design conditions of the quay wall for small boat in the service berths.

Table 5.3-3 Preliminary Design Conditions of Quay Wall for Small Boats

1. Berth Specifications	Crown Height	+7.0 m
	Design Depth	-4.0 m
2. Design Conditions	Maximum Design Ship (Survey boat)	LOA: 25.0 m
		Maximum Draft: 3.0 m
		GT: 50 t
	Berthing Velocity	35 cm/s
	Seismic Coefficient	kh=0.05, kv=0.00
	Design Working Life	50 years
	Mobile Crane	Type 25
	Surcharge	Permanent Condition: 10 kN/m^2 Other Conditions: 5 kN/m^2
3. Natural Conditions	Tide	HHWL: +5.5 m, LLWL: -0.5 m
	Wave Height	0.7 m
	Tidal Current	1.6 m/s (3.1 kt)
	Maximum Wind Velocity	17.5 m/s (34.0 kt)
	CBR (K_{30}) for Subgrade	More than 5% (50 N/cm^3)

Source: JICA Study Team

(2) Types of Berth Structure

The berth structure for the abovementioned design conditions can be divided into the following two main types, depending on the principle on which the front wall of the structure is constructed, in order to obtain sufficient stability:

a) Gravity wall structure:

the front wall of the structure with its own deadweight and bottom friction will be self-sufficient or able to resist the loadings from backfill, useful load, and other horizontal and vertical loads acting on the berth wall structure itself.

b) Sheet pile structure:

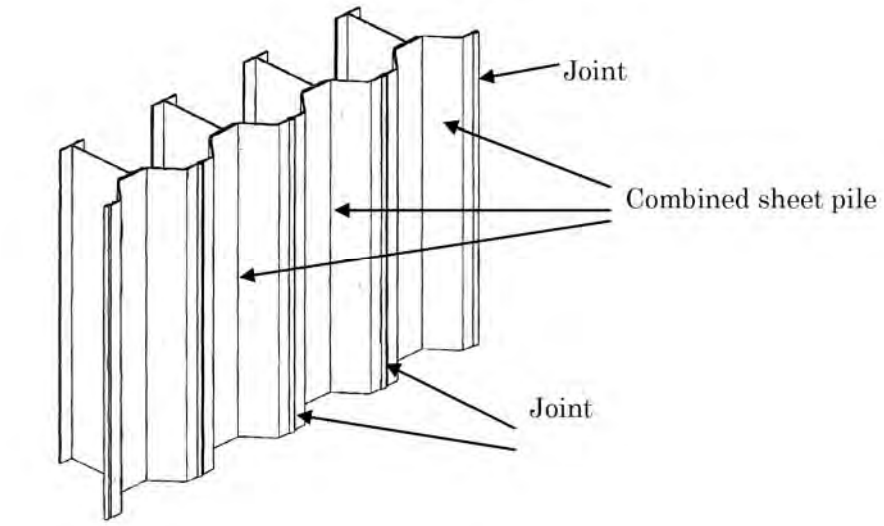
The front wall is not adequate to resist any horizontal loads acting on the structure and must, therefore, be anchored to an anchoring pile or wall behind the berth.

Sheet pile structure is the most optimal type for small boat berth. The main reasons to select sheet pile type are as follows:

- Replacement sand and rubbles for foundation are required for gravity wall structure due to the soft subsoil condition of the designed area.
- Sheet pile type can adapt flexibly to the changes of subsoil conditions compared with gravity type.
- Gravity wall structure such as blocks, caissons, or cells requires a large fabrication yard, a temporary loading berth, and a large floating crane to place the wall units. These make the project cost higher.

Regarding the sheet pile structure, three alternatives for the front wall such as "steel sheet pile", "steel sheet pipe pile", and "hat-type and h-shape combined high stiffness steel sheet piles (refer to Figure 5.3-6)" are compared as shown in Table 5.3-4.

In conclusion, "hat-type and h-shape steel sheet piles" is the most cost-effective type for small boat berth because the number of sheet piles is the smallest and transportation cost is the lowest among the three alternatives (refer to the freight tonnage), although unit mass is 12% bigger than the "steel sheet pipe pile".



Source: Nippon Steel and Sumitomo Metal

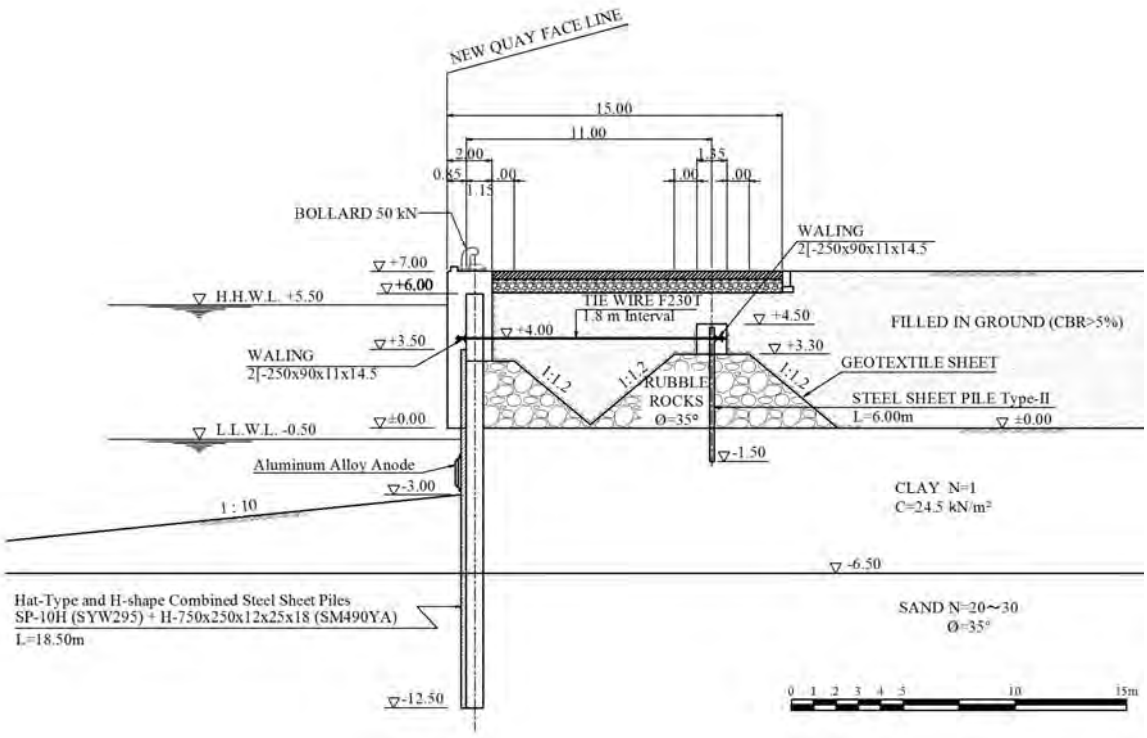
Figure 5.3-6 Hat-type and H-shape Combined Steel Sheet Piles

Table 5.3-4 Comparison Table for Steel Sheet Pile Type

	Steel Sheet Pile	Steel Sheet Pipe Pile	Hat-type and H-shape Steel Sheet Pile
Type	Type VI_L	ϕ 800 x 9 t	10H+H750x250
Section Modulus (cm^3/m)	3,840	4,170	4,050
Unit Mass (kg/m^2)	240	168	188
Freight Tonnage (t/m^2)	0.24	0.55	0.19
Number of Piles per Meter	2.00	1.25	1.11
Direct Cost per Meter	JPY 1,286,000 (1.34)	JPY 1,743,000 (1.82)	JPY 957,000 (1.00)
Evaluation	Not Recommendable	Not Recommendable	**Recommendable**

Source: JICA Study Team

The typical standard section of small boat berth is described in Figure 5.3-7.



Source: JICA Study Team

Figure 5.3-7 Typical Standard Section of Small Boat Berth

5.4 Mooring Facility

(1) Preliminary Design Conditions

Table 5.4-1 shows the preliminary design conditions of the mooring facility for dredgers in the service berths.

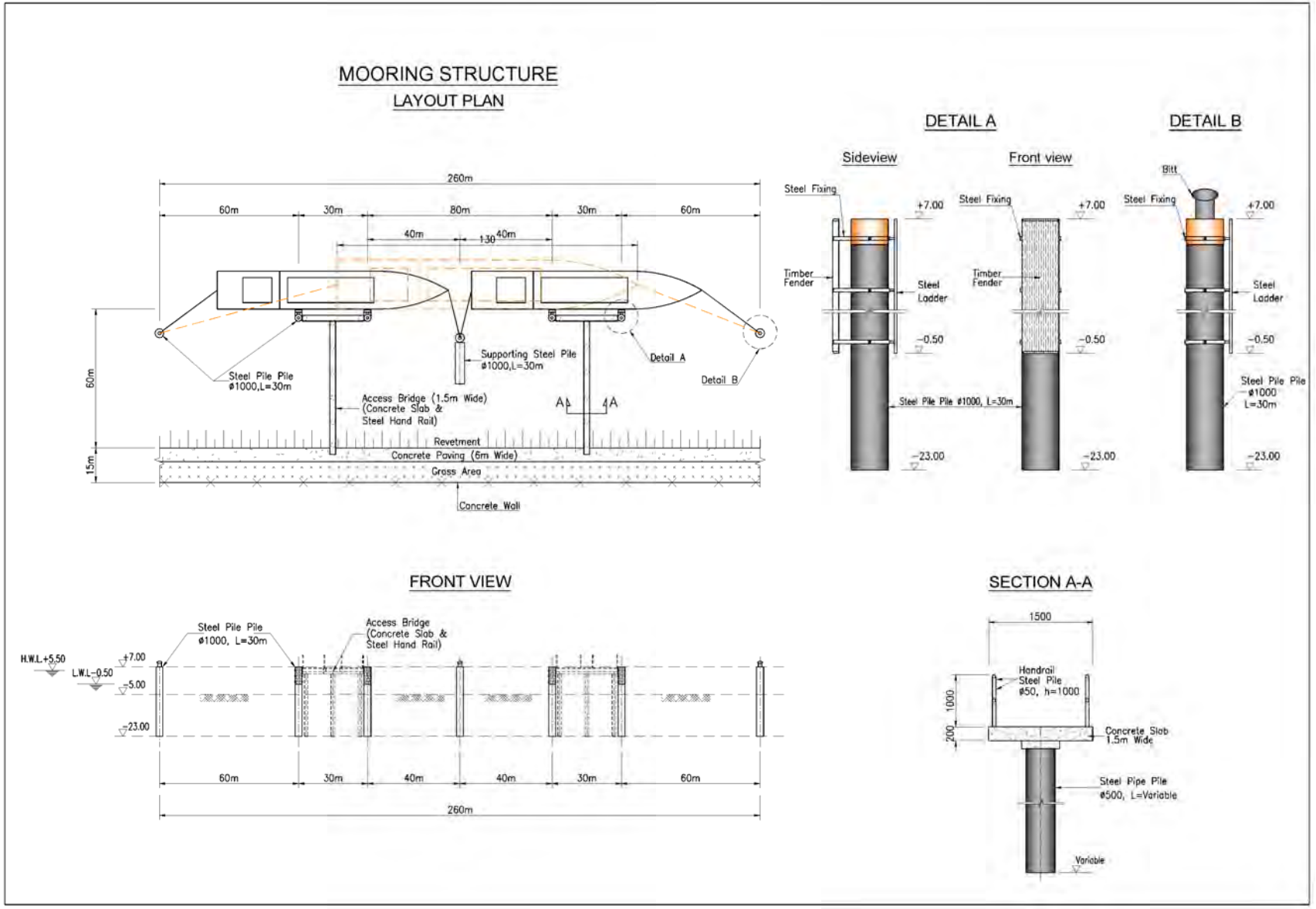
Table 5.4-1 Preliminary Design Conditions of Mooring Facility for Dredgers

1. Berth Specifications	Crown Height	+7.0 m
	Design Depth	-5.0 m
2. Design Conditions	Maximum Design Ship (Dredger T.S.H.D. 8,000 m^3)	LOA: 132.4 m
		Draft Unloaded: 4.0 m
		DWT: 14,599 t, GT: 9,760 t
	Berthing Velocity	3 cm/s
	Seismic Coefficient	kh=0.05, kv=0.00
	Design Working Life	50 years
	Surcharge	N/A
3. Natural Conditions	Tide	HHWL: +5.5 m, LLWL: -0.5 m
	Wave Height	0.7 m
	Tidal Current	1.6 m/s (3.1 kt)
	Maximum Wind Velocity	17.5 m/s (34.0 kt)

Source: JICA Study Team

(2) Type of Mooring Structure

The mooring structure for the abovementioned design conditions will be composed of steel pipe piles as shown in Figure 5.4-1. The mooring facility will be redesigned in the Phase-2 stage in consideration of minimizing the construction costs.



Source: JICA Study Team

Figure 5.4-1 General Drawing of Mooring Facility (Tentative)

5.5 Apron Pavement

A durable pavement area with high performance is vital to port terminal operations. Nowadays, there are different kinds of pavements and the most common types are concrete pavement, asphalt pavement, and concrete block pavement. Based on the following points under the natural and usage conditions in the project area, concrete pavement is applied as the apron pavement.

- Concrete pavement has a proven record of long-term performance under heavy loads in port aprons and yards. It has high resistance to abrasion and point loads.
- It offers high frictional resistance.
- High temperatures, moisture, petrochemicals, or point loads do not damage the area.
- Rigid concrete can minimize the thickness of pavement.

The base course thickness of concrete pavement is set and prepared based on past records as referred in Table 5.5-1. Design bearing capacity coefficient of base course, K_{30}, will be around 50 N/cm^3 equal to CBR of 5% which is assumed for reclaimed sand filling materials.

Table 5.5-1 Reference Values for Base Course Thickness of Concrete Pavement

Design condition	Base course thickness				
Design bearing capacity coefficient of base course K_{30} (N/cm3)	Upper subbase course		Lower subbase course		Total base course thickness
	Cement stabilized base	Graded grain material	Graded grain material	Crusher run etc.	
50 or more and less than 70	–	40	–	20	60
	20	–	20	–	40
	25	–	–	30	55
70 or more and less than 100	–	20	15	–	35
	–	20	–	20	40
	15	–	15	–	30
	15	–	–	15	30
100 or more	–	20	–	–	20
	15	–	–	–	15

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

The selected characteristic value of action for apron pavement is "CP_4" as shown in Table 5.5-2.

Table 5.5-2 Action Conditions of Concrete Pavement

Action classification	Type of action		Action (kN)	Ground contact radius (cm)
CP_1	Fork lift truck	2t	25	10.6
	Tractor trailer	for 20ft, 40ft	50	17.8
	Fork lift truck	3.5t	45	13.8
CP_2	Fork lift truck	6t	75	17.8
CP_3	Truck	25 ton class	100	17.8
	Fork lift truck	10t	125	22.2
	Straddle carrier		125	22.2
	Fork lift truck	15t	185	26.8
CP_4	Mobile crane (truck crane, rough terrain crane, all terrain crane)	Type 20	220	19.9
	Fork lift truck	20t	245	30.7
	Mobile crane (truck crane, rough terrain crane, all terrain crane)	Type 25	260	20.3

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

The concrete slab thickness set with reference to the empirical values given in Table 5.5-3 is considered to have the same performance as the one set using the method of "Pavement Design and Construction Guide".

Table 5.5-3 Reference Values for Concrete Slab Thickness

Action classification	Concrete slab thickness (cm)
CP_1	20
CP_2	25
CP_3	30
CP_4	35
Applied to piled pier slab	10

Source: Technical Standards and Commentaries for Port and Harbour Facilities in Japan

The selected concrete pavement section for apron and yard is as follows:

- 350 mm: Cast-in-place Concrete (σ_b=4.5 N/mm^2)
- 600 mm: Crushed Rock Subbase
- 5% CBR: Subgrade

5.6 Others

Other developments for port facilities are shown in Table 5.6-1. These facilities will be reviewed in consideration of the limited budget.

Table 5.6-1 Other Port Facilities (Tentative)

Facilities	Description	Quantity	Remarks
1. Access Road (Service Berths)	20 m in width	TBD※)	Concrete Pavement
2. Main Gate	RC structure	1	
3. Administration Office	RC building, 40 m x 30 m	1	
4. Water Tank	RC building, 20 m x 20 m	1	
5. Substation	RC building, 30 m x 15 m	1	
6. Store for Dredgers	RC building, 60 m x 40 m	1	
7. Workshop	RC building, 30 m x 20 m	1	
8. Fuel Tanks	(for future use)	15,000 m^2	
9. Concrete Wall		965 m	
10. Revetment		600 m	
11. Open Yard		33,000 m^2	Gravel pavement

※)TBD: to be decided later
Source：JICA Study Team

Moreover, utilities for the Project are planned as follows:

- Water supplement facilities (seawater desalination facilities)
- Electricity facilities (electric cable installation)
- Fuel supplement facilities
- IT system (port management system, gate management system)
- Sewerage treatment facilities

CHAPTER 6

Chapter 6. Preliminary Cost Estimates for Service Berth

6.1 Introduction

This chapter presents the approximate project cost estimates for the service berths as recommended in Chapter 5. Two cases will be presented. First, the Base Case, which will be according to the recommendations from the previous chapter, and the Alternative A Case, which will also be presented in Section 6.3.

6.2 Base Case

This section for the base case aims to present the approximate project cost of the service berths for both dredgers and small boats (tugboats) as described in the previous chapter. This case includes all important project components for dredger berth and tugboat berth as shown in Table 6.2-4 Project Components for Service Berths (Base Case).

(1) Conditions of the Estimation

Basic conditions for the estimates are as follows:

a) Base year for estimation

Year 2015

b) Exchange rates, on the average, as of June 2015 for TTS rate of BTMU

USD 1 = JPY 124.75

c) Contingencies

Rates below were adopted for the calculation of contingencies for both reserves and price escalation.

Contingency for construction	: 20%
Contingency for engineering services	: 15%

d) Administration cost and others

Land acquisition and compensation cost	: not included
Administration cost	: 5% of each construction cost and engineering services cost
Value-added tax	: not included
Sales and other taxes	: not included

(2) Project Components (Base Case)

Priority project components are shown in Table 6.2-4.

(3) Project Cost Estimate (Base Case)

Table 6.2-5 summarizes the service berth construction and basic equipment procurement cost. The cost estimate consists of the construction cost for both dredger and tugboat service berths, procurement of general operational equipment, engineering services, and other administrative costs including taxes and contingencies.

a) Data Collection of Cost Estimation

Due to limited compiled data in Iraq civil/port projects, the JICA Study Team has considered the current condition of the planned area, and the cost estimation data and unit rates were taken and assumed from the recently implemented Port Sector Rehabilitation Project (I) and Al Faw Port Project excluding the security cost.

The assumed unit rates for the main work items are as follows:

Table 6.2-1 Unit Rate for Working Items

USD 1 = JPY 124.75

	Project Components	Working Item	Unit Rate (USD)
Dredger Berth/ Tug Berth	Service Berth	Open Pier Type Berth	2,455.00/m^2
		Hat-H Type Retaining Wall	1,516.00/m^2
	Dredging	Dredging	17.25/m^3
	Reclamation	Reclamation of Sand	34.50/m^3
	Soil Improvement	Surcharging	46.00/m^2
	Pavement	Concrete/Asphalt/ICB Pavement	121.00/m^2
Procurement of Equipment	Mobile Crane	50 t	891,784/Nr
	Mobile Crane	15 t	129,803/Nr
	Fork Lift	3 t	52,120/Nr
	Fork Lift	20 t	148,313/Nr
	Truck Trailer	15 t	80,160/Nr

Source: JICA Study Team

b) Allocation of Project Costs between Japanese Procurement and Local Procurement

The total estimated project costs will be shared by the Japanese procurement portion and the local procurement portion. The proposed allocation of procurement portion is as follows:

Table 6.2-2 Allocation of Procurement Portion

No.	Project Components	Japanese Portion	Local Portion	Remarks
A	Dredger Berth Construction	65%	35%	
B	Tugboat Berth Construction	52%	48%	
C	Procurement of Equipment	100%	0%	

Source: JICA Study Team

(4) Work Schedule

The projected work schedule, which is shown in Table 6.2-3, comprises the preparatory works, construction of dredger berth and tug berths, procurement of equipment including fabrication, and delivery and installation/commissioning at the site.

Table 6.2-3 Estimated Duration of Project Components

No.	Project Components	Construction Period
A	Dredger Berth Construction	29 months
B	Tugboat Berth Construction	21 months
C	Procurement of Equipment	12 months

Source: JICA Study Team

(5) Work Method Outline and Construction Plan

1) A. Dredger Service Berth: 29 months (total duration)

a) A0: Preparatory Works (mobilization to Iraq, site office set up): Six months

b) A1: Service Berth Construction

- Open Pier Type Berth Construction: 13 months

  ・Steel pile driving by crane barge

- Productivity: Three piles are driven per day
- The concrete slab works will take three months after the steel pile driving.
- The activity ratio was considered at 0.70.

- Steel Sheet Pile Retaining Wall Construction: Five months

  - Steel sheet pile driving by crane barge
  - Productivity: 270 lm of sheet piles are driven per day
  - The concrete parapet works and tie rod works will take about two months after the steel sheet pile driving.
  - The activity ratio was considered at 0.70.

c) A2: Dredging Works: Three months

- First activity before the start of pile driving
- Productivity: 3,500 m^3 per day
- The activity ratio was considered at 0.60.
- The disposal area preparation work is considered to be for one month.

d) A3:Reclamation Works: Ten months

- Reclaim from land and water side
- Productivity: 2,000 m^3 per day
- The activity ratio was considered at 0.70.

e) A4: Soil Improvement Works: Nine months

- Sand surcharge method to be applied
- Loading period was considered for six months

f) A5: Pavement Works: 13 months

- Concrete, asphalt, ICB pavement type to be applied
- Productivity: 300 m^2 per day
- The activity ratio was considered at 0.70.

g) A6: Infrastructure Works: 11 months

- Infrastructure works will be carried out after soil improvement
- Water supply
- Sewage system
- Electrical supply system
- ISPS

h) A7: Building Works: 13 months

- Building works will be carried out after soil improvement
- Administration Office
- Store for spare parts (Dredgers)
- Store for spare parts (Other Service Boats)
- Substation
- Fuel tank
- Water tank

2) B. Tugboat Service Berth: 21 months (total duration)

a) B1: Service Berth Construction: Four months

- The same as the dredger service berth condition.
- Steel sheet pile driving by land crane

b) B2: Dredging Works: Four months

- The same as the dredger service berth condition.

c) B3: Reclamation: Seven months

- The same as the dredger service berth condition.

d) B4: Soil Improvement: Eight months

- The same as the dredger service berth condition.

e) B5: Pavement: Nine months

- The same as the dredger service berth condition.

f) B6: Infrastructure: Nine months

- The same as the dredger service berth condition.

g) B7: Buildings: Nine months

- The same as the dredger service berth condition.
- Store for spare parts (other service boats)
- Workshop and warehouse

3) C. Procurement of Equipment: 12 months (total duration)

- Production of equipment, procurement

(6) Fund Disbursement

Table 6.2-7 summarizes the projected monthly and annual fund disbursements, which include the construction and equipment procurement costs. Projections are for a 31-month period.

Table 6.2-4 Project Components for Service Berth (Base Case)

No. 1	Project Component Service Berth Components for Base Case	Service Berth Development (Base Case)
A.	Dredger Berth	
A1	Service Berth	L=450 m Berth, Depth -9.0 m and 600 m Jetty, Depth -3.0 m
A2	Dredging	Approx. V=77,000 m^3
A3	Reclamation	Approx. V=395,000 m^3
A4	Soil Improvement	Approx. A=87,500 m^2
A5	Pavement	Approx. A=81,500 m^2, (Concrete pavement, asphalt pavement, ICB)
A6	Infrastructure (Utility, electricity, drainage)	Utility, Electricity, Drainage, Fence
A7	Buildings	Administration Office, Store for Spare Parts (Dredgers) Store for Spare Parts (Other Service Boats), Substation, Fuel Tank, Water Tank
B.	Tug Berth	
B1	Service Berth	Approx. L=430 m Jetty, Depth -3.0 m
B2	Dredging	Approx. V=200,000 m^3
B3	Reclamation	Approx. V=280,000 m^3
B4	Soil Improvement	Approx. A=56,000 m^2
B5	Pavement	Approx. A=56,000 m^2, (Concrete pavement, asphalt pavement, ICB)
B6	Infrastructure (Utility, electricity, drainage)	Utility, Electricity, Drainage, Fence
B7	Buildings	Store for Spare Parts (Other Service Boats), Workshop and Warehouse
C.	Procurement of Equipment	
C1	Mobile Crane: 50 t	Lifting Capacity 50 t: 1 Nr.
C2	Mobile Crane: 15 t	Lifting Capacity 15 t: 2 Nrs.
C3	Fork Lift: 3 t	Lifting Capacity 3 t: 2 Nrs.
C4	Fork Lift: 20 t	Lifting Capacity 20 t: 1 Nr.
C5	Truck Trailer: 15 t	Loading Capacity 15 t: 2 Nrs.

Source: JICA Study Team

Table 6.2-5 Service Berth Construction and Equipment Procurement Cost

USD 1= JPY 124.75

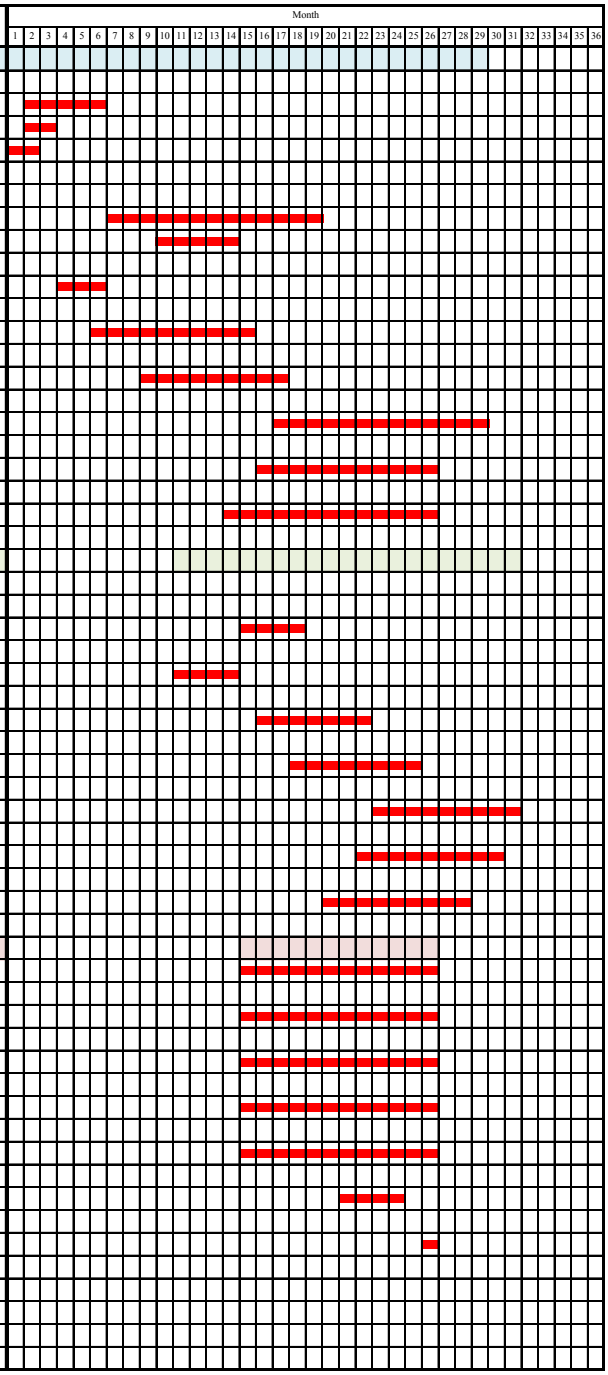
No.	Project Components	Unit	Q'ty	FC		LC	Total
				JPY 1,000	USD 1,000	USD 1,000	USD 1,000
I.	Procurement and Construction			283,346	118,879	77,103	198,254
	A. Dredger Berth			0	71,700	38,577	110,277
	A1 Service Berth	LS	1	0	60,448	0	60,448
	A2 Dredging	LS	1	0	0	2,487	2,487
	A3 Reclamation	LS	1	0	0	14,020	14,020
	A4 Soil Improvement	LS	1	0	11,252	0	11,252
	A5 Pavement	LS	1	0	0	9,909	9,909
	A6 Infrastructure (utility, electricity, drainage)	LS	1	0	0	3,219	3,219
	A7 Buildings	LS	1	0	0	8,942	8,942
	B. Tugboat Berth			0	27,366	25,676	53,042
	B1 Service Berth	LS	1	0	19,654	0	19,654
	B2 Dredging	LS	1	0	0	4,600	4,600
	B3 Reclamation	LS	1	0	0	9,660	9,660
	B4 Soil Improvement	LS	1	0	7,713	0	7,713
	B5 Pavement	LS	1	0	0	6,832	6,832
	B6 Infrastructure (utility, electricity, drainage)	LS	1	0	0	3,464	3,464
	B7 Buildings	LS	1	0	0	1,120	1,120

No.		Project Components	Unit	Q'ty	FC		LC	Total
					JPY 1,000	USD 1,000	USD 1,000	USD 1,000
I.	Procurement and Construction (continuation)							
	C.	Procurement of Equipment			236,122	0	0	1,893
	C1	Mobile Crane: 50 t	Nr	1.0	111,250	0	0	892
	C2	Mobile Crane: 15 t	Nr	2.0	32,386	0	0	260
	C3	Fork Lift: 3 t	Nr	2.0	13,004	0	0	104
	C4	Fork Lift: 20 t	Nr	1.0	18,502	0	0	148
	C5	Truck Trailer: 15 t	Nr	2.0	20,000	0	0	160
		Freight and Insurance	%	16.0	31,223	0	0	250
		Provisional Costs for Spare Parts	%	5.0	9,757	0	0	78
								0
	D.	Base Construction Costs（A+B+C)			236,122	99,066	64,253	165,212
	E.	Contingency (20% of D)		20%	47,224	19,813	12,851	33,042
		Contingency (Price Escalation), included in above 4						
II.	Engineering Services				16,292	6,836	4,433	11,400
	1.	Base Costs for Engineering (5% of I)		5%	14,167	5,944	3,855	9,913
	2.	Contingency (15% of 1)		15%	2,125	892	578	1,487
III		Subtotal (I+II)			299,639	125,715	81,537	209,654
IV		Administration Costs and Others			14,982	6,286	4,077	10,483
	a.	Land Acquisition and Compensation						
	b.	Administration Cost (5% of III)		5%	14,982	6,286	4,077	10,483
	c.	Value-added Tax (VAT)						0
	d.	Sales and Other Taxes						0
V		Grand Total（III+IV)			314,620	132,001	85,614	220,137

Source: JICA Study Team

Table 6.2-6 Project Work Schedule (Base Case)

No.	WORKING ITEM	Unit	Q'ty	Duration (month)
Dredger Berth				
A0	**Preparation**			
	Transport Material	L.S	1.0	5.0
	Mobilization and Demobilization	L.S	1.0	2.0
	Site Office	L.S	1.0	2.0
A1	**Service Berth**			
	Open Pier type	m	450	13.0
	Sheet Pile type	m	600	5.0
A2	**Dredging work**	m3	77,521	3.0
A3	**Reclamation**	m3	394,082	10.0
A4	**Soil Improvement**	m2	87,513	9.0
A5	**Pavement**	m2	81,537	13.0
A6	**Infrastructure (utility, electricity, drainage, ISPS etc.)**	LS	1	11.0
A7	**Buildings**	LS	1	13.0
Tugboat Berth				
B1	**Service Berth**			
	Sheet Pile type	m	432	4.0
B2	**Dredging work**	m3	200,000	4.0
B3	**Reclamation**	m3	280,000	7.0
B4	**Soil Improvement**	m2	55,890	8.0
B5	**Pavement**	m2	55,888	9.0
B6	**Infrastructure (utility, electricity, drainage, ISPS etc.)**	LS	1	9.0
B7	**Buildings**	LS	1	9.0
Procurement of Equipment				
C1	Mobile Crane 50tons	Nrs.	1	12.0
C2	Mobile Crane 15tons	Nrs.	2	12.0
C3	Fork Lift 3tons	Nrs.	2	12.0
C4	Fork Lift 20tons	Nrs.	1	12.0
C5	Track trailer 15tons	Nrs.	2	12.0
C6	Freight&Insurance	LS	1	4.0
C7	Spare Parts	LS	1	1.0



Source: JICA Study Team

Table 6.2-7 Projected Monthly and Annual Fund Disbursement Summary

USD 1= JPY 124.75

Month	Month				Year	Year			
	FC Portion		LC Portion (USD 1,000)	Total (USD 1,000)		FC Portion		LC Portion (USD 1,000)	Total (USD 1,000)
	(JPY 1,000)	(USD 1,000)				(JPY 1,000)	(USD 1,000)		
1	35,418	14,860	9,638	24,782	1	35,418	46,037	22,049	68,370
2	0	0	0	0					
3	0	0	0	0					
4	0	0	705	705					
5	0	0	705	705					
6	0	0	1,896	1,896					
7	0	2,168	1,192	3,359					
8	0	2,168	1,192	3,359					
9	0	3,230	1,192	4,422					
10	0	7,871	1,192	9,062					
11	0	7,871	2,169	10,040					
12	0	7,871	2,169	10,040					
13	0	7,871	2,169	10,040	2	109,475	52,209	30,395	83,482
14	0	7,871	2,754	10,625					
15	0	7,407	1,776	9,183					
16	0	7,407	2,006	9,413					
17	0	7,407	2,654	10,061					
18	0	7,163	2,654	9,818					
19	0	2,987	2,654	5,641					
20	82,935	820	2,760	4,244					
21	13,270	820	2,760	3,686					
22	0	820	3,087	3,907					
23	0	820	2,560	3,379					
24	13,270	820	2,560	3,485					
25	0	820	2,560	3,379	3	91,229	820	11,809	13,360
26	91,229	0	2,560	3,291					
27	0	0	1,726	1,726					
28	0	0	1,726	1,726					
29	0	0	1,620	1,620					
30	0	0	972	972					
31	0	0	645	645					
32	0	0	0	0					
33	0	0	0	0					
34	0	0	0	0					
35	0	0	0	0					
36	0	0	0	0					
	236,122	99,066	64,253	165,212	**Total**	**236,122**	**99,066**	**64,253**	**165,212**

Source: JICA Study Team

6.3 Alternative A

This section aims to present an approximate project cost for the alternative case of the service berths termed as Alternative A. This alternative has taken into consideration the possibility of budget limitations during the implementation period. Thus, in order to minimize the project cost, the JICA Study Team omitted some items from the Base Case such as the dredger service berth; (A1) the length was shortened from 450 m to 250 m; (A2) Dredging work was omitted, assuming the possibility that this item of works might be sourced out from or undertaken by one of the Iraqi government agencies that might have the capability to do so. For the other items that were omitted based on need basis, please refer to Table 6.3-3.

(1) Conditions of Estimation

Basic conditions for the estimates are as follows:

a) Base year for the estimation

Year 2015

b) Exchange rates, on the average, as of June 2015 for TTS rate of BTMU

USD 1 = JPY 124.75

c) Contingency

Percentages shown below are adopted for the calculation of contingencies for both reserves and price escalation.

Contingency for construction	: 10%
Contingency for engineering services	: 15%

d) Administration cost and others

Land acquisition and compensation cost	: not included
Administration cost	: 5% of each construction cost and engineering services cost
Value-added tax	: not included
Sales and other taxes	: not included

(2) Project Components (Alternative A)

Priority project components are shown in 3.

(3) Project Cost Estimate (Alternative A)

Table 6.3-4 summarizes the service berth construction and basic equipment procurement cost. The cost estimate consists of the construction cost for dredger berths only, procurement of general operational equipment, engineering services, and other administrative costs including taxes and contingencies.

a) Data Collection on Cost Estimation

Same as the Base Case.

b) Allocation of Project Costs between Japanese Procurement and Local Procurement

The total estimated project costs will be shared by the Japanese procurement portion and the local procurement portion. The proposed allocation of the procurement portion is as follows:

Table 6.3-1 Allocation of Procurement Portion

No.	Project Components	Japanese Procurement Portion	Local Procurement Portion	Remarks
A	Dredger Berth Construction	70%	30%	
B	Tugboat Berth Construction	0%	0%	
C	Procurement of Equipment	100%	0%	

Source: JICA Study Team

(4) Work Schedule (Alternative A)

The projected work schedule, which is shown in Table 6.3-5, comprises the preparatory works, construction of dredger berth, procurement of equipment including fabrication, and delivery and installation/commissioning at the site.

Table 6.3-2 Estimated Duration of Project Components

No.	Project Components	Construction Period
A	Dredger Berth Construction	21 months
B	Tugboat Berth Construction	Not applicable for Alternative A
C	Procurement of Equipment	12 months

Source: JICA Study Team

(5) Work Method Outline and Construction Plan (Alternative A)

1) A. Dredger Service Berth: 21 months (total duration)

a) A0: Preparatory Works (mobilization to Iraq, site office set up): Six months

b) A1: Service Berth Construction

- Open Pier Type Berth Construction: Nine months

  ・Steel pile driving by crane barge
  ・Productivity: Three piles are driven per day
  ・The concrete slab works will take about three months after the steel pile driving.
  ・The activity ratio was considered at 0.70.

- Steel Sheet Pile Retaining Wall Construction: Three months

  ・Steel sheet pile driving by crane barge
  ・Productivity: 270 lm of sheet piles are driven per day
  ・The concrete parapet works and tie rod works will take two months after the steel sheet pile driving.
  ・The activity ratio was considered at 0.70.

- Mooring Pile Driving and Construction: Two months

  ・Steel pile driving by crane barge
  ・Productivity: Two piles are driven per day
  ・The fender facility and accessory works will take a month after the steel pile driving.
  ・The activity ratio was considered at 0.70.

- Access Bridge Construction: Three months

・Steel pile driving by crane barge
・Productivity: Two piles are driven per day
・The access bridge is steel structure. Steel structure works will take two months right after steel pile driving.
・The activity ratio was considered at 0.70.

c) A2: Dredging Works: To be carried out by GCPI before pile driving work

・First activity before the start of pile driving

d) A3: Reclamation Works: Six months

・Reclaim from land and water side
・Productivity: 2,000 m^3 per day
・The activity ratio was considered at 0.70.

e) A4: Soil Improvement Works: Not considered for Alternative A

f) A5: Pavement Works: Three months

・Only low cost road construction for temporary access to the dredger berth

g) A6: Infrastructure Works: Five months

・Water supply
・Electrical supply system

h) A7: Building Works: Ten months

・Building works are carried out after reclamation work
・Administration office
・Workshop and warehouse

2) B. Tugboat Berth Construction: Not considered for Alternative A

3) C. Procurement of Equipment: 12 months (total duration)

・Production of equipment, procurement

(6) Fund Disbursement

Table 6.3-6 summarizes the projected monthly and annual fund disbursements, which include the construction and equipment procurement costs. Projections are for a 21-month period.

Table 6.3-3 Project Components for Service Berth (Alternative A)

No. 1	Project Component Service Berth Components for Base Case	Service Berth Development (Base Case)
A.	Dredger Berth	
A1	Service Berth	L=250 m Berth, Depth -9.0 m
A2	Dredging	N/A
A3	Reclamation	Approx. V=240,800 m^3
A4	Soil Improvement	N/A
A5	Pavement	Approx. A=12,500 m2, (Gravel pavement, ICB)
A6	Infrastructure (Utility, electricity, drainage)	Electricity, Fence
A7	Buildings	Administration Office, Workshop, and Warehouse
B.	Tug Berth	
B1	Service Berth	N/A
B2	Dredging	N/A
B3	Reclamation	N/A
B4	Soil Improvement	N/A
B5	Pavement	N/A
B6	Infrastructure (Utility, electricity, drainage)	N/A
B7	Buildings	N/A
C.	Procurement of Equipment	
C1	Mobile Crane: 50 t	Lifting Capacity 50 t: 1 Nr
C2	Mobile Crane: 15 t	Lifting Capacity 15 t: 1 Nr
C3	Fork Lift: 3 t	Lifting Capacity 3 t: 1 Nr
C4	Fork Lift: 20 t	Lifting Capacity 20 t: 1 Nr
C5	Truck Trailer: 15 t	Loading Capacity 15 t: 1 Nr

Source: JICA Study Team

Table 6.3-4 Service Berth Construction and Equipment Procurement Cost (Alternative A)

USD 1= JPY 124.75

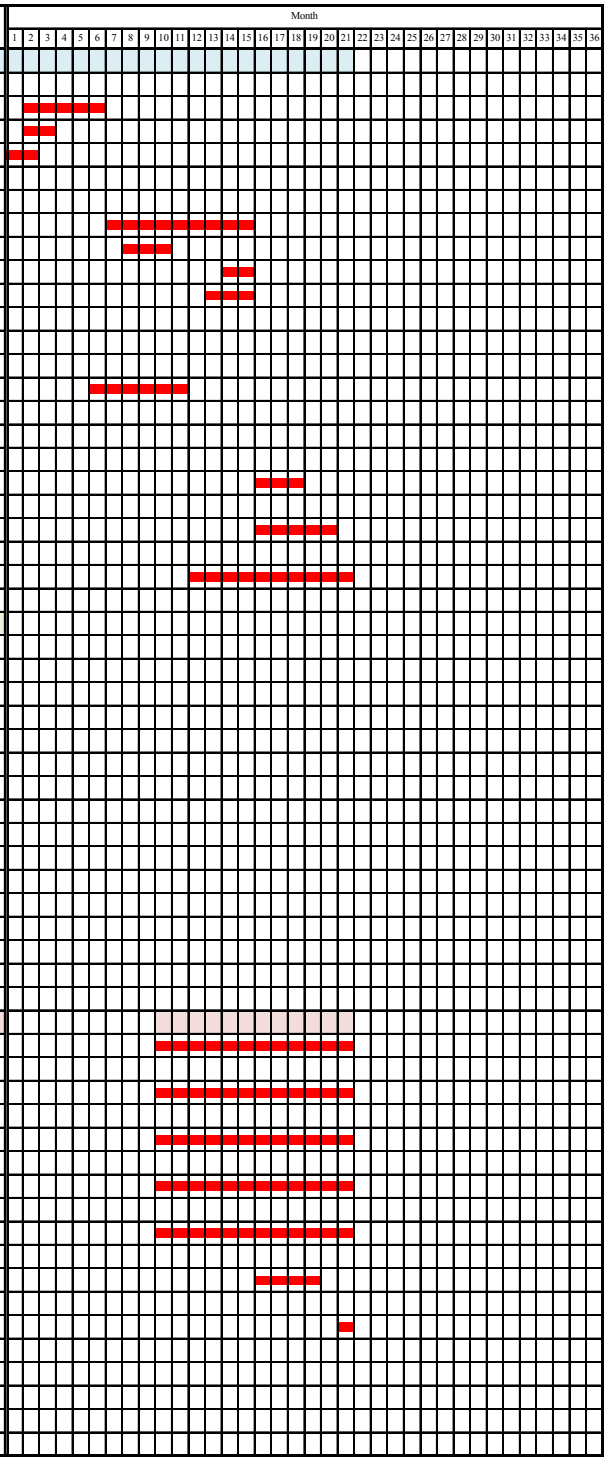
No.	Project Components	Unit	Q'ty	FC		LC	Total
				JPY 1,000	USD 1,000	USD 1,000	USD 1,000
I.	Procurement and Construction			216,217	38,297	16,245	56,276
	A. Dredger Berth	LS	1	0	34,816	14,768	49,584
	A1 Service Berth	LS	1	0	34,816	0	34,816
	A2 Dredging	0	0	0	0	0	0
	A3 Reclamation	LS	1	0	0	9,652	9,652
	A4 Soil Improvement	0	0	0	0	0	0
	A5 Pavement	LS	1	0	0	862	862
	A6 Infrastructure (utility, electricity, drainage)	LS	1	0	0	2,501	2,501
	A7 Buildings	LS	1	0	0	1,754	1,754
	B. Tugboat Berth	LS	0	0	0	0	0
	B1 Service Berth	0	0	0	0	0	0
	B2 Dredging	0	0	0	0	0	0
	B3 Reclamation	0	0	0	0	0	0
	B4 Soil Improvement	0	0	0	0	0	0
	B5 Pavement	0	0	0	0	0	0
	B6 Infrastructure (utility, electricity, drainage)	0	0	0	0	0	0
	B7 Buildings	0	0	0	0	0	0

No.		Project Components	Unit	Q'ty	FC		LC	Total
					JPY 1,000	USD 1,000	USD 1,000	USD 1,000
I.	Procurement and Construction (continuation)							
	C.	Procurement of Equipment			196,561	0	0	1,576
	C1	Mobile Crane: 50 t	Nr	1.0	111,250	0	0	892
	C2	Mobile Crane: 15 t	Nr	1.0	16,193	0	0	130
	C3	Fork Lift: 3 t	Nr	1.0	6,502	0	0	52
	C4	Fork Lift: 20 t	Nr	1.0	18,502	0	0	148
	C5	Truck Trailer: 15 t	Nr	1.0	10,000	0	0	80
		Freight and Insurance	%	16.0	25,992	0	0	208
		Provisional Costs for Spare Parts	%	5.0	8,122	0	0	65
	D.	Base Construction Costs（A+B+C)			196,561	34,816	14,768	51,160
	E.	Contingency (10% of D)		10%	19,656	3,482	1,477	5,116
		Contingency (Price Escalation), included in above 4						
II.	Engineering Services				12,432	2,202	934	3,236
	1.	Base Costs for Engineering (5% of I)		5%	10.811	1,915	812	2,814
	2.	Contingency (15% of 1)		15%	1,622	287	122	422
III		Subtotal (I+II)			228,649	40,500	17,179	59,512
IV		Administration Costs and Others			11,432	2,025	859	2,976
	a.	Land Acquisition and Compensation						
	b.	Administration Cost (5% of III)		5%	11,432	2,025	859	2,976
	c.	Value-added Tax (VAT)						0
	d.	Sales and Other Taxes						0
V		Grand Total（III+IV)			240,082	42,525	18,038	62,487

Source: JICA Study Team

Table 6.3-5 Project Work Schedule (Alternative A)

No.	WORKING ITEM	Unit	Q'ty	Duration (month)
Dredger Berth				
A0	**Preparation**			
	Transport Material	L.S	1.0	5.0
	Mobilization and Demobilization	L.S	1.0	2.0
	Site Office	L.S	1.0	2.0
A1	**Service Berth**			
	Open Pier type	m	250	9.0
	Sheet Pile type	m	310	3.0
	Mooring Pile	Nrs.	12	2.0
	Access Bridge	m	180	3.0
A2	**Dredging work**	m3	0	0.0
A3	**Reclamation**	m3	240,800	6.0
A4	**Soil Improvement**	m2	0	0.0
A5	**Pavement**	m2	12,634	3.0
A6	**Infrastructure (electricity, Fence)**	LS	1	5.0
A7	**Buildings**	LS	1	10.0
Tugboat Berth				
B1	**Service Berth**			
	Sheet Pile type	m	0	0.0
B2	**Dredging work**	m3	0	0.0
B3	**Reclamation**	m3	0	0.0
B4	**Soil Improvement**	m2	0	0.0
B5	**Pavement**	m2	0	0.0
B6	**Infrastructure (utility, electricity, drainage, ISPS etc.)**	LS	0	0.0
B7	**Buildings**	LS	0	0.0
Procurement of Equipment				
C1	Mobile Crane 50tons	Nrs.	1	12.0
C2	Mobile Crane 15tons	Nrs.	1	12.0
C3	Fork Lift 3tons	Nrs.	1	12.0
C4	Fork Lift 20tons	Nrs.	1	12.0
C5	Track trailer 15tons	Nrs.	1	12.0
C6	Freight&Insurance	LS	1	4.0
C7	Spare Parts	LS	1	1.0



Source: JICA Study Team

Table 6.3-6 Projected Monthly and Annual Fund Disbursement Summary (Alternative A)

USD 1= JPY 124.75

Month	Month				Year	Year			
	FC Portion		LC Portion (USD 1,000)	Total (USD 1,000)		FC Portion		LC Portion (USD 1,000)	Total (USD 1,000)
	(JPY 1,000)	(USD 1,000)				(JPY 1,000)	(USD 1,000)		
1	29,484	5,222	2,215	7,674	1	29,484	27,647	10,568	38,451
2	0	0	0	0					
3	0	0	0	0					
4	0	0	0	0					
5	0	0	0	0					
6	0	0	1,367	1,367					
7	0	1,739	1,367	3,107					
8	0	5,735	1,367	7,103					
9	0	5,735	1,367	7,103					
10	0	5,735	1,367	7,103					
11	0	1,739	1,367	3,107					
12	0	1,739	149	1,889					
13	0	2,085	149	2,234	2	167,077	7,169	4,200	12,709
14	0	2,542	149	2,691					
15	69,040	2,542	149	3,245					
16	11,046	0	818	907					
17	0	0	818	818					
18	0	0	818	818					
19	11,046	0	574	663					
20	0	0	574	574					
21	75,944	0	149	758					
22	0	0	0	0					
23	0	0	0	0					
24	0	0	0	0					
25	0	0	0	0	3	0	0	0	0
26	0	0	0	0					
27	0	0	0	0					
28	0	0	0	0					
29	0	0	0	0					
30	0	0	0	0					
31	0	0	0	0					
32	0	0	0	0					
33	0	0	0	0					
34	0	0	0	0					
35	0	0	0	0					
36	0	0	0	0					
	196,561	34,816	14,768	51,160	Total	196,561	34,816	14,768	51,160

Source: JICA Study Team

CHAPTER 7

Chapter 7. Evaluation of Project

7.1 Economic Analysis

(1) General

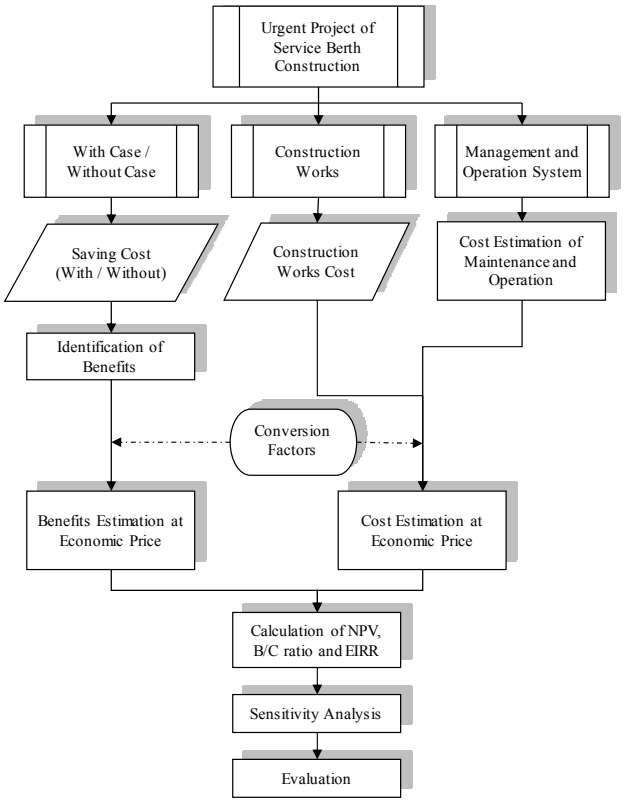
The purpose of the economic analysis is to assess the economic feasibility of the project on the target year from the viewpoint of the national economy. In this chapter, the economic benefits and costs are calculated with economic price and to evaluate whether the benefits exceed those that could be obtained from other investment opportunities in Iraq.

(2) Methodology of Economic Analysis

Economic analysis is assessed by the following method:

The urgent project ("With case") is defined and it is compared to the "Without the project" case (hereinafter referred to as the "Without case"). All benefits and costs in market price of the difference between "With case" and "Without case" is calculated and converted to economic price. All benefits and costs are evaluated at economic prices.

In this study, the Net Present Value (NPV), the benefit/cost ratio (B/C ratio) and the economic internal rate of return (EIRR) based on a cost-benefit analysis are used to assess the feasibility of the urgent project. The EIRR is a discount rate, which makes the costs and the benefits of the project during the project life equal. The benefit/cost ratio is obtained by dividing the benefits by costs based on the present value. The flow of the economic analysis is shown in figure below.



Source: JICA Study Team

Figure 7.1-1 Procedure of Economic Analysis

Service berths are consisted of two major components, one is for dredger and survey boat, and the other is for tug boat and other work boat. However, the service berth facilities for tug and other work boat is removed from this economic analysis because its development will be implemented

by a private terminal operator under a contract between GCPI and the operator. On the other hand, two options are evaluated in the economic analysis of the service berth for dredger and tug boat: one is a development of full facilities as a Base Case and the other is the most basic facilities as an Alternative-A for cost reduction.

The benefit of the two options under the urgent project is listed as follows.

- Development of service berth to provide bunker, water and crew exchange of dredger and survey boat safely,
- Full use of cargo berth for merchant vessel without time loss by berth waiting during provision of bunker, water and crew exchange of dredger and survey boat.

1) Based Year

The year of 2015 is applied as base year mentioned in the Section of "6.2 of chapter6. Preliminary Cost Estimates for Service Berth".

2) Project Life

The project life (the period calculation) in the economic analysis is assumed to be thirty three (33) years from the year 2016 to the year 2048. The reason set such duration is a depreciation period of service berth facilities, which is at thirty years after completion of the facilities.

3) Foreign Exchange Rate

The Exchange rate adopted for this study is US$ 1.00 = JPY 124.75, the same rate are used in the project cost estimation.

4) "With Case" and "Without Case"

A cost-benefit analysis is conducted on the difference between the "With case" in which an investment is made and the "Without case" in which no investment is made, that is; the benefits and costs arising from the investment for the project are compared.

Dredger and survey boat do not have any docking facility as exclusive use to be supplied bunker oil, water and crew exchange unless the urgent project is implemented. The exclusive use of berth for dredger and survey boat has some merits such as operation efficiency and safety and reduction of operation cost. In addition, berth congestion of merchant ships under "Without case" will be heavier than those of "With case". The ship's waiting by the berth congestion will produce additional demurrage cost and loss of time value (opportunity cost) of cargo, whose cost and loss will be shifted to and a burden of Iraqi.

(3) Economic Price

1) General

For the economic analysis, all prices must be expressed as economic prices. In general, the construction costs, the operation costs and the maintenance costs are estimated at market prices. In addition, the market prices often include transfer items, such as customs duties, subsidies, etc. Therefore, the market prices have to be converted into economic prices by using conversion factor and eliminating these transfer elements.

2) Standard Conversion Factor (SCF)

Customs duties create a price difference between the domestic market and the international market. The SCF is used to determine the economic price of non-tradable goods that have only market prices.

In this study, the SCF is tentatively set at 85% for conversion to the economic price from the project cost estimated based on the market prices.

(4) Economic Benefits of the Project

1) Benefit Extraction

Impact of project implementation varies with each project but main impacts on this urgent project and methods of evaluation are considered as below:

Table 7.1-1 Impact and Evaluation Method

Category		Item		Evaluation
User	Transportation	・Non		
	Recreation	・Non		
	Environment	・Non		
	Safety	・Decrease of accident ・Safety improvement on berthing and storage, etc.	⇒	Qualitative evaluation: i.
	Operation	・Reduction of operation cost	⇒	Quantitative evaluation: ii.
Local Society	Local economy	・Increase of salary and employment on utilization of facilities and construction of facilities ・Secured local industry	⇒	n.a.
Public	Taxes	・Increase of tax income	⇒	n.a.

Source: JICA Study Team

a) Decrease of accident / Safety improvement on berthing

Development of service berth will contribute to congestion reduction between dredger/ survey boat and cargo vessel in UQP and KZP. The congestion reduction will result in improvement of navigation efficiency and decrease of sea accident. The development will also specify a berth for dredger and survey boat, and these ships can be docked at the berth at all time and safely. In that context safety of port security and port management will be enhanced. These benefit is, however, difficult to measure so that it is taken in qualitative evaluation.

b) Reduction of operation cost

Development of service berth will contribute reduction of operation cost and loss of time value (opportunity cost). Dredger and survey boat have no choice to dock at cargo berth for provision of water, bunker and crew exchange despite of cargo vessel waiting unless the urgent project is implemented. This situation occurs extra cargo vessel's demurrage cost, loss of opportunity cost of cargo and increase of operation cost such as truck driver and port labor.

2) Benefit Item

As above-mentioned in benefit extraction, we can measure reduction of cost as economic benefits of the urgent project. Items of the economic benefit are considered as below:

- Saving of demurrage cost
- Saving of time value (opportunity cost) of cargo
- Saving of truck driver and port labor cost

3) Calculation of Benefit

Unit value of saving cost between "With case" and "Without case" and object quantity both of "With case" and "Without case" are mentioned below. Benefit is converted to economic price by SCF in the economic evaluation.

Mooring pile facilities of the Alternative A is less inconvenient for crew exchange and provision of water, fuel and others stuff than bunkering berth facilities of the Base Case. Therefore, benefit, viz. cost saving between "With case" and "Without case", of the Alternative A is assumed to be about half of that of the Base Case. On the other hand, convenience of dredger berth facilities on

the Alternative A is considered to be equal to that of the Base Case so both benefits at the dredger berth can be deemed to be equal. So the benefit ratio of the Alternative A is at three-quarters (0.75 = (0.5+1) / (1+1)) of that of the Base Case. In addition, any benefit does not generate in 2019 in the Base Case because construction work is continued at the year.

a) Saving of demurrage cost

"With case"

Dredger and survey boat moor at the new wharf and/or pile under the urgent project so any waiting time does not occur general cargo vessels.

"Without case"

Dredger and survey boat moor at wharf of general cargo terminal such as berth No. 12, and 13 (total 400m) so additional waiting time occurs general cargo vessels.

- Unit value of saving cost

It is not considered that any dredger and survey boat docks at container wharf of private operator granted by GCPI as concession. The dredger and survey boat moor at entrance side of channel mouth of UQP North, not depth of the channel such as berth No. 21 (Ro-Ro wharf) in "Without case". In addition, berth No. 2 and 3 for dry bulk is too short to some dredgers for stay. Therefore, an object of demurrage is general cargo vessel which moors at berth No 12 and 13 operated by GCPI.

Assumptions for demurrage estimation is mentioned in table below.

Table 7.1-2 Assumption of Demurrage Cost for General Cargo Vessel

Personnel Cost	Annual salary (USD)	Divisor	Per hour (USD)
Crew	30,000	3,168 hours= 12month*22days*12hrs	9.5
Captain	100,000	3,168 hours= 12month*22days*12hrs	31.5
Operation Cost (40,000DWT vessel)	Daily Cost (USD)	Divisor	Per hour
Fuel on berthing	5,100	24 hours	212.5
Electricity on berthing	6,100	24 hours	254.2
Construction Cost	Initial Cost (USD)	Divisor	Per hour
General cargo vessel (40,000DWT)	70,000,000	175,200 hours= 20years*365days*24hrs	399.5

Source: JICA Study Team

The demurrage of general cargo vessel is summarized in Table 7.1-3. The demurrage cost can be said around 1,085 USD per hour.

Table 7.1-3 Demurrage Cost per Hour of General Cargo Vessel (40,000DWT)

4,000DWT vessel	Unit Price	Q'ty	Amount (USD/h)
Crew per hr	9.5	20	190.0
Capt. per hr	31.5	1	31.5
Fuel per hr	212.5	1	212.5
Elect per hr	254.2	1	254.2
Depreciation per hr	399.5	1	399.5
			1,087.7

Source: JICA Study Team

- Quantity: queuing time

The Study Team assumes that berthing of dredger and survey boat at berth No. 12 and 13 makes general cargo vessels wait. Hence, queuing theory of M/M/s is applied to estimate additional waiting time of general cargo vessel. The queuing theory of M/M/s on Little's low is expressed formulas below:

$$W_q = L_q / \lambda$$

where W_q: Waiting time of vessel from arrival to start of port service,
$1/\lambda$: Average arrival time (hour).

The L_q is expressed below:

$$L_q = \{\rho(s\rho)^s / s!\,(1-\rho)^2\} P_0$$

where L_q: Number of vessel in the queuing,

s: Number of service window, number of berth for general cargo.

The ρ and P_0 are also expressed below:

$$\rho = \lambda / s\mu$$

$$P_0 = 1 / \{\Sigma_{n=0}^{s-1}[(s\rho)^n / n!] + [(s\rho)^s / s!(1-\rho)]\}$$

where ρ: Average occupancy,
λ: Average arrival rate of vessel per hour,
$1/\mu$: Average service hours per vessel,
P_0: Probability of no vessel in the queue,
n: Number of vessel in the queue.

Tables below show input data, L_q and P_0.

Table 7.1-4 Input Data for Calculation

WITH	2015	2025	2035	WITHOUT	2015	2025	2035
Ship call/year	250	311	401	Ship call/year	250	311	401
λ=	0.0287	0.0357	0.0460	λ=	0.0287	0.0357	0.0460
1/λ=	34.85	28.01	21.73	1/λ=	34.85	28.01	21.73
1/μ=	115.40	113.45	112.02	1/μ=	115.40	113.45	112.02
s=	9	9	9	s=	7	7	7
ρ=	0.3679	0.4500	0.5729	ρ=	0.4731	0.5785	0.7366

Source: JICA Study Team

Table 7.1-5 Lq and P0 at 2015, 2025 and 2035

WITH	2015	2025	2035	WITHOUT	2015	2025	2035
P_0	0.0364	0.0174	0.0057	P_0	0.0362	0.0169	0.0050
L_q	0.0044	0.0209	0.1264	L_q	0.0534	0.1952	1.0144

Source: JICA Study Team

Results of Wq in 2015, 2025 and 2035 is 429 hours, 1,527 hours and 7,779 hours, respectively. Table below shows queuing time every year calculated by sequence of numbers with common difference based on the results of Wq in 2015, 2025 and 2035. It is assumed to remain the same queuing time after 2035.

Table 7.1-6 Result of Queuing Time

Year	Hours	Year	Hours
2019	868	2028	3,403
2020	978	2029	4,028
2021	1,088	2030	4,653
2022	1,198	2031	5,278
2023	1,308	2032	5,904
2024	1,417	2033	6,529
2025	1,527	2034	7,154
2026	2,152	2035	7,779
2027	2,778		

Source: JICA Study Team

- Saving of demurrage cost

Table 7.1-7 Saving of Demurrage Cost

Year	Queuing	Demurrage (USD)	SCF	Base Case Benefit (1) ('000 USD)	Alternative-A Benefit (1)*0.75 ('000 USD)
2019	868	1,085	0.85	801	601
2020	978	1,085	0.85	902	676
2021	1,088	1,085	0.85	1,003	752
2022	1,198	1,085	0.85	1,105	828
2023	1,308	1,085	0.85	1,206	904
2024	1,417	1,085	0.85	1,307	980
2025	1,527	1,085	0.85	1,408	1,056
2026	2,152	1,085	0.85	1,985	1,489
2027	2,778	1,085	0.85	2,562	1,921
2028	3,403	1,085	0.85	3,138	2,354
2029	4,028	1,085	0.85	3,715	2,786
2030	4,653	1,085	0.85	4,291	3,219
2031	5,278	1,085	0.85	4,868	3,651
2032	5,904	1,085	0.85	5,445	4,084
2033	6,529	1,085	0.85	6,021	4,516
2034	7,154	1,085	0.85	6,598	5,948
2035	7,779	1,085	0.85	7,175	5,381

Note: any saving cost does not generate in 2019 in Base Case
Source: JICA Study Team

b) Saving of time value (opportunity cost) of cargo

"With case"

The dredger and survey boat moor at the new wharf and/or pile under the urgent project so any waiting time does not occur general cargo vessels. Therefore, neither occurs time loss of cargo transportation caused by berthing at existing facilities of dredger and survey boat.

"Without case"

Dredger and survey boat moor at wharves of general cargo terminal such as berth No. 12 and 13 (total 400m) so extra waiting time for berthing occurs time loss of cargo transportation.

- Unit value of saving cost

Time value on basic unit of cargo in 2003 was estimated by MLIT of Japan, data are summarized in table below. Mean time value of cargo in 2003 is calculated at 4.34 USD by applying 114 JPY/USD which is the average exchange rate in 2003.

Table 7.1-8 Time Value on Basic Unit of Cargo in 2003

Cargo type	JPY/ton/hr
Agricultural and Fishery Products	130
Mineral Products	604
Miscellaneous Manufactured Articles	653
Special Purpose Products	604
Others	484
as of 2003	495
	USD/ton/hr
Mean time value	**4.34**

Source: A report of cost-effectiveness analysis on each project by MLIT of Japan

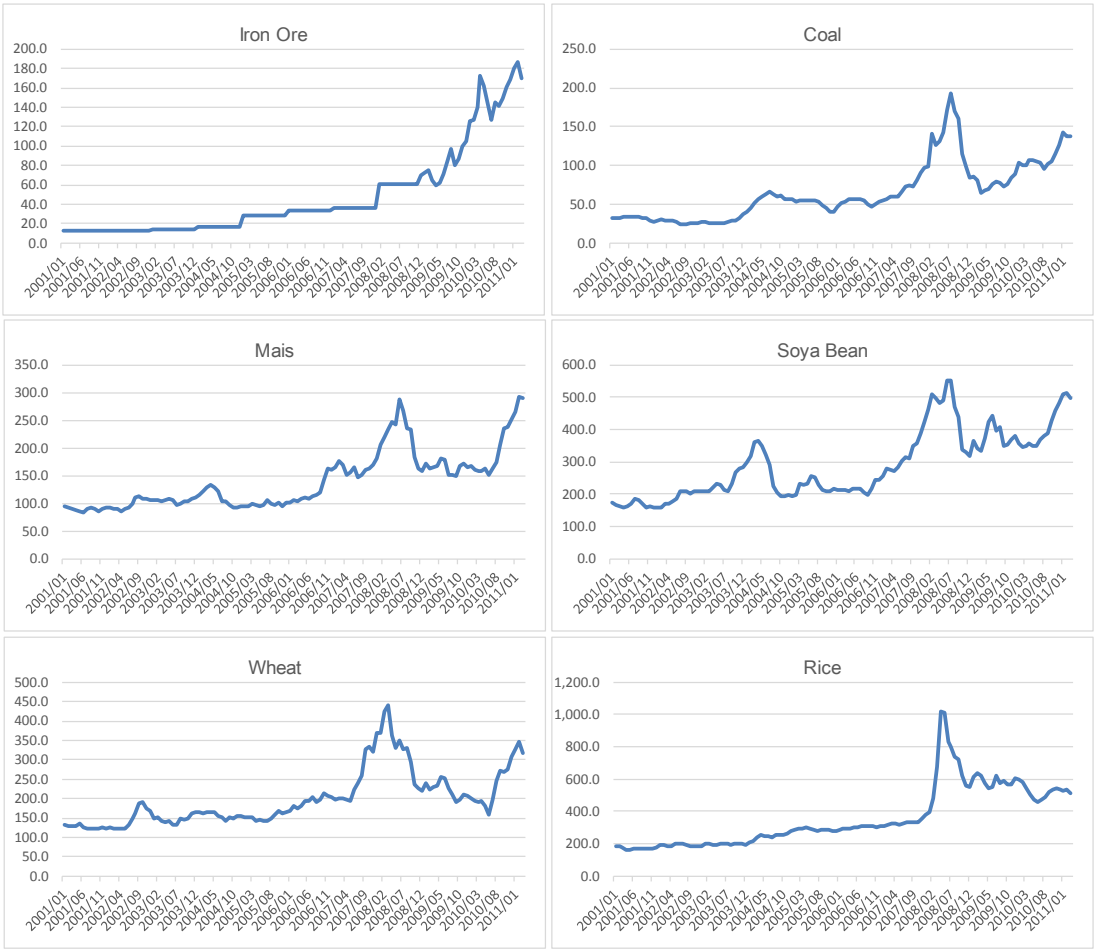
Table and figure below shows price changes of major resources for 10 years from 2001. It is found that price is inflated minimum 53% up and maximum 1,060% up by comparing between 2003 and 2010. A raise in price is obvious trend in the decade due to shortage of resources by economic growth of developing country.

Table 7.1-9 Price Change of Major Resources

Unit price	USD/barrel	US cent/ton	USD/ton	USD/ton	USD/ton	USD/ton	USD/ton	USD/ton
Y/M	Crude Oil	Iron Ore	Coal	Copper	Mais	Soya Bean	Wheat	Rice
2001	25.9	13.0	32.3	1,580.2	89.6	168.8	126.8	172.7
2002	26.1	12.7	27.1	1,560.3	99.3	188.8	148.5	191.8
2003	31.1	13.8	28.0	1,779.4	105.2	233.3	146.2	199.5
2004	41.4	16.4	56.7	2,863.5	111.8	276.8	156.9	245.8
2005	56.5	28.1	51.0	3,676.5	98.4	223.2	152.4	287.8
2006	66.0	33.5	52.6	6,731.4	121.6	217.4	191.7	303.5
2007	72.3	36.6	70.4	7,131.6	163.3	317.3	255.2	332.4
2008	99.6	61.6	136.2	6,963.5	223.3	453.3	326.0	700.2
2009	61.7	80.0	77.0	5,165.3	165.5	378.5	223.5	589.4
2010	79.4	146.7	106.0	7,538.4	186.0	385.0	223.7	520.6
2010/2003	2.55	10.63	3.79	4.24	1.77	1.65	1.53	2.61

Note: Crude Oil (WTI spot price), Iron Ore (Brasil contract price to Euro) , Coal (Australia spor price), Copper (spot price of London Metal Exchange), Mais (produce of USA), Soya Bean (produce of USA, Rotterdam FX), Wheat (produce of USA), Rice (produce of Thailand)

Source: IMF



Source: IMF data

Figure 7.1-2 Price Trend of Major Resources

Data of the table and figure is not the latest one but it can be said the trend of high price under a condition of high demand is and will be continuing. Therefore, the Study Team is set mean time value of cargo at 8.50 USD, which is 100 % up of the time value in 2003, as safer side.

Table 7.1-10 Time Value on Basic Unit of Cargo for Economic Analysis

Mean time value	USD/hr/ton
as of 2003	4.34
Unit value of saving cost	**8.50**

Source: JICA Study Team

Table below shows weighted average productivity handled at Berth No. 12 and 13 of UQP North in 2025 and 2035. The weighted average productivity is calculated by using of daily productivity and cargo volume in Table 7.1-11. Hourly productivity is divided a daily productivity by 21 (=24 hours minus 3 hours for 1hour shift change, three times a day).

The result is at 146 ton/hour.

Table 7.1-11 Calculation of Weighted Average Productivity

Commodity	2025			2035		
	Productivity	Cargo Vol.	W. average	Productivity	Cargo Vol.	W. average
Rice	4,000	1,211,000	1,746	4,000	1,416,000	1,599
Sugar(GC)	2,000	773,000	557	2,000	1,129,000	637
Steel Plate/Pipe	3,000	325,000	351	5,000	496,000	700
General Cargo(UQP)	1,500	465,000	251	2,000	502,000	283
Total	---	2,774,000	2,906	---	3,543,000	3,219
Ton/hour			138			153
					Average	**146**

Source: JICA Study Team

The time value of general cargo is summarized in Table 7.1-12. Time cost of general cargo is 1,240 USD per hour.

Table 7.1-12 Time Cost of General Cargo

Time value of cargo	8.50 USD/ton/hour
Productivity	146 ton/hour
	1,241.0 USD/hour

Source: JICA Study Team

- Queuing time

The same queuing time mentioned in a section of demurrage is applied because it is considered that demurrage offshore makes time value of general cargo loss.

- Saving of time value (opportunity cost) of cargo

Table 7.1-13 Saving of Time Value of Cargo

Year	Queuing	Time Value (USD)	SCF	Base Case Benefit (1) ('000 USD)	Alternative-A Benefit (1)*0.75 ('000 USD)
2019	868	1,240	0.85	915	686
2020	978	1,240	0.85	1,031	773
2021	1,088	1,240	0.85	1,147	860
2022	1,198	1,240	0.85	1,262	947
2023	1,308	1,240	0.85	1,378	1,034
2024	1,417	1,240	0.85	1,494	1,120
2025	1,527	1,240	0.85	1,610	1,207
2026	2,152	1,240	0.85	2,269	1,701
2027	2,778	1,240	0.85	2,928	2,196
2028	3,403	1,240	0.85	3,587	2,690
2029	4,028	1,240	0.85	4,246	3,184
2030	4,653	1,240	0.85	4,905	3,678
2031	5,278	1,240	0.85	5,564	4,173
2032	5,904	1,240	0.85	6,223	4,667
2033	6,529	1,240	0.85	6,881	5,161
2034	7,154	1,240	0.85	7,540	5,655
2035	7,779	1,240	0.85	8,199	6,150

Note: any saving cost does not generate in 2019 in Base Case

Source: JICA Study Team

c) Saving of driver and port labor cost

"With case"

The dredger and survey boat moor at the new wharf and/or pile under the urgent project so any waiting time for berthing of the dredger and survey boat do not occur general cargo vessels. Therefore, no extra time to wait for starting of general cargo unloading occurs truck driver and port labor.

"Without case"

Dredger and survey boat moor at wharves of general cargo terminal such as berth No. 12 and 13 (total 400m) so additional waiting time for berthing occurs truck driver of unloaded general cargo.

- Unit value of saving cost

24 truck drivers and 45 port labors per hour are assumed to wait for starting of general cargo unloading additionally. Unit value of saving cost of driver and labor is summarized in table below. The saving cost per hour is at 300 USD.

Table 7.1-14 Unit Value of Saving Cost of Driver and Labor

	Unit Price	Divisor	Q'ty	Amount (USD/h)
Truck driver and operation cost	40 USD/day	8 hours	24 trucks/hour/berth	120.0
Port labor	32 USD/day	8 hours	45 labors/hour (15 labors x 3 gangs)	180.0
TOTAL				**300.0**

Source: JICA Study Team

- Queuing time

The same queuing time mentioned in the section of demurrage and time value of general cargo is applied because it is considered that vessel waiting offshore makes driver and labor cost increase.

- Saving of driver and labor cost

Table 7.1-15 Saving Cost of Truck Driver and Port Labor

Year	Queuing	Hourly Cost (USD)	SCF	Base Case Benefit (1) ('000 USD)	Alternative-A Benefit (1)*0.75 ('000 USD)
2019	868	300	0.85	221	166
2020	978	300	0.85	249	187
2021	1,088	300	0.85	277	208
2022	1,198	300	0.85	305	229
2023	1,308	300	0.85	333	250
2024	1,417	300	0.85	361	271
2025	1,527	300	0.85	389	292
2026	2,152	300	0.85	549	412
2027	2,778	300	0.85	708	531
2028	3,403	300	0.85	868	651
2029	4,028	300	0.85	1,027	770
2030	4,653	300	0.85	1,187	890
2031	5,278	300	0.85	1,346	1,010
2032	5,904	300	0.85	1,505	1,129
2033	6,529	300	0.85	1,665	1,249
2034	7,154	300	0.85	1,824	1,368
2035	7,779	300	0.85	1,984	1,488

Note: any saving cost does not generate in 2019 in Base Case
Source: JICA Study Team

d) Total benefit

Total benefit is the sum of a) ~ c) evaluated in the concept of economic benefit. It is shown for whole project life in Table 7.1-16.

Table 7.1-16 Total Benefit of Service Berth During Project Life in Base Case

Year	Demurrage Cost Saving	Cargo Time-Cost Saving	Driver/Labor's Waiting Cost Saving	Benefit Total
2019	0	0	0	0
2020	902	1,031	249	2,182
2021	1,003	1,147	277	2,427
2022	1,105	1,262	305	2,672
2023	1,206	1,378	333	2,917
2024	1,307	1,494	361	3,162
2025	1,408	1,610	389	3,408
2026	1,985	2,269	549	4,803
2027	2,562	2,928	708	6,198
2028	3,138	3,587	868	7,593
2029	3,715	4,246	1,027	8,988
2030	4,291	4,905	1,187	10,383
2031	4,868	5,564	1,346	11,778
2032	5,445	6,223	1,505	13,173
2033	6,021	6,881	1,665	14,568
2034	6,598	7,540	1,824	15,962
2035	7,175	8,199	1,984	17,358
≀	≀	≀	≀	≀
2048	7,175	8,199	1,984	17,358
Total	145,998	166,855	40,368	353,221

Note: any saving cost does not generate in 2019 in Base Case
Source: JICA Study Team

Table 7.1-17 Total Benefit of Service Berth During Project Life in Alternative-A

Year	Demurrage Cost Saving	Cargo Time-Cost Saving	Driver/Labor's Waiting Cost Saving	Benefit Total
2019	601	686	166	1,453
2020	676	773	187	1,637
2021	752	860	208	1,820
2022	828	947	229	2,004
2023	904	1,034	250	2,188
2024	980	1,120	271	2,372
2025	1,056	1,207	292	2,556
2026	1,489	1,701	412	3,602
2027	1,921	2,196	531	4,648
2028	2,354	2,690	651	5,694
2029	2,786	3,184	770	6,741
2030	3,219	3,678	890	7,787
2031	3,651	4,173	1,010	8,833
2032	4,084	4,667	1,129	9,879
2033	4,516	5,161	1,249	10,926
2034	4,948	5,655	1,368	11,972
2035	5,381	6,150	1,488	13,018
≀	≀	≀	≀	≀
2048	5,381	6,150	1,488	13,018
Total	110,099	125,827	30,442	266,369

Note: any saving cost does not generate in 2019 in Base Case
Source: JICA Study Team

(5) Economic Cost of the Project

1) Project Costs

As mentioned in previous chapter, table below is disbursement schedule for service berth as the urgent project including contingency of construction (20% as the Base Case and 10% as the Alternative-A of construction cost, respectively), engineering fee (5% of construction cost plus its' contingency) and contingency of engineering (15% of engineering fee).

Table 7.1-18 Disbursement Schedule of Service Berth in Base Case

Year	Dreger & survey boat berth		Enginnering
	Civil ('000USD)	Equipment ('000USD)	('000USD)
2016	0	0	2,015
2017	69,810	284	2,015
2018	56,634	804	3,303
2019	5,888	804	385
Sub total	132,332	1,891	7,718
		Civ+Equip 134,223	TOTAL 141,941

Source: JICA Study Team

Table 7.1-19 Disbursement Schedule of Service Berth in Alternative-A

Year	Dreger & survey boat berth		Enginnering
	Civil ('000USD)	Equipment ('000USD)	('000USD)
2016	0	0	1,216
2017	42,036	260	1,216
2018	12,506	1,473	804
Sub total	54,542	1,733	3,236

Civ+Equip 56,276 TOTAL 59,512

Source: JICA Study Team

In economic analysis, project costs are generally divided into the two categories, viz. foreign portion (traded goods and services) and local portion (non-traded goods and services).

Local portion such as non-traded goods and services that is priced in local (domestic) market is converted into amount expressed in economic prices by multiplying the SCF of 0.85.

Foreign portion such as traded goods and services that is priced in the international market is assumed to be expressed in economic prices as it is.

Tables below show allocated project cost to both portions of foreign and local.

Table 7.1-20 Allocation of Project Cost to Foreign and Local Portions in Base Case

Year	Dreger & survey boat berth				Enginnering ('000USD)		Administration ('000USD)	
	Civil ('000USD)		Equipment ('000USD)					
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
2016	0	0	0	0	2,015	0	0	1,853
2017	50,319	19,491	284	0	2,015	0	0	1,853
2018	35,721	20,914	804	0	3,303	0	0	3,037
2019	0	5,888	804	0	385	0	0	0
Sub total	86,040	46,292	1,891	0	7,718	0	0	6,743

Civ+Equip 134,223 w Engn 141,941 TOTAL 148,684

Source: JICA Study Team

Table 7.1-21 Allocation of Project Cost to Foreign and Local Portions in Alternative-A

Year	Dreger & survey boat berth				Enginnering ('000USD)		Administration ('000USD)	
	Civil ('000USD)		Equipment ('000USD)					
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
2016	0	0	0	0	1,216	0	0	1,118
2017	30,411	11,625	260	0	1,216	0	0	1,118
2018	7,886	4,620	1,473	0	804	0	0	739
Sub total	38,297	16,245	1,733	0	3,236	0	0	2,976

Civ+Equip 56,276 w Engn 59,512 TOTAL 62,487

Source: JICA Study Team

The project cost in market price including the contingency portion is converted to the economic price using the conversion factor. The project cost converted into economic price is shown in tables below.

Table 7.1-22 Allocated Project Cost in Economic Price in Base Case

Year	Dreger & survey boat berth				Enginnering ('000USD)		Administration ('000USD)	
	Civil ('000USD)		Equipment ('000USD)					
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
2016	0	0	0	0	2,015	0	0	1,575
2017	50,319	16,568	284	0	2,015	0	0	1,575
2018	35,721	17,777	804	0	3,303	0	0	2,581
2019	0	5,004	804	0	385	0	0	0
Sub total	86,040	39,348	1,891	0	7,718	0	0	5,732
			Civ+Equip	127,279	w Engn	134,997	TOTAL	**140,728**

Source: JICA Study Team

Table 7.1-23 Allocated Project Cost in Economic Price in Alternative-A

Year	Dreger & survey boat berth				Enginnering ('000USD)		Administration ('000USD)	
	Civil ('000USD)		Equipment ('000USD)					
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
2016	0	0	0	0	1,216	0	0	950
2017	30,411	9,881	260	0	1,216	0	0	950
2018	7,886	3,927	1,473	0	804	0	0	628
Sub total	38,297	13,808	1,733	0	3,236	0	0	2,529
			Civ+Equip	53,839	w Engn	57,075	TOTAL	**59,604**

Source: JICA Study Team

Table 7.1-24 Summary of Allocation of Project Cost in Base Case

Year	Cost ('000 USD)			
	Project Cost	Project Components		
		Dredger	Engineering	Admin
2016	**3,590**	0	2,015	1,575
2017	**70,760**	67,170	2,015	1,575
2018	**60,185**	54,301	3,303	2,581
2019	**6,193**	5,808	385	0
Total	**140,728**	127,279	7,718	5,732

Source: JICA Study Team

Table 7.1-25 Summary of Allocation of Project Cost in Alternative-A

Year	Cost ('000 USD)			
	Project Cost	Project Components		
		Dredger	Engineering	Admin
2016	**2,166**	0	1,216	950
2017	**42,719**	40,553	1,216	950
2018	**14,718**	13,286	804	628
Total	**59,604**	53,839	3,236	2,529

Source: JICA Study Team

2) Operation and maintenance costs

Additional cost items for "With case" for management / operation and maintenance are listed below:

a) Maintenance costs of infrastructure and equipment

It is assumed to be 1% of initial investment costs of infrastructures and 3% of equipment for "With case".

b) Fuel and utilities costs

It is assumed to be included the above mentioned "Maintenance costs of Infrastructure and equipment".

c) Personnel cost

The additional employee number for "With case" is assumed to be zero.

3) Renewal Investment Costs

From the start of operations and through the project life, some equipment such as truck crane, forklift and truck that are procured in the initial stage will be replaced when lifetime expires. The lifetime of the truck crane, forklift and truck are set at fifteen (15), ten (10) and five (5) years, respectively.

4) Total Cost

Total cost is the sum of project cost and maintenance & operation cost evaluated in the concept of economic cost. It is shown for whole project life in Table 7.1-26 and Table 7.1-27.

Table 7.1-26 Total Cost of Service Berth During Project Life in Base Case

Year	Cost ('000 USD)				
	Project Cost	Operation & Maintenance			Cost Total
		Renewal Investment	Personnel & Administration	Maintenance	
2016	3,590	0	0	0	3,590
2017	70,760	0	0	0	70,760
2018	60,185	0	0	0	60,185
2019	6,193	0	0	0	6,193
2020	0	0	0	1,311	1,311
2021	0	0	0	1,311	1,311
2022	0	0	0	1,311	1,311
2023	0	68	0	1,311	1,379
2024	0	0	0	1,311	1,311
2025	0	0	0	1,311	1,311
2026	0	0	0	1,311	1,311
2027	0	0	0	1,311	1,311
2028	0	239	0	1,311	1,549
2029	0	0	0	1,311	1,311
2030	0	0	0	1,311	1,311
2031	0	0	0	1,311	1,311
2032	0	0	0	1,311	1,311
2033	0	936	0	1,311	2,247
2034	0	0	0	1,311	1,311
2035	0	0	0	1,311	1,311
2036	0	0	0	1,311	1,311
2037	0	0	0	1,311	1,311
2038	0	239	0	1,311	1,549
2039	0	0	0	1,311	1,311
2040	0	0	0	1,311	1,311
2041	0	0	0	1,311	1,311
2042	0	0	0	1,311	1,311
2043	0	68	0	1,311	1,379
2044	0	0	0	1,311	1,311
2045	0	0	0	1,311	1,311
2046	0	0	0	1,311	1,311
2047	0	0	0	1,311	1,311
2048	0	1,107	0	1,311	2,417
Total	140,728	2,657	0	38,008	181,393

Source: JICA Study Team

Table 7.1-27 Total Cost of Service Berth During Project Life in Alternative-A

Year	Cost ('000 USD)				
	Project Cost	Operation & Maintenance			Cost Total
		Renewal Investment	Personnel & Administration	Maintenance	
2016	2,166	0	0	0	2,166
2017	42,719	0	0	0	42,719
2018	14,718	0	0	0	14,718
2019	0	0	0	573	573
2020	0	0	0	573	573
2021	0	0	0	573	573
2022	0	0	0	573	573
2023	0	68	0	573	641
2024	0	0	0	573	573
2025	0	0	0	573	573
2026	0	0	0	573	573
2027	0	0	0	573	573
2028	0	239	0	573	812
2029	0	0	0	573	573
2030	0	0	0	573	573
2031	0	0	0	573	573
2032	0	0	0	573	573
2033	0	936	0	573	1,510
2034	0	0	0	573	573
2035	0	0	0	573	573
2036	0	0	0	573	573
2037	0	0	0	573	573
2038	0	239	0	573	812
2039	0	0	0	573	573
2040	0	0	0	573	573
2041	0	0	0	573	573
2042	0	0	0	573	573
2043	0	68	0	573	641
2044	0	0	0	573	573
2045	0	0	0	573	573
2046	0	0	0	573	573
2047	0	0	0	573	573
2048	0	1,107	0	573	1,680
Total	59,604	2,657	0	17,192	79,452

Source: JICA Study Team

7.2 Economic Evaluation of the Project

1) Calculation of the Net Present Value (NPV)

The Net Present Value is calculated by using the following formula.

$$NPV = \frac{\sum_{i=1}^{n} (Bi - Ci)}{(1+r)^{i-1}}$$

Where, *n*: Period of economic calculation (project life)
Bi: Benefit in *i* year
Ci: Cost in *i* year
r: Discount rate = 6 %

The result of NPV estimation is shown as following in Table 7.2-1 and Table 7.2-2. NPVs amount to minus USD 37 million in the Base Case and USD 19 million in the Alternative-A, respectively.

Table 7.2-1 Result of Economic Calculation in Base Case

Year	Cost ('000 USD)					Benefit ('000 USD)				Total Benefit-Cost	Present Value		
	Project Cost	Operation & Maintenance			Cost Total	Dumerrage Cost Saving	Cargo Time-cost Saving	Driver/Labor's waiting Cost Saving	Benefit Total		Total Cost	Total Benefit	Net Benefit
		Renewal Investment	Personnel & Administration	Maintenance									
2016	3,590	0	0	0	3,590	0	0	0	0	-3,590	3,590	0	-3,590
2017	70,760	0	0	0	70,760	0	0	0	0	-70,760	66,755	0	-66,755
2018	60,185	0	0	0	60,185	0	0	0	0	-60,185	53,564	0	-53,564
2019	6,193	0	0	0	6,193	0	0	0	0	-6,193	5,200	0	-5,200
2020	0	0	0	1,311	1,311	902	1,031	249	2,182	872	1,038	1,729	690
2021	0	0	0	1,311	1,311	1,003	1,147	277	2,427	1,117	979	1,814	834
2022	0	0	0	1,311	1,311	1,105	1,262	305	2,672	1,362	924	1,884	960
2023	0	68	0	1,311	1,379	1,206	1,378	333	2,917	1,539	917	1,940	1,023
2024	0	0	0	1,311	1,311	1,307	1,494	361	3,162	1,852	822	1,984	1,162
2025	0	0	0	1,311	1,311	1,408	1,610	389	3,408	2,097	776	2,017	1,241
2026	0	0	0	1,311	1,311	1,985	2,269	549	4,803	3,492	732	2,682	1,950
2027	0	0	0	1,311	1,311	2,562	2,928	708	6,198	4,887	690	3,265	2,574
2028	0	239	0	1,311	1,549	3,138	3,587	868	7,593	6,043	770	3,773	3,003
2029	0	0	0	1,311	1,311	3,715	4,246	1,027	8,988	7,677	614	4,214	3,599
2030	0	0	0	1,311	1,311	4,291	4,905	1,187	10,383	9,072	580	4,592	4,013
2031	0	0	0	1,311	1,311	4,868	5,564	1,346	11,778	10,467	547	4,914	4,368
2032	0	0	0	1,311	1,311	5,445	6,223	1,505	13,173	11,862	516	5,185	4,669
2033	0	936	0	1,311	2,247	6,021	6,881	1,665	14,568	12,321	834	5,410	4,575
2034	0	0	0	1,311	1,311	6,598	7,540	1,824	15,963	14,652	459	5,592	5,133
2035	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	433	5,737	5,304
2036	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	409	5,412	5,004
2037	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	386	5,106	4,720
2038	0	239	0	1,311	1,549	7,175	8,199	1,984	17,358	15,809	430	4,817	4,387
2039	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	343	4,544	4,201
2040	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	324	4,287	3,963
2041	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	305	4,044	3,739
2042	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	288	3,815	3,527
2043	0	68	0	1,311	1,379	7,175	8,199	1,984	17,358	15,979	286	3,599	3,314
2044	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	256	3,396	3,139
2045	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	242	3,203	2,962
2046	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	228	3,022	2,794
2047	0	0	0	1,311	1,311	7,175	8,199	1,984	17,358	16,047	215	2,851	2,636
2048	0	1,107	0	1,311	2,417	7,175	8,199	1,984	17,358	14,940	375	2,690	2,315
Total	140,728	2,657	0	38,008	181,393	145,998	166,855	40,368	353,221	171,828	144,828	107,520	-37,308

Iraq Treasury Bond, coupon rate: 5.8%

EIRR 4.1%

B/C ratio 0.74

Source: JICA Study Team

Table 7.2-2 Result of Economic Calculation in Alternative-A

Year	Cost ('000 USD)					Benefit ('000 USD)				Total Benefit-Cost	Present Value		
	Project Cost	Operation & Maintenance			Cost Total	Dumerrage Cost Saving	Cargo Time-cost Saving	Driver/Labor's waiting Cost Saving	Benefit Total		Total Cost	Total Benefit	Net Benefit
		Renewal Investment	Personnel & Administration	Maintenance									
2016	2,166	0	0	0	2,166	0	0	0	0	-2,166	2,166	0	-2,166
2017	42,719	0	0	0	42,719	0	0	0	0	-42,719	40,301	0	-40,301
2018	14,718	0	0	0	14,718	0	0	0	0	-14,718	13,099	0	-13,099
2019	0	0	0	573	573	601	686	166	1,453	880	481	1,220	739
2020	0	0	0	573	573	676	773	187	1,637	1,064	454	1,296	842
2021	0	0	0	573	573	752	860	208	1,820	1,247	428	1,360	932
2022	0	0	0	573	573	828	947	229	2,004	1,431	404	1,413	1,009
2023	0	68	0	573	641	904	1,034	250	2,188	1,547	426	1,455	1,029
2024	0	0	0	573	573	980	1,120	271	2,372	1,799	360	1,488	1,129
2025	0	0	0	573	573	1,056	1,207	292	2,556	1,983	339	1,513	1,173
2026	0	0	0	573	573	1,489	1,701	412	3,602	3,029	320	2,011	1,691
2027	0	0	0	573	573	1,921	2,196	531	4,648	4,075	302	2,449	2,147
2028	0	239	0	573	812	2,354	2,690	651	5,694	4,883	403	2,830	2,427
2029	0	0	0	573	573	2,786	3,184	770	6,741	6,168	269	3,160	2,892
2030	0	0	0	573	573	3,219	3,678	890	7,787	7,214	253	3,444	3,191
2031	0	0	0	573	573	3,651	4,173	1,010	8,833	8,260	239	3,686	3,447
2032	0	0	0	573	573	4,084	4,667	1,129	9,879	9,306	226	3,889	3,663
2033	0	936	0	573	1,510	4,516	5,161	1,249	10,926	9,416	561	4,057	3,497
2034	0	0	0	573	573	4,948	5,655	1,368	11,972	11,399	201	4,194	3,994
2035	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	189	4,303	4,113
2036	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	179	4,059	3,880
2037	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	169	3,829	3,661
2038	0	239	0	573	812	5,381	6,150	1,488	13,018	12,207	225	3,613	3,387
2039	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	150	3,408	3,258
2040	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	142	3,215	3,074
2041	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	134	3,033	2,900
2042	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	126	2,862	2,736
2043	0	68	0	573	641	5,381	6,150	1,488	13,018	12,377	133	2,700	2,567
2044	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	112	2,547	2,435
2045	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	106	2,403	2,297
2046	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	100	2,267	2,167
2047	0	0	0	573	573	5,381	6,150	1,488	13,018	12,445	94	2,138	2,044
2048	0	1,107	0	573	1,680	5,381	6,150	1,488	13,018	11,338	260	2,017	1,757
Total	59,604	2,657	0	17,192	79,452	110,099	125,827	30,442	266,369	186,916	63,351	81,860	18,509

Iraq Treasury Bond, coupon rate: 5.8%

EIRR 7.7%

B/C ratio 1.29

Source: JICA Study Team

2) Calculation of the Benefit/Cost ratio (B/C ration)

The benefit/cost ratio is obtained by dividing the economic benefit by the economic cost. The result of B/C ratios are shown in Table 7.2-1 and Table 7.2-2. The ratios are 0.74 in the Base Case and 1.29 in the Alternative-A, respectively. The discount rate adopted for calculation of B/C is 6 %, which is same as the one in NPV calculation.

3) Calculation of the EIRR

The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the economic feasibility of the important project. The EIRR is the discount rate, which makes the costs and benefits of a project life equal.

It is calculated by using the following formula.

$$\frac{\sum_{i=1}^{n}(Bi - Ci)}{(1+r)^{i-1}} = 0$$

Where, *n*: Period of economic calculation (project life)
Bi: Benefit in *i* year
Ci: Cost in *i* year
r: Discount rate

The result of EIRR is shown in Table 7.2-1 and Table 7.2-2. The estimated EIRRs are at 4.1% in the Base Case and at 7.7% in the Alternative-A, respectively.

4) Sensitivity Analysis

In order to see whether the project in the Alternative-A is still feasible when some conditions changes, a sensitivity analysis is made for the following three cases in the Alternative-A.

Case 1: Project cost increases by 10%
Case 2: Benefit decreases by 10%
Case 3: Both Case 1and Case 2 occur simultaneously

The result of the sensitivity analysis is derived as follows.

Table 7.2-3 Sensitivity Analysis in Alternative-A

Alternative	NPV (USD million)	B/C ratio	EIRR
Case 0	18.6	1.29	7.7 %
Case 1	12.2	1.17	7.1 %
Case 2	10.3	1.16	7.0 %
Case 3	4.0	1.06	6.4 %

Source: JICA Study Team

Even the Case 3, the economic feasibilities of the urgent project are exceeding threshold value i.e. EIRRs and B/C ratios are over 6% and 1.0, respectively, and NPVs are a plus.

7.3 Conclusion

The Base Case cannot be said that it is economically beneficial to Iraq because the benefit is small against the construction cost of service berth as full facilities development. The Alternative-A, however, generates just enough economically benefit to the country. In addition, unmeasured benefits and merits are also generated such as reduction of sea accident, safety improvement of berthing and stability of port operation. These benefits and merits are indirect effect but finally contribute to Iraqi economy by avoiding suspension of entering and operation of shipping line to and at UQP/KZP. Therefore, the Alternative-A of service berth construction is recommended to be implemented as early as possible from the viewpoint of national economy.

CHAPTER 8

Chapter 8. Initial Environmental Examination (IEE)

8.1 Introduction

General Company for Ports of Iraq (GCPI) is a governmental company under the Ministry of Transport in the Republic of Iraq. It is responsible with the management of Iraqi ports and navigation in the territorial waters. The company manages Umm Qasr Port (UQP), Khor Al Zubayr Port (KZP), Al Maqil Port and Abu Flus Port.

GCPI owns and operates quite number of work vessels and port service boats; such as dredgers, tug boats, survey boats, tankers, floating cranes, and so on. It is however noted that no designated service berths nor mooring areas, which is essential for smooth and efficient operations of the work vessels, are currently unavailable. Under such situation, the work vessels and port service boats are currently using available commercial cargo berths, whenever such facilities are not used by cargo ships, in loading spare parts/water/food, crew changes, and/or other necessary preparation of the works.

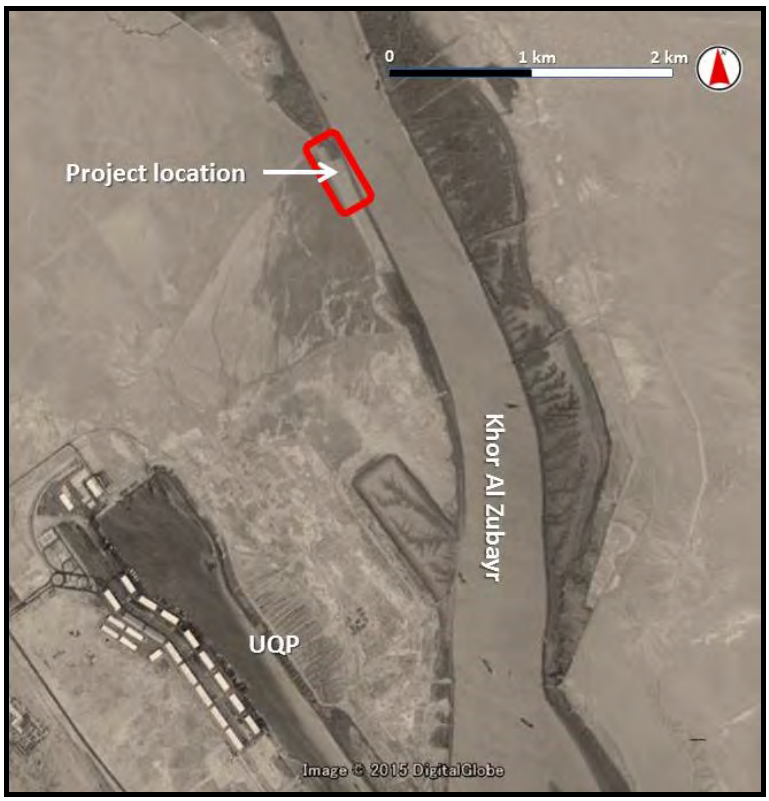
However, it has been recognized that recent situation may not easily accept for work vessels to use cargo berths as cargo throughput has constantly been increasing according to a recovery of port function these days, consequently a lesser chance of empty berth finding can be anticipated. Further, such tendency may continue for a long while, it is understood that a construction of service berth for work vessels and port service boats is important and therefore urgently required. As an initial step, GCPI plans to establish a service berth for the dredgers, which they own a total of 15 dredgers.

The main objective of the Initial Environmental Examination (IEE) is to identify the potential environmental impacts of the Project and to propose mitigation measures and monitoring programs so that any potential adverse impacts are contained within acceptable levels.

However, since this IEE was prepared in the pre-feasibility stage of this Project, some essential information were lacking or not finalized, namely the construction plan. Some baseline environmental information was also not available. This IEE therefore was prepared with limited information and thus should be considered as a preliminary document and should be revised and updated once all the essential information are available. Note that this Chapter provides only the summary of the IEE and the full IEE is attached as Appedix I.

8.2 Project Description

The service berth is planned to be located along the shore of Khor Al Zubayr waterway in Al-Zubayr district, Basra Governorate, approximately 6 km upstream from UQP. Figure 8.2-1 shows the location of the planned service berth.



Source: Prepared using Google Earth

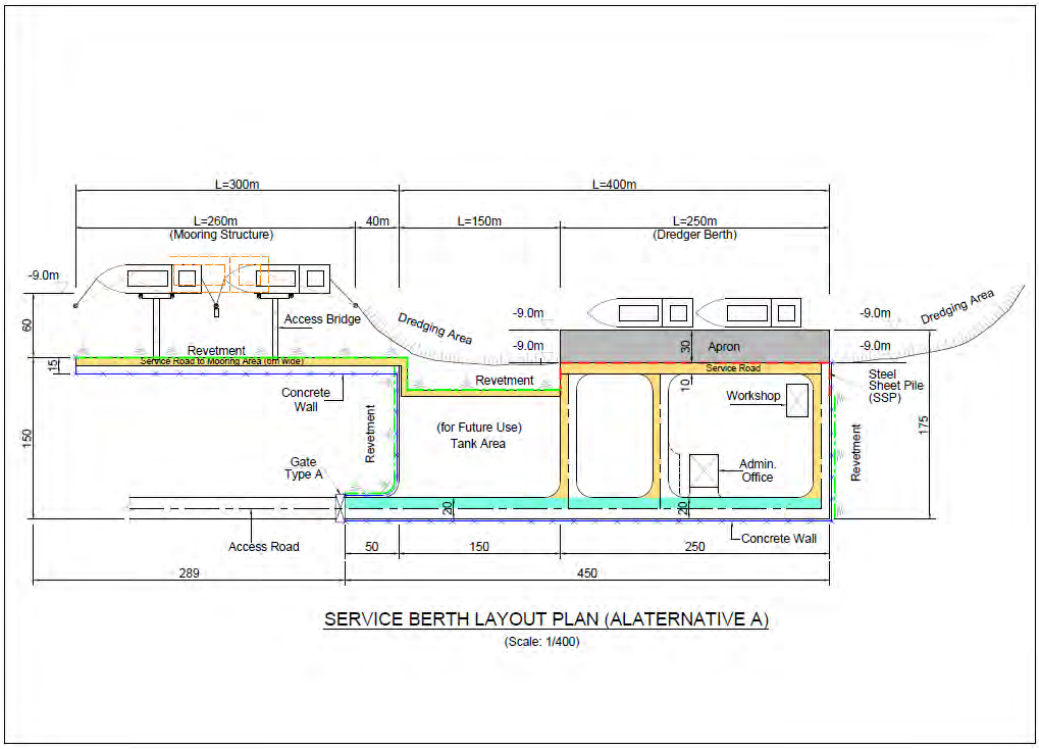
Figure 8.2-1 Location of the Planned Service Berth

Table 8.2-1 shows the main facilities and specifications of the service berth. Figure 8.2-2 shows the layout of the service berth.

Table 8.2-1 Main Facilities and Specifications of the Service Berth

Facility	Specification
Dredger berth (apron structure)	Berth length: 250 m, Depth: -9.0 m
Dredger berth (mooring structure) and access bridge	Overall length:260 m (pile:12 nrs.) Access bridge: 180 m
Revetment	Length: 300 m (steel sheet pile type)
Service road	Area: 12,500 m^2 (gravel paving and Interlocking Concrete Block (ICB))
Administration building	26 m x 30 m, RC structure, 2-storey
Workshop	18 m x 32 m, Steel frameworks
Warehouse	Approx. 40 m x 60 m

Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA



Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

Figure 8.2-2 Layout of the Service Berth

8.3 Baseline Environmental and Social Conditions

The Service Berth is planned to be located along the shore of Khor Al Zubayr waterway. A narrow intertidal mudflat area is present along the shore. Part of the mudflat has been reclaimed in the past using dredged material. For such reason, it is unlikely that the mudflat in the Project area have any significant ecosystem value.

Although human presence and activity in the Project area is limited, some fishermen park their boats in the planned service berth area. Information on these fishermen is currently lacking and therefore should be collected in the ensuing stages to assess the impacts on these fishermen.

8.4 Potential Environmental Impacts and Mitigation Measures

The potential environmental impacts of the Project for the construction and operation phases were identified through a scoping exercise. While significant negative impacts were not identified, some pollution risks were identified such as air pollution, water pollution, waste, noise and bottom sediment. Mitigation measures are therefore proposed to avoid or minimize pollution. Table 8.4-1 and Table 8.4-2 show the proposed mitigation measures for the construction and operation phases respectively. Note that impacts on the fishermen was not assessed due to lack information.

Table 8.4-1 Proposed Mitigation Measures during Construction Phase

Item			Scoping rating	Potential impacts	Mitigation measure
Physical environment	1	Air pollution	B-	Exhaust and dust emission from construction vehicles	・ Construction vehicles should to the extent possible avoid passing through sensitive areas (e.g. residential areas) during transportation of construction materials. A fixed route should be designated for construction vehicles. ・ Construction vehicles should be regularly inspected and maintained in good condition.
	2	Water pollution	B-	Oil leakages and spills from construction machines	・ Construction machines should be regularly inspected and maintained in good condition. ・ Construction machines with any oil leaks should be removed from the waterway until repaired. ・ Development of oil spill contingency plan.
	3	Waste	B-	Generation of construction waste	**[Solid waste]** ・ Solid wastes should be stored in a designated location inside the construction site and in manner to prevent dispersal by wind. ・ Sufficient number of waste bins should be placed at the construction sites. ・ Littering at the constriction sites and into the waterway should be strictly prohibited. ・ Daily clean-up at the construction sites. ・ Solid wastes should be disposed at an authorized facility. **[Hazardous waste]** ・ Hazardous wastes should be contained in specialized containers and stored in a designated location inside the construction site. ・ Measures should be taken to prevent spills and leakages into the surrounding environment. ・ Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal. **[Human waste]** ・ Temporary toilet should be installed at the construction site. The generated sludge should be disposed at an authorized facility.
	4	Noise/vibration	B-	Noise emission from construction vehicles	・ Construction vehicles should to the extent possible avoid passing through sensitive areas (e.g. residential areas) during transportation of construction materials. A fixed route should be designated for construction vehicles. ・ Construction vehicles should be regularly inspected and maintained in good condition.

Source: JICA Study Team

Table 8.4-2 Proposed Mitigation Measures during Operation Phase

Item			Scoping rating	Potential impacts	Mitigation measure
Physical environment	1	Water pollution	B-	Wastewater discharge from ships and port facilities	**[Ships]** ・ Discharge of ship wastewater into the waterway and sea should be regulated in accordance to MARPOL regulations. ・ Wastewater (e.g. oily water, bilge water) that cannot be discharged in accordance to MARPOL regulations should be transported to an authorized facility for treatment. ・ Facilities for collecting and transporting wastewater should be available (e.g. tank truck) **[Port facility]** ・ Port facilities (e.g. administration office) should be equipped with sewage treatment facility (e.g. septic tank) and discharge in accordance to Iraqi discharge standard. ・ Workshop should be equipped with an oil-water separator. The separated oil should be treated at an authorized facility. The separated water should be discharged in accordance to Iraqi discharge standard.
	2	Waste	B-	Generation of wastes from ships	**[Solid waste]** ・ Disposal of solid waste into the waterway and sea should be strictly prohibited and should only be disposed at an authorized facility. ・ Facilities for collecting and transporting wastewater should be available (e.g. garbage truck) **[Hazardous waste]** ・ Hazardous wastes should be contained in specialized containers and stored in a designated location inside the ship. ・ Measures should be taken to prevent spills and leakages into the surrounding environment (e.g. containment bund). ・ Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal.
			B-	Generation of wastes from port facilities	**[Solid waste]** ・ Solid wastes should be stored in a designated location inside the construction site and in manner to prevent dispersal by wind. ・ Sufficient number of waste bins should be placed at the port area. ・ Littering inside the port area and into the waterway should be strictly prohibited. ・ Solid wastes should be disposed at an authorized facility. **[Hazardous waste]** ・ Hazardous wastes should be contained in specialized containers and stored in a designated location inside the port area. ・ Measures should be taken to prevent spills and leakages into the surrounding environment. ・ Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal.

Item			Scoping rating	Potential impacts	Mitigation measure
	3	Bottom sediment	B-	Sediment contamination by use of hazardous anti-fouling paints	The use of hazardous anti-fouling paints should be prohibited.

Source: JICA Study Team

8.5 Conclusion and Recommendation

In general, the Project is likely to have limited negative environmental impacts mainly because there are no important or sensitive ecosystems and any residential areas near the Project area. Although construction works and operation activities may inevitably generate some negative impacts, these should be contained within acceptable levels providing that appropriate mitigation measures are implemented. For these reasons, this Project is likely to be classified as "Category B" under Iraqi EIA regulations.

For effective implementation, a detailed environmental management plan, waste management plan, oil spill contingency plan should also be prepared including the implementing organizational structure, responsibilities, budget and so on. Assignment of qualified environmental officer and maintenance officer will also be necessary. Furthermore, following are some pollution control facilities that should be considered for the service berth:

- Oil/water separator in the workshop
- Sewage treatment facility in the port buildings
- Storage area for hazardous and non-hazardous wastes including spill containment facility
- Collection and transport vehicles for waste and wastewater
- Equipment for oil spill response

In addition, there are still some issues that should be studied and resolved, which is primarily regarding the fishermen that are currently using the area for parking their boats. They may be required to relocate their activity if boat parking space becomes unavailable through construction of the service berth. Since, information on these fishermen is currently lacking, it is recommended to collect baseline information of these fishermen and then assess how the Project will affect them. Following are some of the information that should be collected:

- Number of boats and fishermen using the Project area
- Place of residence and method of access to the Project area
- Reason for using the Project area
- Main fishing area and targeted species
- Availability of alternative boat parking area
- Land ownership of the Project area

Alternatively, to avoid any impacts on the fishermen, it is worth considering to shift the location of the service berth southward so that it does not overlap with the fishing boat parking area.

CHAPTER 9

Chapter 9. Conclusion and Recommendation for the Next Step

9.1 Conclusion

9.1.1 Service Berth Location and Arrangement

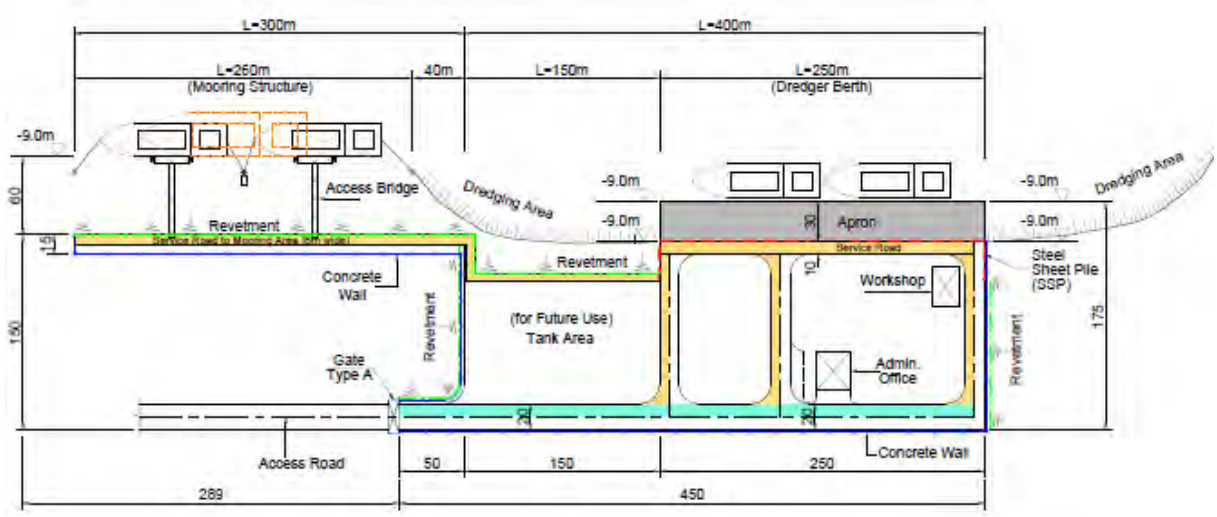
Among the five options described in Chapter 3, Option-5 has been selected as the most appropriate location and arrangement for service berth through hearings and discussions with concerned departments/organizations of GCPI, and according to the results of the consequent optimization study. This option suggests a separate arrangement of service berths for tugboats, including other relatively small port service boats, and for dredgers, respectively, under the following arrangements:

- Service berth for tug and other service boats is located in UQP north entrance area adjacent to Berth No.10 with a length of 200 m, which is to be provided through an investment of a private terminal operator; and
- Service berth for dredgers is constructed at the location between UQP and LPG Terminal, which was used as a disposal area of dredged spoil during dredging work under the previous Port Sector Rehabilitation Project (IQ-P1).

9.1.2 Required Facilities and Project Costs

Based on the requirements of the facilities for service berth and taking into consideration the urgency, budgetary restriction, and construction time duration, two cases have been examined, namely, "Base Case" and "Alternative A". From the examination results, Alternative A has been recommended as the most reasonable and practical, which has also been justified as appropriate from the economic analysis result hereinafter described.

The suggested layout plan and estimated project cost are shown in the following Figure 9.1-1 and Table 9.1-1, respectively.



Source: JICA Study Team

Figure 9.1-1 Layout Plan of Service Berth for Dredgers (Alternative A)

Table 9.1-1 Estimated Project Cost (USD 1 = JPY 124.75)

Item	Estimated Cost (USD 1,000)
1. Procurement and Construction	56,276
2. Engineering Services	3,236
Subtotal	59,512
3. Administration Cost	2,976
Total Project Cost	62,488

Source: JICA Study Team

9.1.3 Project Evaluation Result

Project evaluation has been conducted for the two cases (Base Case and Alternative A) by economic analysis, and the following results are obtained:

Table 9.1-2 Economic Analysis of Service Berth

Base Case	NPV (USD in million)	B/C Ratio	EIRR
Case 0	- 37.2	0.74	4.1 %
Alternative A	**NPV (USD in million)**	**B/C Ratio**	**EIRR**
Case 0	18.6	1.29	7.7 %
Case 1	12.2	1.17	7.1 %
Case 2	10.3	1.16	7.0 %
Case 3	4.0	1.06	6.4 %

Note: Case 1: Increase cost by 10%; Case 2: Decrease benefit by 10%, Case 3: Both cases happen simultaneously
Source: JICA Study Team

From the above table, Alternative A has been judged to be economically feasible.

9.1.4 Initial Environmental Examination

The initial environmental examination (IEE) has been carried out for the Alternative A case of the Project. The result indicates that the Project is likely classified as "Category B" under the Iraqi EIA regulations because the Project would have limited negative environmental impacts as described in Chapter 8.

9.2 Recommendations for the Next Step

In order to realize the Project at the earliest possible time, it is strongly recommended that the Project defined as Alternative A has to be implemented as an urgent project, being included in the Port Sector Rehabilitation Project (II), which is at present under project scope review and design.

To this end, the following steps have to be taken:

- Confirmation of environmental category (Category B is expected) of the Project; submitting the prepared IEE to the Iraqi authority concerned is the first step.
- Once confirmed, detailed environmental management plan including waste management plan and oil spill contingency plan have to be prepared for the acceptance of the authority in accordance with the Iraqi EIA regulations by conducting necessary environmental conditions survey of the project area.
- Based on the above survey results together with other natural conditions investigation, the suggested plan and design should be reviewed and revised accordingly, before the implementation of the Project.

In addition to the above, it should also be noted that further review of the future plan (Base Case) should be conducted since the project suggested as urgent project may not be economically fit for the full development of the dredgers berth. As such, the proposed future layout plan is shown in Figure 9.2-1 for reference.

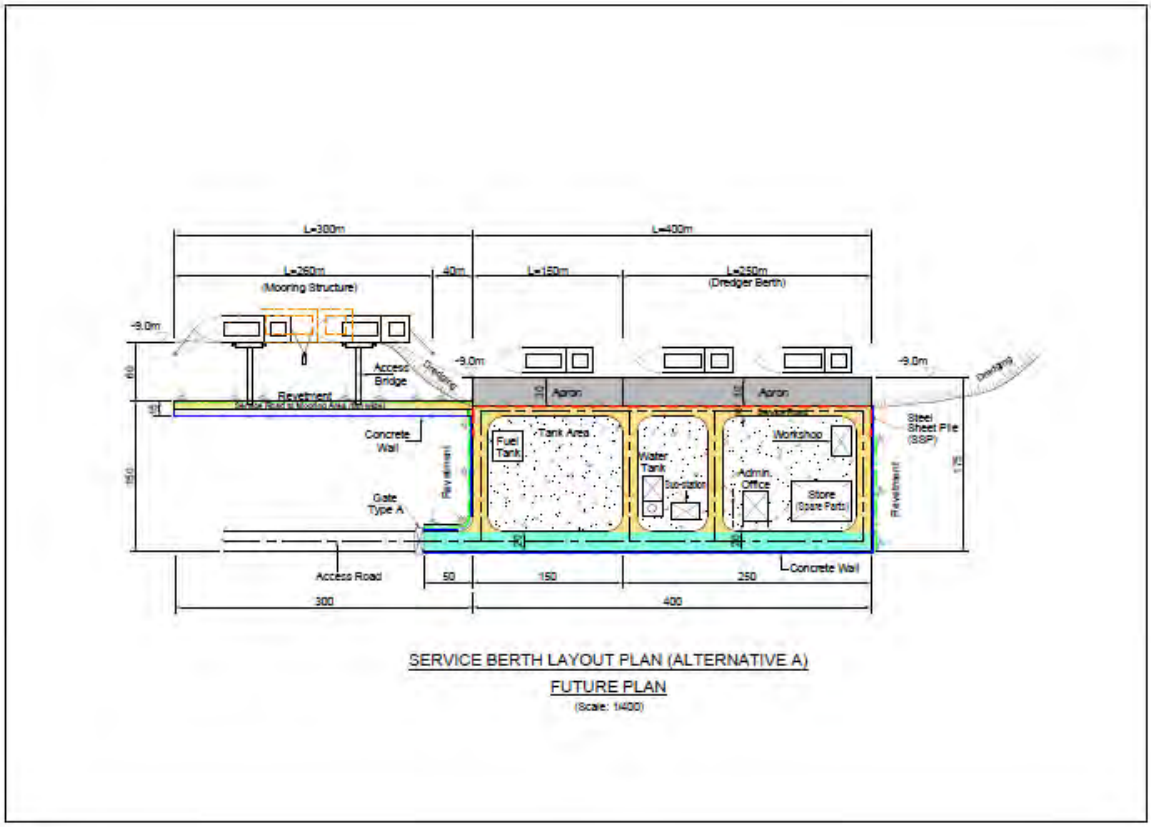


Figure 9.2-1 Proposed Future Plan of Dredger Berth

APPENDIX

Initial Environmental Examination of Service Berth

December 2015

ABBREVIATIONS

BOD	Biological oxygen demand
DO	Dissolved oxygen
EC	Electrical conductivity
GCPI	General Company for Ports of Iraq
IEE	Initial Environmental Examination
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
KZP	Khor Al Zubayr Port
MOE	Ministry of Environment
TSP	Total suspended particulate
TPH	Total petroleum hydrocarbons
UQP	Umm Qasr Port

CONTENTS

TABLES

FIGURES

Chapter 1. Introduction

1.1 Background of the Project

General Company for Ports of Iraq (GCPI) is a governmental company under the Ministry of Transport in the Republic of Iraq. It is responsible with the management of Iraqi ports and navigation in the territorial waters. The company manages Umm Qasr Port (UQP), Khor Al Zubayr Port (KZP), Al Maqil Port and Abu Flus Port.

GCPI owns and operates quite number of work vessels and port service boats; such as dredgers, tug boats, survey boats, tankers, floating cranes, and so on. It is however noted that no designated service berths nor mooring areas, which is essential for smooth and efficient operations of the work vessels, are currently unavailable. Under such situation, the work vessels and port service boats are currently using available commercial cargo berths, whenever such facilities are not used by cargo ships, in loading spare parts/water/food, crew changes, and/or other necessary preparation of the works.

However, it has been recognized that recent situation may not easily accept for work vessels to use cargo berths as cargo throughput has constantly been increasing according to a recovery of port function these days, consequently a lesser chance of empty berth finding can be anticipated. Further, such tendency may continue for a long while, it is understood that a construction of service berth for work vessels and port service boats is important and therefore urgently required. As an initial step, GCPI plans to establish a service berth for the dredgers, which they own a total of 15 dredgers.

1.2 Objective of the Initial Environmental Examination

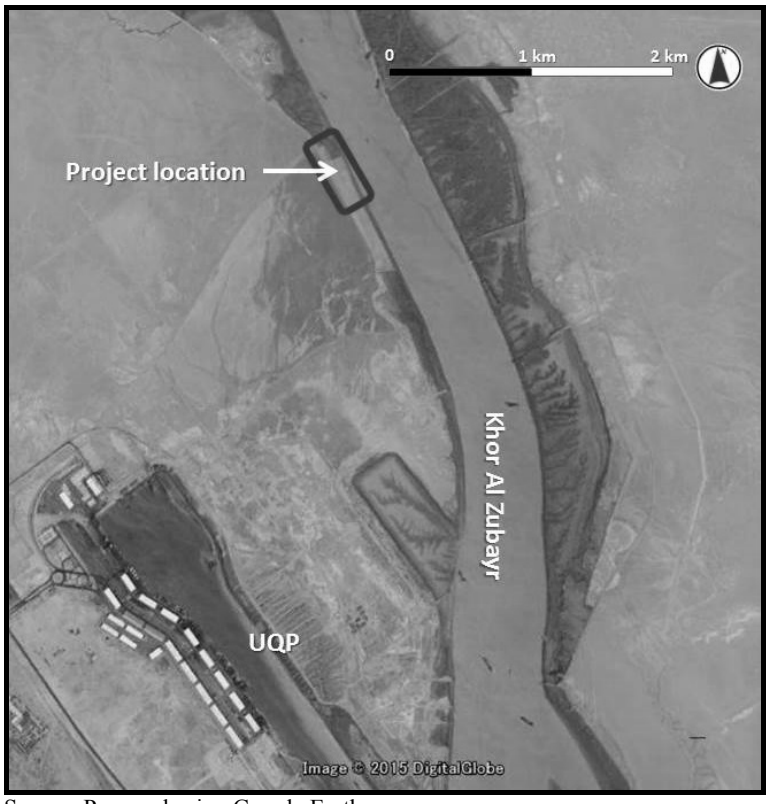
The main objective of the Initial Environmental Examination (IEE) is to identify the potential environmental impacts of the Project and to propose mitigation measures and monitoring programs so that any potential adverse impacts are contained within acceptable levels.

However, since this IEE was prepared in the pre-feasibility stage of this Project, some essential information were lacking or not finalized, namely the construction plan. Some baseline environmental information was also not available. This IEE therefore was prepared with limited information and thus should be considered as a preliminary document and should be revised and updated once all the essential information are available. Recommendation are also made in the final Chapter for further studies.

Chapter 2. Project description

2.1 Location of the service berth

The service berth is planned to be located along the shore of Khor Al Zubayr waterway in Al-Zubayr district, Basra Governorate, approximately 6 km upstream from UQP. Figure 2.1-1 shows the location of the planned service berth.



Source: Prepared using Google Earth

Figure 2.1-1 Location of the planned service berth

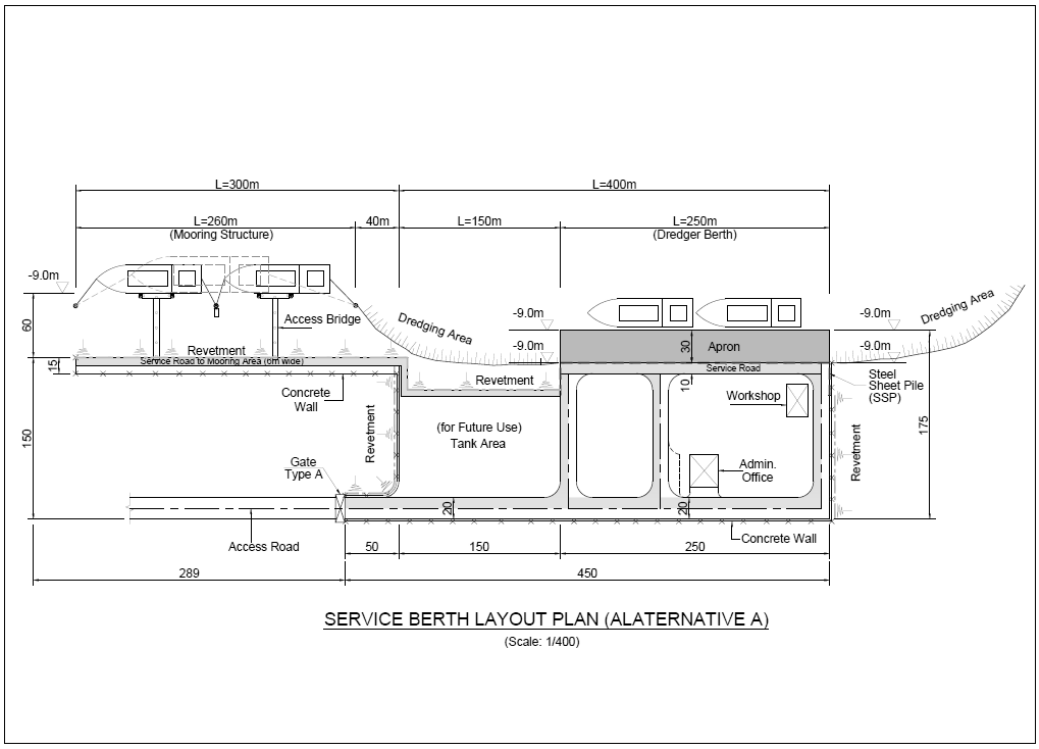
2.2 Layout and main facilities of the service berth

Table 2.2-1 shows the main facilities and specifications of the service berth. Figure 2.2-1 shows the layout of the service berth.

Table 2.2-1 Main facilities and specifications of the service berth

Facility	Specification
Dredger berth (apron structure)	Berth length: 250 m, Depth: -9.0 m
Dredger berth (mooring structure) and access bridge	Overall length:260 m (pile:12 nrs.) Access bridge: 180 m
Revetment	Length: 300 m (steel sheet pile type)
Service road	Area: 12,500 m^2 (gravel paving and Interlocking Concrete Block (ICB))
Administration building	26 m x 30 m, RC structure, 2-storey
Workshop	18 m x 32 m, Steel frameworks
Warehouse	Approx. 40 m x 60 m

Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA



Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

Figure 2.2-1 Layout of the service berth

2.3 GCPI dredgers

GCPI currently owns 14 dredgers and plans to procure one more. Table 2.3-1 shows the type and specification of the GCPI dredgers.

Table 2.3-1 Type and specification of the GCPI dredgers

Type and capacity	No.	Length (m)	Breadth (m)	Draft (m)
TSHD (8,000 m^3)	1	132.4	22.0	8.2
TSHD (6,000 m^3)	3	114	19.2	6.6
TSHD (3,500-4,000 m^3)	5	90-100	16.0-17.0	5.5-6.0
TSHD (<3,000 m^3)	1	<90	15.0	<5.5
CSD (750-1,500 m^3)	3	46-70	7.0-14.0	1.5-3.0
GHD (2,000 m^3)	1	100-120	18.0-20.0	6.0-7.0
GHD (500 m^3)	1	57	12.5	3.9

TSHD: Trailing suction hopper dredger, CSD: Cutter suction dredger, GHD: Grab Hopper Dredger
Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

2.4 Construction plan

The construction plan is still under study and therefore information is limited. Construction works can be broadly separated into marine and terrestrial components. Table 2.4-1 shows the main construction works involved.

Table 2.4-1 Main construction works

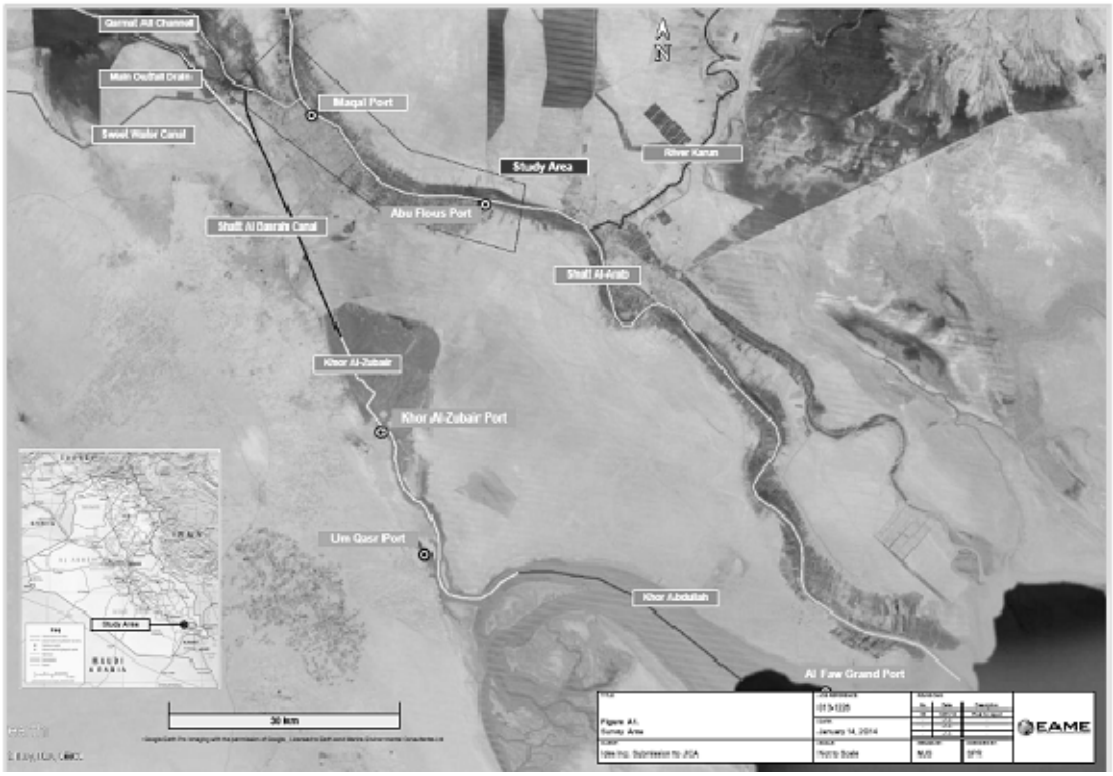
Component	Main construction works	Necessary construction equipment
Marine	・ Dredger berth: Installation of steel pipe piles	・ Pile driver
Terrestrial	・ Revetment: Installation of steel sheet pile ・ Land reclamation and ground levelling works ・ Service road: Pavement works	・ Pile driver ・ Dump trucks ・ Road roller ・ Excavator ・ Cranes ・ Concrete mixer

Chapter 3. Baseline environmental and social conditions

3.1 Natural environmental conditions

3.1.1 Hydrology

The Service Berth is located in the south end of the Khor Al Zubayr waterway, which is a large tidal inlet of the Arabian Gulf extending over 25 km inland. The Khor Al Zubayr waterway receives freshwater inflow of the Shatt al Arab River via the Shatt Al Basrah Canal at its northern end and opens up into Khor Abdallah waterway in the southeast. Maximum tidal range is in the order of 5 m and current speed can reach up to 3-5 knots. The volume of suspended sediment within the channel is approximately 157 tonnes per hour[1]. Figure 3.1-1 shows the rivers and waterways in or around the Project area.



Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

Figure 3.1-1 Rivers and waterways in or around Project area

3.1.2 Air Quality

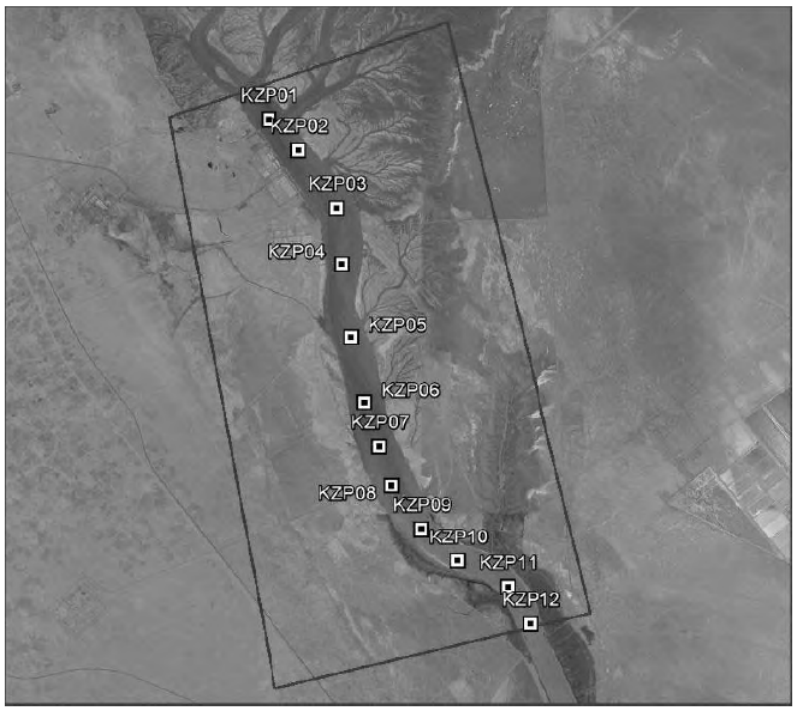
There are no available air quality data in or around the Project area. The overall air quality in Basrah has been deteriorating as development, population, traffic and industrial activity have increased.

The Ministry of Environment (MOE) has conducted air quality monitoring on a trial basis. Minimum monthly total suspended particulate (TSP) monitored by MOE from May to December 2009 in Basrah ranged between 202 - 2,181 μg/m^3 and exceeded EU and WHO guideline value of 300 μg/m^3 and 150-230 μg/m^3 respectively. SO_2, NO_2 and CO from the Basrah and Zubayr monitoring stations on 31 March and 4 April 2013 were below IFC guideline values.

[1] Dawood J. Al-Rubaiay (1984), Irrigation and Drainage Systems in Basrah Province, Iraq, University of Durham Thesis for the Degree of Doctor of Philosophy

3.1.3 Water Quality

Water quality survey was conducted in March 2012 at the northern part of Khor Al Zubayr waterway, slightly upstream of the Project area. Figure 3.1-2 shows the survey location.



Source: Data collection survey on port sector development plan in Iraq, June 2012, JICA

Figure 3.1-2 Location of water quality survey in Khor Al Zubayr waterway

The survey results are summarized in Table 3.1-1. The results are compared with environmental standard in Iraq for fresh water and EU standard for bathing water quality for the result of coliform bacteria. The main findings of the survey are as follows:

- Electrical conductivity (EC) was extremely high ranging between 59,000 - 77,000 μS/cm (equivalent to salinity of ca. 50-70 ‰).
- Dissolved oxygen (DO) was generally above Iraqi standard (5 mg/L).
- Biological oxygen demand (BOD), an indicator of organic pollution, was above Iraqi standard (3 mg/L) at most sites, ranging between 3.2-6.6 mg/L.
- Total petroleum hydrocarbons (TPH), an indicator of oil and grease, were not detected at all stations.
- Coliform count was Too Numerous To Count (TNTC) at all stations, which is probably due to the inflow of untreated sewage.
- Cyanide (CN), Arsenic (As), Cadmium (Cd), Lead (Pb) and Mercury (Hg) were below Iraqi standard.

Based on the survey results, Khor Al Zubayr waterway seems to be polluted by inflow of untreated sewage as indicated by high levels of BOD and Coliform.

Table 3.1-1 Water Quality in Khor Al Zubayr Waterway

Stn	Tide	Depth		Temp.	EC	SS	pH	DO	BOD	TN	TP	TPH	Coli.	CN	As	Cd	Cr(VI)	Pb	Hg	PCBs
		m		°C	µS/cm	mg/L	-	mg/L	mg/L	mg/L	mg/L	µg/L	cfu/100ml	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
K01	Low	S	0	14.9	66,000	330	8.47	7.4	3.6	1.3	0.140	<10	TNTC	<10	2.5	<0.1	<5	<1.0	<0.5	<7.0
		B	2.9	14.9	67,000	610	8.48	7.1	3.4	1.9	0.064	<10	TNTC	<10	3.8	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.4	64,000	610	8.45	6.9	4.0	0.8	0.330	<10	TNTC	<10	<1.1	<0.1	<5	2.1	<0.5	<7.0
		B	7.7	14.6	67,000	590	8.46	6.6	6.6	0.7	0.120	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
K02	Low	S	0	14.9	65,000	700	8.45	6.7	3.4	1.4	0.120	<10	TNTC	<10	3.2	<0.1	<5	<1.0	0.9	<7.0
		B	3.1	15.1	65,000	630	8.44	6.4	<3.0	0.7	0.088	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.3	63,000	450	8.49	6.8	<3.0	0.8	0.054	<10	TNTC	<10	2.6	<0.1	<5	<1.0	<0.5	<7.0
		B	7.8	14.2	65,000	550	8.46	6.5	3.2	0.9	0.380	<10	TNTC	<10	2.2	<0.1	<5	<1.0	<0.5	<7.0
K03	Low	S	0	14.8	65,000	610	8.51	6.0	3.5	1.1	0.096	<10	TNTC	<10	3.2	<0.1	<5	<1.0	<0.5	<7.0
		B	3.4	15.2	68,000	690	8.55	7.3	3.3	1.2	0.180	<10	TNTC	<10	1.7	<0.1	<5	<1.0	0.6	<7.0
	High	S	0	14.6	63,000	460	8.36	7.0	<3.0	0.8	0.057	<10	TNTC	<10	3.0	<0.1	<5	<1.0	<0.5	<7.0
		B	8.4	14.9	64,000	470	8.40	6.6	3.5	0.8	0.110	<10	TNTC	<10	3.1	<0.1	<5	<1.0	<0.5	<7.0
K04	Low	S	0	14.8	72,000	620	8.50	7.3	<3.0	0.7	0.120	<10	TNTC	<10	2.8	<0.1	<5	<1.0	<0.5	<7.0
		B	2.8	15.2	72,000	640	8.49	6.2	3.2	1.0	0.180	<10	TNTC	<10	3.9	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.4	63,000	430	8.38	6.3	<3.0	0.6	0.074	<10	TNTC	<10	1.7	<0.1	<5	<1.0	<0.5	<7.0
		B	7.6	14.3	66,000	450	8.39	5.8	<3.0	0.5	0.095	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
K05	Low	S	0	14.7	65,000	440	8.43	7.5	3.1	0.5	0.068	<10	TNTC	<10	4.9	<0.1	<5	<1.0	<0.5	<7.0
		B	3.3	15.0	70,000	670	8.42	7.5	3.4	0.5	0.220	<10	TNTC	<10	4.2	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.4	59,000	410	8.44	6.1	<3.0	1.0	0.070	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
		B	8.1	14.1	65,000	440	8.39	6.2	<3.0	1.0	0.120	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
K06	Low	S	0	15.0	67,000	610	8.43	7.1	3.2	0.7	0.120	<10	TNTC	<10	2.4	<0.1	<5	<1.0	<0.5	<7.0
		B	2.9	15.4	67,000	640	8.43	6.9	3.7	0.7	0.220	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.2	63,000	410	8.38	5.7	<3.0	7.0	0.091	<10	TNTC	<10	4.1	<0.1	<5	<1.0	<0.5	<7.0
		B	7.7	14.1	65,000	460	8.38	5.7	<3.0	1.6	0.150	<10	TNTC	<10	2.3	<0.1	<5	<1.0	<0.5	<7.0
K07	Low	S	0	15.1	65,000	590	8.42	6.8	4.9	0.5	0.066	<10	TNTC	<10	2.9	<0.1	<5	<1.0	<0.5	<7.0
		B	3.3	15.1	64,000	640	8.42	6.6	4.8	0.7	0.250	<10	TNTC	<10	3.7	<0.1	<5	<1.0	0.6	<7.0
	High	S	0	14.2	63,000	400	8.37	4.2	<3.0	4.1	0.077	<10	TNTC	<10	1.6	<0.1	<5	<1.0	<0.5	<7.0
		B	8.3	14.2	64,000	390	8.37	4.0	<3.0	4.4	0.075	<10	TNTC	<10	1.1	<0.1	<5	1.5	<0.5	<7.0
K08	Low	S	0	14.6	66,000	620	8.43	6.7	<3.0	0.5	0.150	<10	TNTC	<10	4.4	<0.1	<5	<1.0	<0.5	<7.0
		B	4.1	14.0	64,000	890	8.43	7.4	5.4	0.6	0.300	<10	TNTC	<10	3.0	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.4	64,000	420	8.36	3.8	<3.0	2.6	0.130	<10	TNTC	<10	2.9	<0.1	<5	1.0	<0.5	<7.0
		B	9.3	14.1	77,000	470	8.36	4.0	<3.0	2.9	0.070	<10	TNTC	<10	2.1	<0.1	<5	<1.0	<0.5	<7.0
K09	Low	S	0	14.5	68,000	700	8.43	6.5	4.7	0.6	0.150	<10	TNTC	<10	3.7	<0.1	<5	<1.0	<0.5	<7.0
		B	3.6	15.4	67,000	650	8.41	6.4	6.1	0.9	0.250	<10	TNTC	<10	1.4	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.1	66,000	140	8.36	3.8	<3.0	1.5	<0.03	<10	TNTC	<10	3.9	<0.1	<5	<1.0	<0.5	<7.0
		B	8.4	14.0	64,000	440	8.36	3.9	<3.0	0.8	0.068	<10	TNTC	<10	2.3	<0.1	<5	<1.0	<0.5	<0.40
K10	Low	S	0	14.4	67,000	590	8.49	6.5	5.1	0.6	0.120	<10	TNTC	<10	2.3	<0.1	<5	<1.0	<0.5	<7.0
		B	3.8	14.8	69,000	610	8.46	7.3	5.3	0.7	0.120	<10	TNTC	<10	4.1	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.1	63,000	420	8.30	3.7	<3.0	1.4	0.120	<10	TNTC	<10	3.5	<0.1	<5	1.9	<0.5	<7.0
		B	8.6	14.1	64,000	360	8.39	3.9	<3.0	1.2	0.170	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
K11	Low	S	0	15.1	66,000	590	8.41	7.4	5.3	0.6	0.110	<10	TNTC	<10	3.9	<0.1	<5	<1.0	<0.5	<7.0
		B	4.9	15.2	70,000	600	8.46	6.5	5.5	0.8	0.130	<10	TNTC	<10	1.8	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.0	64,000	340	8.37	4.0	<3.0	1.8	<0.03	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
		B	9.9	14.1	64,000	490	8.36	4.0	<3.0	1.2	0.070	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
K12	Low	S	0	15.0	62,000	540	8.34	7.0	3.4	0.7	0.110	<10	TNTC	<10	3.5	<0.1	<5	<1.0	<0.5	<7.0
		B	3.5	15.4	65,000	650	8.39	6.5	4.2	0.9	0.190	<10	TNTC	<10	2.0	<0.1	<5	<1.0	<0.5	<7.0
	High	S	0	14.0	66,000	520	8.36	3.4	<3.0	1.9	<0.03	<10	TNTC	<10	<1.1	<0.1	<5	<1.0	<0.5	<7.0
		B	8.5	14.0	63,000	360	8.36	3.5	<3.0	1.5	0.039	<10	TNTC	<10	1.6	<0.1	<5	1.8	<0.5	<7.0
Standard																				
Iraqi *		-		-	-	-	6.5-8.5	>5	<3	-	-	-	-	20	50	5	-	50	1	-
EU **		Coliform : Excellent (200 cfu/100ml), Good (400 cfu/100ml), Sufficient (330 cfu/100ml)																		

* New determinants for the prevention of pollution of rivers (No.25, 1967)

** EU Directive 2006/7/EC concerning the management of bathing water quality

*** TNTC : Too Numerous To Count

Source: Data collection survey on port sector development plan in Iraq, June 2012, JICA

3.1.4 Sediment Quality

Sediment quality survey was conducted at the same location as the water quality survey at the Khor Al Zubayr waterway in March 2012 (see Figure 3.1-2). The survey result is summarized in Table 3.1-2.

The results are compared with the Canadian Sediment Quality Guideline Values for the Protection of Aquatic Life (fresh water) because there are no environmental standard in Iraq and neighbour countries. In the Canadian Guideline, ISQG corresponds to the threshold level below which adverse biological effects are not expected while PEL defines the level above which adverse effects are expected to occur frequently. The main findings of the survey are as follows:

- Total Petroleum Hydrocarbons (TPH), an indicator of oil and grease, were not detected at all stations.
- Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg), PCB and DDT were not detected or were below ISQG.
- Dioxins, even High Values (concentration of non-detected congeners at detection limit), were below PEL.

Table 3.1-2 Sediment quality in Khor Al Zubayr waterway

Item	Unit	K01	K02	K03	K04	K05	K06	K07	K08	K09	K10	K11	K12	ISQG*	PEL*
Depth	m	8.7	8.8	9.4	8.6	9.1	8.7	9.3	10.3	9.4	9.6	10.9	9.5	-	-
Water Content	%	31	39	35	29	38	33	32	28	32	35	30	36	-	-
TOC	%	0.5	0.6	0.6	0.5	0.7	0.7	0.6	0.6	1.1	0.6	0.6	<0.1	-	-
TPH(C10-C40)	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-
Total Phenol	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
TN	mg/kg	1.1	1.0	1.5	1.3	1.1	0.9	1.1	280.0	1.0	1.1	190	1.0	-	-
TP	mg/kg	450	480	490	430	460	450	420	410	460	430	410	450	-	-
TS	mg/kg	2,600	2,300	2,700	3,500	2,900	2,900	3,400	3,400	4,800	3,700	4,300	3,400	-	-
Cyanide	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
As	mg/kg	3.7	4.1	3.7	3.0	2.3	3.3	4.2	4.9	2.7	3.4	3.5	3.5	5.9	17.0
Sn	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Fe	mg/kg	28,000	29,000	30,000	28,000	28,000	28,000	27,000	24,000	27,000	29,000	29,000	27,000	-	-
Mn	mg/kg	410	430	420	390	410	410	390	370	420	430	440	400	-	-
Cd	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	3.5
Cr(VI)	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	-
Pb	mg/kg	2.2	3.2	4.1	3.6	3.8	2.6	2.5	3.4	3.2	2.1	3.4	3.0	35	91.3
Hg	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.17	0.486
Cu	mg/kg	23	23	24	21	22	24	21	21	24	23	23	23	35.7	197
Ni	mg/kg	89	88	90	78	86	86	79	72	88	87	89	82	-	-
Zn	mg/kg	38	42	43	35	40	38	36	33	40	39	40	38	123	315
PCBs	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.034	0.277
DDT	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.00119	0.00477
TBT	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Dioxins (high)**	ngTEQ/kg	0.758	0.749	0.714	0.680	0.721	0.606	0.779	0.645	0.566	0.677	0.595	0.644	0.85	21.5
Dioxins (low)**	ngTEQ/kg	0.0185	ND	0.0002	ND	0.0007	0.0051	0.327	0.0043	ND	ND	ND	0.0002		

* ISQG - Interim Sediment Quality Guidelines correspond to threshold level below which adverse biological effects ate not expeted
PEL - Probable Effect Level defines the level above which adverse effects are expected to occur frequently
ISQG and PEL developed by Task Group of the Canadian Council of Ministers of the Environment
** High value - concentration of Non Detected congeners at detection limit
Law value - concentration of Non Detected congeners at zero
Toxic Equivalent (TEQ) was calculated based on WHO 1998 TEF values for fish
ND: Not Detected

Source: Data collection survey on port sector development plan in Iraq, June 2012, JICA

3.1.5 Ecosystem

The service berth will be located over a narrow intertidal mudflat area. Figure 3.1-3 shows the mudflat in the planned service berth area. Part of the mudflat has been reclaimed in the past using dredged material. Mudflats are known as important habitat for various aquatic species and birds. Following are general descriptions of the flora and fauna around the Khor Al Zubayr area.

Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

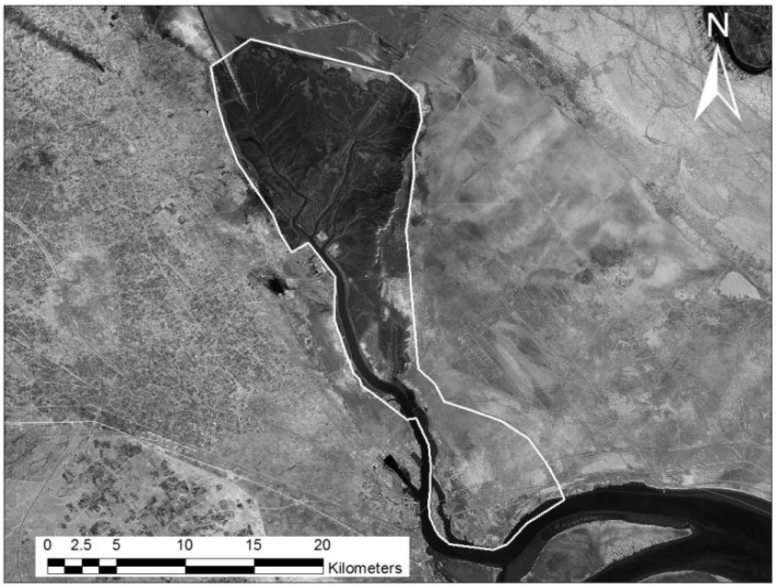
Figure 3.1-3 Mudflat in the planned service berth area

(1) Flora

Plant life is limited due to the high saline levels in the soil and disturbance from anthropogenic activities. Flora likely to be present are halophytes such as species of the families Boraginaceae, Chenopodiaceae and Zygophyllaceae.

(2) Bird

The Khor Al Zubayr area is designated as an Important Bird Area (IBA) by BirdLife International . Figure 3.1-4 shows the boundary of the Khor Al Zubayr IBA. Note that the service berth is located outside of the Khor Al Zubayr IBA.



Source: Nature Iraq

Figure 3.1-4 Boundary of Khor Al Zubayr IBA

According to the biodiversity study undertaken by Nature Iraq in 2009 for the Khor Al Zubayr area, a total of 27 species of bird were recorded (see Table 3.1-3). One species, Greater Spotted Eagle (*Aquila clanga*) is classified as Vulnerable (VU) under the IUCN Red List. However, it is unlikely that the Project area is important for *Aquila clanga* due to the disturbed nature of the area. All the other recorded species are not classified as threatened species under the IUCN Red List.

Table 3.1-3 Bird species recorded by Nature Iraq in Khor Al Zubayr area

Common name	Scientific name	IUCN Red List
Black-crowned Night Heron	*Nycticorax nycticorax*	LC
Squacco Heron	*Ardeola ralloides*	LC
Grey Heron	*Ardea cinerea*	LC
Purple Heron	*Ardea purpurea*	LC
Little Egret	*Egretta garzetta*	LC
Western Reef Heron	*Egretta gularis*	LC
Great Cormorant	*Phalacrocorax carbo*	LC
Marsh Harrier	*Circus aeruginosus*	LC
Hen Harrier	*Circus cyaneus*	LC
Greater Spotted Eagle	*Aquila clanga*	VU
Little Ringed Plover	*Charadrius dubius*	LC
Kentish Plover	*Charadrius alexandrinus*	LC
Eurasian Curlew	*Numenius arquata*	NT
Ruff	*Philomachus pugnax*	LC
Armenian Gull	*Larus armenicus*	Not Listed
Black headed Gull	*Larus ridibundus*	LC
Gull billed Tern	*Gelochelidon [Sterna] nilotica*	LC
Caspian Tern	*Hydroprogne [Sterna] caspia*	LC
Collared Dove	*Streptopelia decaocto*	LC
White-throated Kingfisher	*Halcyon smyrnensis*	LC
Grey Shrike	*Lanius sp.*	LC
Rook	*Corvus frugilegus*	LC
Crested Lark	*Galerida cristata*	LC
Graceful Prinia	*Prinia gracilis*	LC
House Sparrow	*Passer domesticus*	LC
Spanish Sparrow	*Passer hispaniolensis*	LC
Dead Sea Sparrow	*Passer moabiticus*	LC

LC: Least concern, NT: Near threatened, VU: Vulnerable
Source: Nature Iraq 2009

(3) Fish

According to Hussain, N.A. et al. (2011)[2], two Anchovy species, *Thryssa mystax and T. hamiltonii* are found within the waters of Khor Al Zubayr. A unique species found only in this area of Iraq is Waltons Mudskipper (*Periophthalmus waltoni*). It is an amphibious air-breather and can be found in the soft mud within the tidal range. It has not been assessed for the IUCN Red List.

A survey conducted by Al-Daham and Yousif (1990)[3] collected a total of 47 species over a 12 month period. None of the fish species found within Khor Al Zubayr, Umm Qasr and Khawar Abdallha are included on the IUCN Red List of Threatened Species.

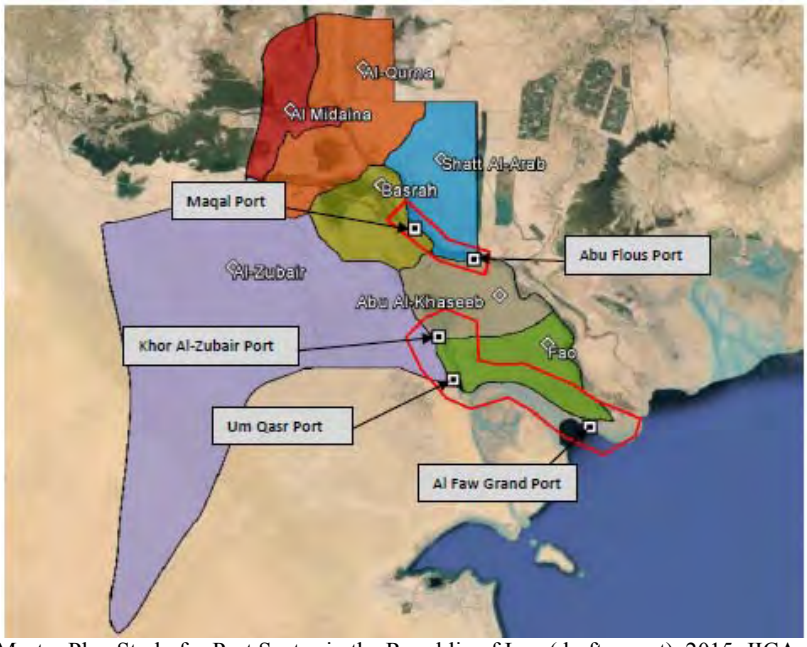
[2] Hussain, N.A., Ali,T.S. (2011) Some biological aspects of Thryssa hamiltonii and Thryssa mystax in Khor Al Zubair, Northwest Arabian Gulf. Indian Journal of Fisheries, 34(2), 152-162

[3] Al-Daham.N.K.and Yousif. A.Y. (1990) Composition, seasonality and abundance of fishes in the Shatt Al Basrah Canal, an estuary in Southern Iraq; Estuarine, Coastal and Shelf Science; Vol. 31,4, 411-421

3.2 Social environmental conditions

3.2.1 Population

The service berth lies in the northern part of an administrative district called Umm Qasr City in Al Zubayr district. According to the census survey in 2013, the population of Umm Qasr City is about 55,000. Figure 3.2-1 shows the district boundary of the Basrah Governorate. Table 3.2-1 shows the population of the districts in Basrah Governorate.



Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

Figure 3.2-1 District Boundaries of Basrah Governorate

Table 3.2-1 Population of Basrah Governorate (year 2013)

Districct	Subdistrict (Adminstrative Unit)	Urban Areas			Rural Areas			Total		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Basra	Basra Disrtict Center	553,733	557,490	1,111,223	24,924	23,597	48,521	578,657	581,087	1,159,744
	Hartha	53,204	53,565	106,769	22,330	21,141	43,470	75,534	74,706	150,240
	Sub-Total	**606,937**	**611,055**	**1,217,992**	**47,254**	**44,738**	**91,991**	**654,191**	**655,793**	**1,309,984**
Abo Al-Khasib	Abo Al-Khasib Disrtict Center	93,463	94,098	187,561	8,517	8,063	16,580	101,980	102,161	204,141
	Sub-Total	**93,463**	**94,098**	**187,561**	**8,517**	**8,063**	**16,580**	**101,980**	**102,161**	**204,141**
Zubair	Zubair Disrtict Center	136,138	137,061	273,199	46,081	43,628	89,709	182,219	180,689	362,908
	Safwan	11,673	11,752	23,425	15,511	14,685	30,196	27,184	26,437	53,621
	Umm Qasr	22,535	22,688	45,223	5,209	4,932	10,141	27,744	27,620	55,364
	Sub-Total	**170,346**	**171,501**	**341,847**	**66,801**	**63,245**	**130,046**	**237,147**	**234,746**	**471,893**
Qurna	Qurna Disrtict Center	57,232	57,620	114,852	7,730	7,319	15,049	64,963	64,939	129,901
	Al-Dair	14,121	14,217	28,338	37,095	35,199	72,214	51,216	49,336	100,552
	Al-Thaghur	1,529	1,539	3,068	17,106	16,195	33,301	18,635	17,734	36,369
	Sub-Total	**72,882**	**73,376**	**146,258**	**61,931**	**58,713**	**120,564**	**134,814**	**132,009**	**266,822**
Faw	Faw Disrtict Center	16,222	16,332	32,553	3,177	3,008	6,185	19,399	19,340	38,738
	Sub-Total	**16,222**	**16,332**	**32,553**	**3,177**	**3,008**	**6,185**	**19,399**	**19,340**	**38,738**
Shat Al-Arab	Shat Al-Arab Disrtict Center	60,201	60,610	120,811	4,143	3,922	8,066	64,344	64,032	128,877
	Al-Nashwa	1,423	1,432	2,855	14,790	14,003	28,793	16,213	15,435	31,648
	Sub-Total	**61,624**	**62,042**	**123,666**	**18,933**	**17,925**	**36,859**	**80,557**	**79,967**	**160,525**
Al-Mdaina	Al-Mdaina Disrtict Center	14,208	14,304	28,512	23,320	22,079	45,399	37,528	36,383	73,911
	Ez-AdDien Saleem	12,900	12,988	25,888	19,706	18,657	38,363	32,606	31,645	64,251
	Talha (Al-Sadeq)	20,653	20,794	41,447	20,913	19,800	40,713	41,567	40,593	82,160
	Sub-Total	**47,761**	**48,086**	**95,847**	**63,939**	**60,536**	**124,475**	**111,701**	**108,621**	**220,322**
Total		**1,069,235**	**1,076,490**	**2,145,724**	**270,552**	**256,228**	**526,700**	**1,339,789**	**1,332,637**	**2,672,425**

Source: Ministry of Planning/Basra Office

3.2.2 Cultural heritage

Iraq has three UNESCO World Heritage sites, Hatra, Ashur and Samarra Archaeological City. There are no cultural heritages in or around the Project area.

3.2.3 Fishery

Fishery activities are conducted throughout Khor Al Zubayr and Khawar Abdallha waterways. Extensive commercial fishing is not conducted and most of fishermen conduct their works using small boats. There are few studies on fishery around the Project area.

Around Khar Al Zubayr waterway, fishermen activities are seasonal, their efforts increase from April to August. They make no more than 200 dollars in winter periods where activities are extremely limited due to weather and safety conditions and the available fish species. This value raises to an average of 800 – 1,000 dollars in high seasons[4]. A list of the fish species found around at Khar Al Zubayr is shown in Table 3.2-2.

Table 3.2-2 List of fish species found around Khar Al Zubayr

Family	Scientific name	Local Name
Mugilidae	*Liza spp.*	Byah
Sparidae	*Acanthopagrus latus*	Shanak
Stromateidae	*Pompus argenteus*	Zbady
Scinedae	*Otolithes ruber*	Nuaby
Scinedae	*Johnius belengerii*	Tataoo
Clupeidae	*Tenualosa ilisha*	Sobor
Clupeidae	*Ilisha elongata*	Abo Uena
Serranidae	*Epinephelus tuvina (Forskal)*	Hamur zaetony
Siliagonidae	*Siliago sihama*	Hasum

Source: Draft IEE on KZP Development, Data Collection Survey on Port Sector Development Plan In Iraq, 2012, JICA

Some fishermen park their boats in the planned service berth area. Figure 3.2-2 shows the fishing boats parked in the planned service berth area.

Source: Master Plan Study for Port Sector in the Republic of Iraq (draft report), 2015, JICA

Figure 3.2-2 Fishing boats parked in the planned service berth area

[4]Draft IEE on KZP Development, Data Collection Survey on Port Sector Development Plan In Iraq, 2012, JICA

Chapter 4. Scoping of environmental impacts

This chapter identifies the potential environmental impacts of the Project for the construction and operation phases through a scoping exercise. The method and results of the scoping are described below.

4.1 Method of scoping

Scoping was conducted based on available baseline environmental data and information available in the Project's pre-feasibility study. JICA's "Guidelines for environmental and social considerations (2010)" was also referred, which provides a list of items to be considered in the scoping process including physical, biological and social environmental aspects. Items rated as having potential negative impacts were rated as either "A-", "B-" in order of significance. Items rated as "C-" means that extent of negative impact is unknown due for instance to lack of information. No negative impacts are expected for items rated as D.

4.2 Results of scoping

Table 4.2-1 shows the results of the scoping including the rationale behind the rating. No items were rated as "A-" indicating that significant negative impacts are not expected. Several items were rated as "B-" namely air pollution, water pollution, waste, noise and bottom sediment. While significant negative impacts are not expected, appropriate mitigation measures should be considered for these items. Several items were rated as "C-", which is mainly related to the impacts on fishermen were information is currently lacking.

Table 4.2-1 Results of the scoping

Item			Stage	Rating	Rationale
Physical environment	1	Air pollution	C	B-	・Dust and exhaust gases emitted from construction vehicles (e.g. dump trucks) may have adverse impacts if they travel through sensitive areas (e.g. residential area). ・Although construction works will inevitably generate some dust and exhaust gases, it should not be of any major concern as there are no sensitive areas (e.g. residential area) nearby.
			PC	D	Although exhaust gases emitted from the dredgers may degrade the local air quality, impacts should be insignificant as there are no sensitive areas (e.g. residential area) nearby.
	2	Water pollution	C	B-	Marine construction works (e.g. pile driving) may cause water pollution through for example oil leaks and spills.
			PC	B-	Possible pollution due to discharge of untreated wastewater from ships and buildings (e.g. sewage, bilge water).
	3	Soil pollution	C, PC	D	The risk of soil pollution should be low as there are no major soil pollution sources.
	4	Waste	C	B-	Construction wastes (e.g. solid waste, waste oil, human waste) may cause pollution if not managed properly.
			PC	B-	Waste from ships and port facilities may cause pollution if not managed properly.
	5	Noise/vibration	C	B-	・Noise emitted from construction vehicles may have adverse impacts if they travel through sensitive areas (e.g. residential area). ・Although construction works will inevitably generate some noise, it should not be of any major concern as there are no sensitive areas (e.g. residential area) nearby.
			PC	D	There are no major noise sources.
	6	Ground subsidence	C, PC	D	There are no activities that may cause ground subsidence.
	7	Offensive odor	C, PC	D	There are no odor sources.
	8	Bottom sediment	C	D	The risk of sediment pollution should be low as there are no major sediment pollution sources.
			PC	B-	Anti-fouling paints used by dredgers may cause sediment pollution.
Natural Environment	9	Conservation area	C, PC	D	There are no conservation areas near the Project area.
	10	Ecosystem, flora/fauna	C, PC	D	There is no ecosystem of significant importance in the Project area.
	11	Hydrology	C, PC	D	Although the new berth may alter the current flow, it should be of insignificant level as the berths will be constructed with steel pipe piles.
	12	Topography	C, PC	D	There will be no alteration of topography of any significance.
Social Environment	13	Involuntary resettlement	C, PC	D	There will be no involuntary resettlement.
	14	Vulnerable social groups (poor, indigenous people etc.)	C, PC	D	There are no vulnerable social groups around the Project area.
	15	Livelihood, living environment	C	B+	Construction works should provide employment opportunities to the local people.

Item			Stage	Rating	Rationale
				C-	Possible impacts on the livelihood of fishermen if they can no longer use the area for boat parking. Further studies are required.
			PC	C-	Possible impacts on the livelihood of fishermen if they can no longer use the area for boat parking. Further studies are required.
	16	Land use	C, PC	C-	The current land use of the area is uncertain. Further studies are required.
	17	Local resource	C, PC	D	No impacts of any significance are expected.
	18	Water use	C, PC	C-	The current water use of the area is uncertain (e.g. fishing activitiy). Further studies are required.
	19	Social infrastructures and services	C, PC	D	There are no social infrastructures and services around the Project area.
	20	Social institutions	C, PC	D	There are no activities that may have adverse impacts on social institutions.
	21	Misdistribution of benefit and losses	C, PC	C-	Possible impacts on fishermen. Further studies are required.
	22	Local conflicts of interest	C, PC	C-	Possible impacts on fishermen. Further studies are required.
	23	Cultural heritage	C, PC	D	There are no cultural heritages around the Project area.
	24	Landscape	C, PC	D	The Project area has limited landscape value.
	25	Gender	C, PC	D	There are no activities that may trigger gender issues.
	26	Children's rights	C, PC	D	There are no activities that may violate children's rights.
	27	Infectious diseases (HIV/AIDS etc.)	C, PC	D	The risk of spreading infectious diseases should be low providing that standard precautions are made.
	28	Occupational safety	C, PC	D	The risk of occupational accidents should be low providing that standard safety practices are implemented.
Others	29	Accidents	C, PC	D	The risk of accident should be low as the Project area is located in a remote area.
Others	30	Trans-boundary and climate change impacts	C, PC	D	The Project does not involve any activities that may have trans-boundary or climate change impacts.

Legend of Project stage:

C: Construction phase

PC: Post-construction phase

Rating criteria:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown.

D: No impact is expected.

Chapter 5. Mitigation measures and monitoring program

In this Chapter, mitigation measures and monitoring programs are proposed for items rated as "B-" in the previous scoping exercise. Note that the proposed mitigation measures and monitoring programs are general in nature and therefore should be revised and updated once the construction plans are more refined.

5.1 Mitigation measures

Tables 5.1-1 and 5.1-2 show the proposed mitigation measures for the construction and operation phases respectively.

Table 5.1-1 Proposed mitigation measures during construction phase

Item			Scoping rating	Potential impacts	Mitigation measure
Physical environment	1	Air pollution	B-	Exhaust and dust emission from construction vehicles	・Construction vehicles should to the extent possible avoid passing through sensitive areas (e.g. residential areas) during transportation of construction materials. A fixed route should be designated for construction vehicles. ・Construction vehicles should be regularly inspected and maintained in good condition.
	2	Water pollution	B-	Oil leakages and spills from construction machines	・Construction machines should be regularly inspected and maintained in good condition. ・Construction machines with any oil leaks should be removed from the waterway until repaired. ・Development of oil spill contingency plan.
	3	Waste	B-	Generation of construction waste	**[Solid waste]** ・Solid wastes should be stored in a designated location inside the construction site and in manner to prevent dispersal by wind. ・Sufficient number of waste bins should be placed at the construction sites. ・Littering at the constriction sites and into the waterway should be strictly prohibited. ・Daily clean-up at the construction sites. ・Solid wastes should be disposed at an authorized facility. **[Hazardous waste]** ・Hazardous wastes should be contained in specialized containers and stored in a designated location inside the construction site. ・Measures should be taken to prevent spills and leakages into the surrounding environment. ・Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal. **[Human waste]** ・Temporary toilet should be installed at the construction site. The generated sludge should be disposed at an authorized facility.
	4	Noise/vibration	B-	Noise emission from construction vehicles	・Construction vehicles should to the extent possible avoid passing through sensitive areas (e.g. residential areas) during transportation of construction materials. A fixed route should be designated for construction vehicles. ・Construction vehicles should be regularly inspected and maintained in good condition.

Table 5.1-2 Proposed mitigation measures during operation phase

Item			Scoping rating	Potential impacts	Mitigation measure
Physical environment	1	Water pollution	B-	Wastewater discharge from ships and port facilities	**[Ships]** ・ Discharge of ship wastewater into the waterway and sea should be regulated in accordance to MARPOL regulations. ・ Wastewater (e.g. oily water, bilge water) that cannot be discharged in accordance to MARPOL regulations should be transported to an authorized facility for treatment. ・ Facilities for collecting and transporting wastewater should be available (e.g. tank truck) **[Port facility]** ・ Port facilities (e.g. administration office) should be equipped with sewage treatment facility (e.g. septic tank) and discharge in accordance to Iraqi discharge standard. ・ Workshop should be equipped with an oil-water separator. The separated oil should be treated at an authorized facility. The separated water should be discharged in accordance to Iraqi discharge standard.
	2	Waste	B-	Generation of wastes from ships	**[Solid waste]** ・ Disposal of solid waste into the waterway and sea should be strictly prohibited and should only be disposed at an authorized facility. ・ Facilities for collecting and transporting wastewater should be available (e.g. garbage truck) **[Hazardous waste]** ・ Hazardous wastes should be contained in specialized containers and stored in a designated location inside the ship. ・ Measures should be taken to prevent spills and leakages into the surrounding environment (e.g. containment bund). ・ Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal.

Item			Scoping rating	Potential impacts	Mitigation measure
			B-	Generation of wastes from port facilities	**[Solid waste]** ・ Solid wastes should be stored in a designated location inside the construction site and in manner to prevent dispersal by wind. ・ Sufficient number of waste bins should be placed at the port area. ・ Littering inside the port area and into the waterway should be strictly prohibited. ・ Solid wastes should be disposed at an authorized facility. **[Hazardous waste]** ・ Hazardous wastes should be contained in specialized containers and stored in a designated location inside the port area. ・ Measures should be taken to prevent spills and leakages into the surrounding environment. ・ Hazardous wastes should be treated/disposed at an authorized facility. Hazardous wastes that are not accepted in the region should be transported overseas for treatment or disposal.
	3	Bottom sediment	B-	Sediment contamination by use of hazardous anti-fouling paints	The use of hazardous anti-fouling paints should be prohibited.

5.2 Monitoring program

Table 5.2-1 shows the proposed environmental monitoring program for the both the construction and operation phases.

Table 5.2-1 Proposed monitoring program for the construction and operation phases

Phase	Item	Method
Construction	Water quality	**[Parameter]** ・ Water temp., pH, Turbidity, Suspended solids (SS), Total Petroleum Hydrocarbon (TPH), Coliform bacteria **[Frequency]** ・ 4 times/year **[Location]** ・ 3 sites (upstream, front and downstream of Project site)
Operation	Water quality	**[Parameter]** ・ Water temp., pH, Turbidity, Suspended solids (SS), Dissolved oxygen (DO), Total nitrogen (TN), Total phosphorus (TP), Total Petroleum Hydrocarbon (TPH), Coliform bacteria **[Frequency]** ・ 2 times/year **[Location]** ・ 3 sites (upstream, front and downstream of Project site)
	Effluent quality	**[Parameter]** ・ Water temp., pH, Biological oxygen demand (BOD), Total Petroleum Hydrocarbon (TPH), Coliform bacteria **[Frequency]** ・ 2 times/year **[Location]** ・ Discharge outlet
	Sediment quality	**[Parameter]** ・ Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), Total petroleum hydrocarbon (TPH), Tributyltin **[Frequency]** ・ 1 time/year **[Location]** ・ 3 sites (upstream, front and downstream of Project site)

Chapter 6. Conclusion and recommendations

In general, the Project is likely to have limited negative environmental impacts mainly because there are no important or sensitive ecosystems and any residential areas near the Project area. Although construction works and operation activities may inevitably generate some negative impacts, these should be contained within acceptable levels providing that appropriate mitigation measures are implemented as proposed in Chapter 5. For these reasons, this Project is likely to be classified as "Category B" under Iraqi EIA regulations[5]. Category B project is defined as follows:

Definition of Category B projects:
This category relates to those activities which have less potential to result in pollution than those in Category (A). Such activities include industrial, agricultural, or other activities which can result in site contamination which can be controlled. Such activities can therefore be established within city boundaries and within the development plots allocated for them, provided that pollution control equipment/treatment units are installed in accordance with relevant national regulations and instructions.

For effective implementation, a detailed environmental management plan, waste management plan, oil spill contingency plan should also be prepared including the implementing organizational structure, responsibilities, budget and so on. Assignment of qualified environmental officer and maintenance officer will also be necessary. Furthermore, following are some pollution control facilities that should be considered for the service berth:

- Oil/water separator in the workshop
- Sewage treatment facility in the port buildings
- Storage area for hazardous and non-hazardous wastes including spill containment facility
- Collection and transport vehicles for waste and wastewater
- Equipment for oil spill response

In addition, there are still some issues that should be studied and resolved, which is primarily regarding the fishermen that are currently using the area for parking their boats. They may be required to relocate their activity if boat parking space becomes unavailable through construction of the service berth. Since, information on these fishermen is currently lacking, it is recommended to collect baseline information of these fishermen and then assess how the Project will affect them. Following are some of the information that should be collected:

- Number of boats and fishermen using the Project area
- Place of residence and method of access to the Project area
- Reason for using the Project area
- Main fishing area and targeted species
- Availability of alternative boat parking area
- Land ownership of the Project area

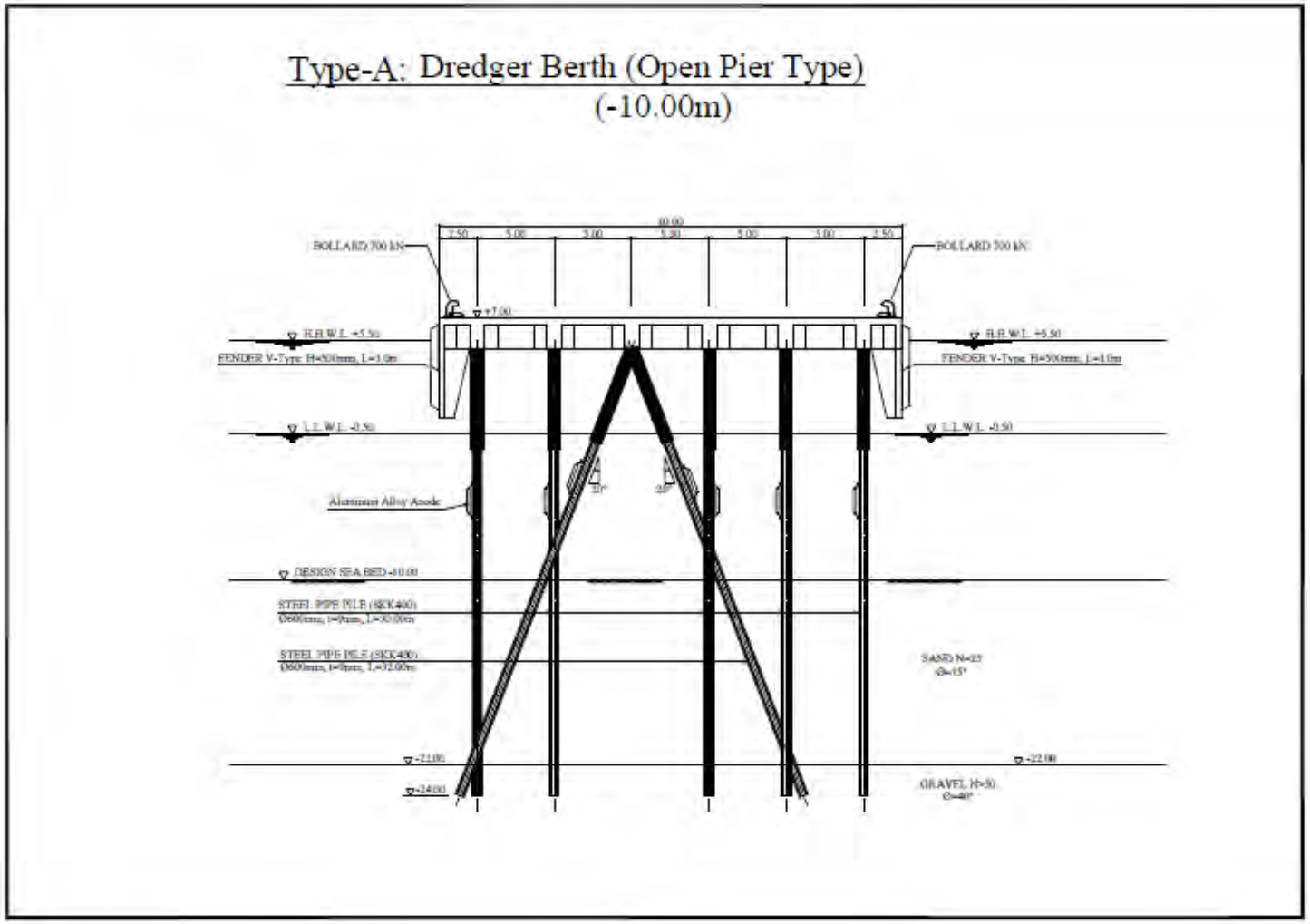
Alternatively, to avoid any impacts on the fishermen, it is worth considering to shift the location of the service berth southward so that it does not overlap with the fishing boat parking area.

[5] Environmental Criteria for Industrial, Agricultural, and Public Service Projects (1990) and Environmental Determinants for the Establishment of Projects and Monitor the Implementation of Safety (Instruction No.3, 2011).

Preliminary Design Drawings

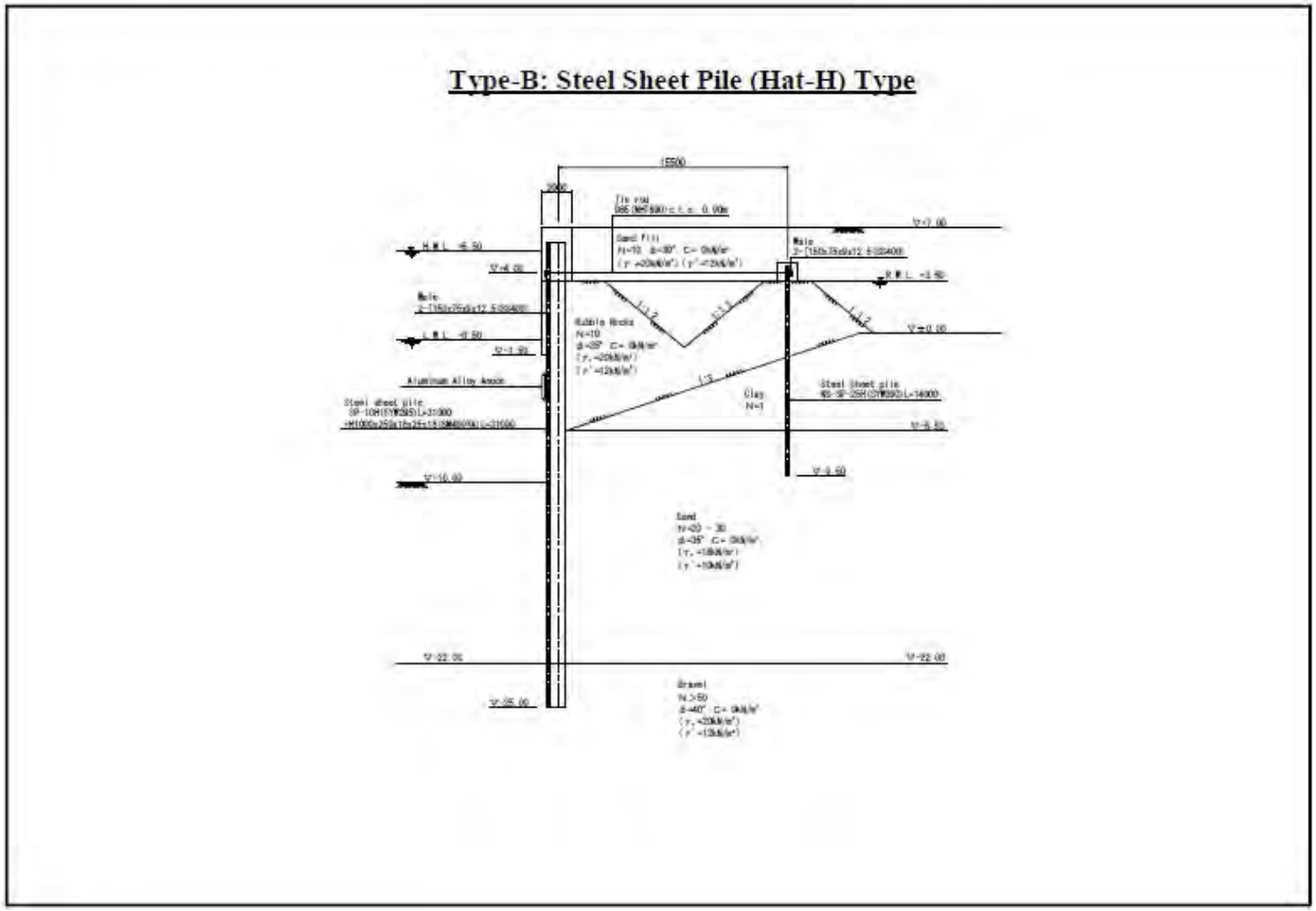
December 2015

APPENDIX-II. Preliminary Design Drawings



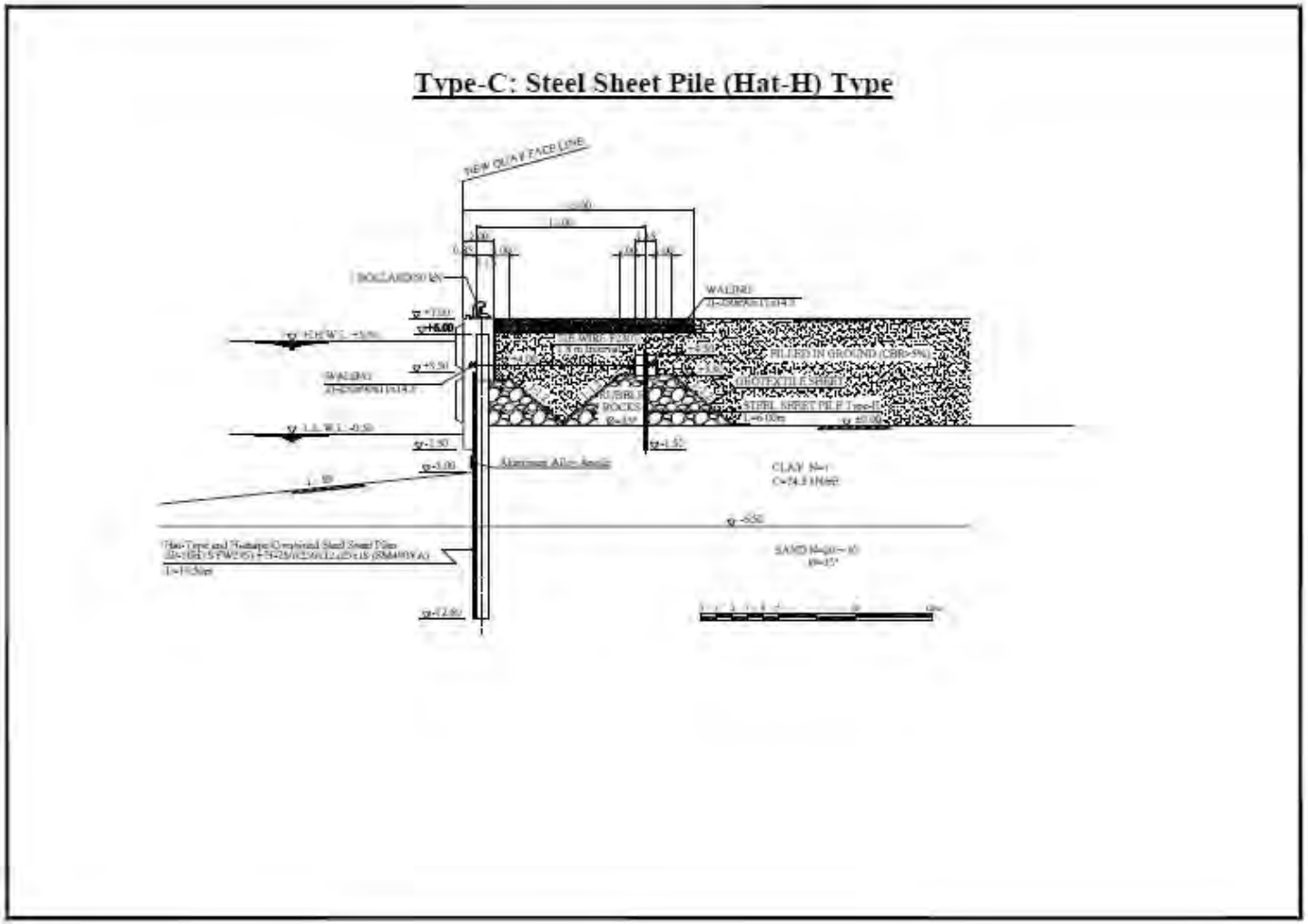
Source: JICA Study Team

APPENDIX-II 1 Type-A: Dredger Berth (Open Pier Type)



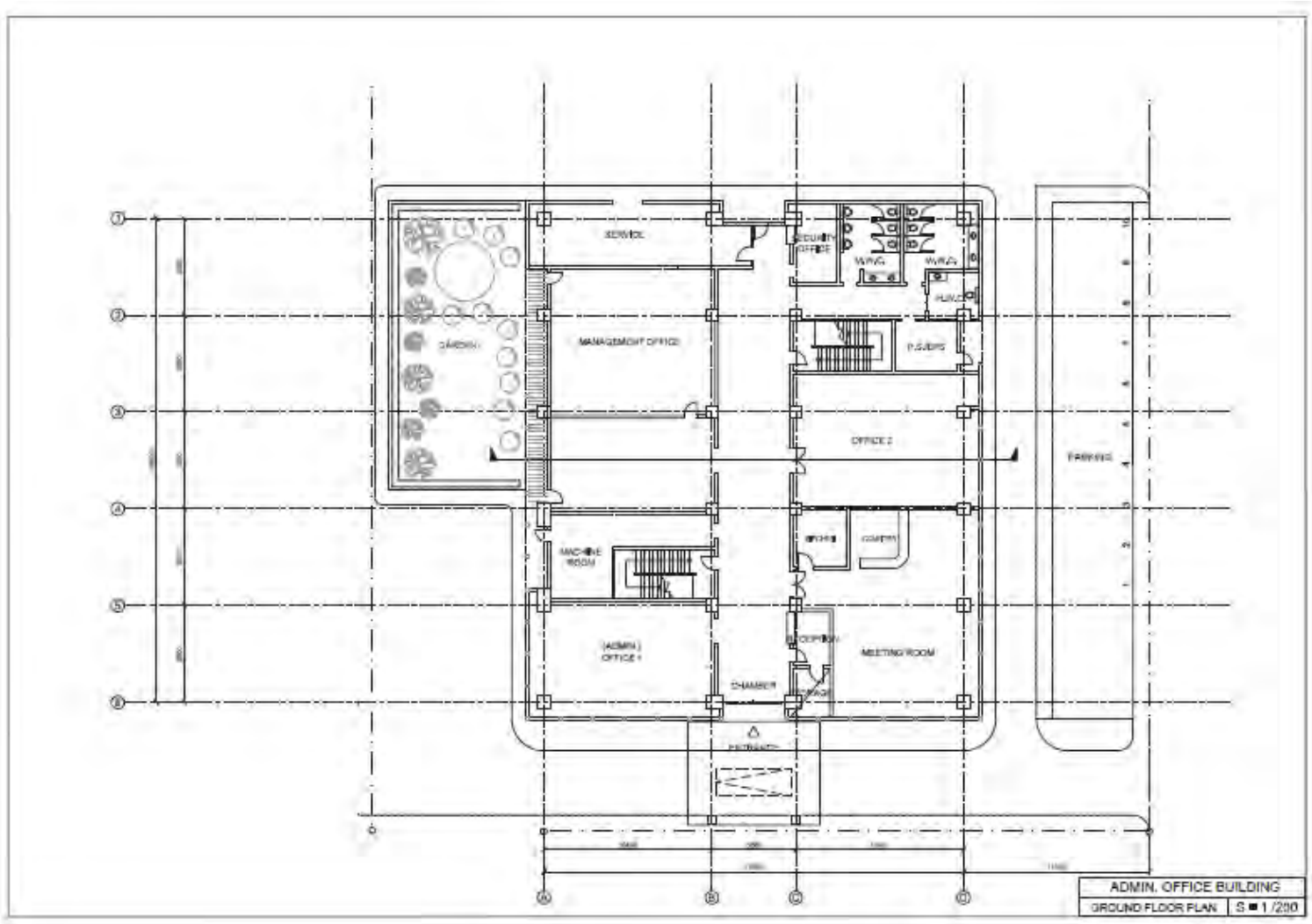
Source: JICA Study Team

APPENDIX-II 2 Type-B: Steel Sheet Pile (Hat-H) Type



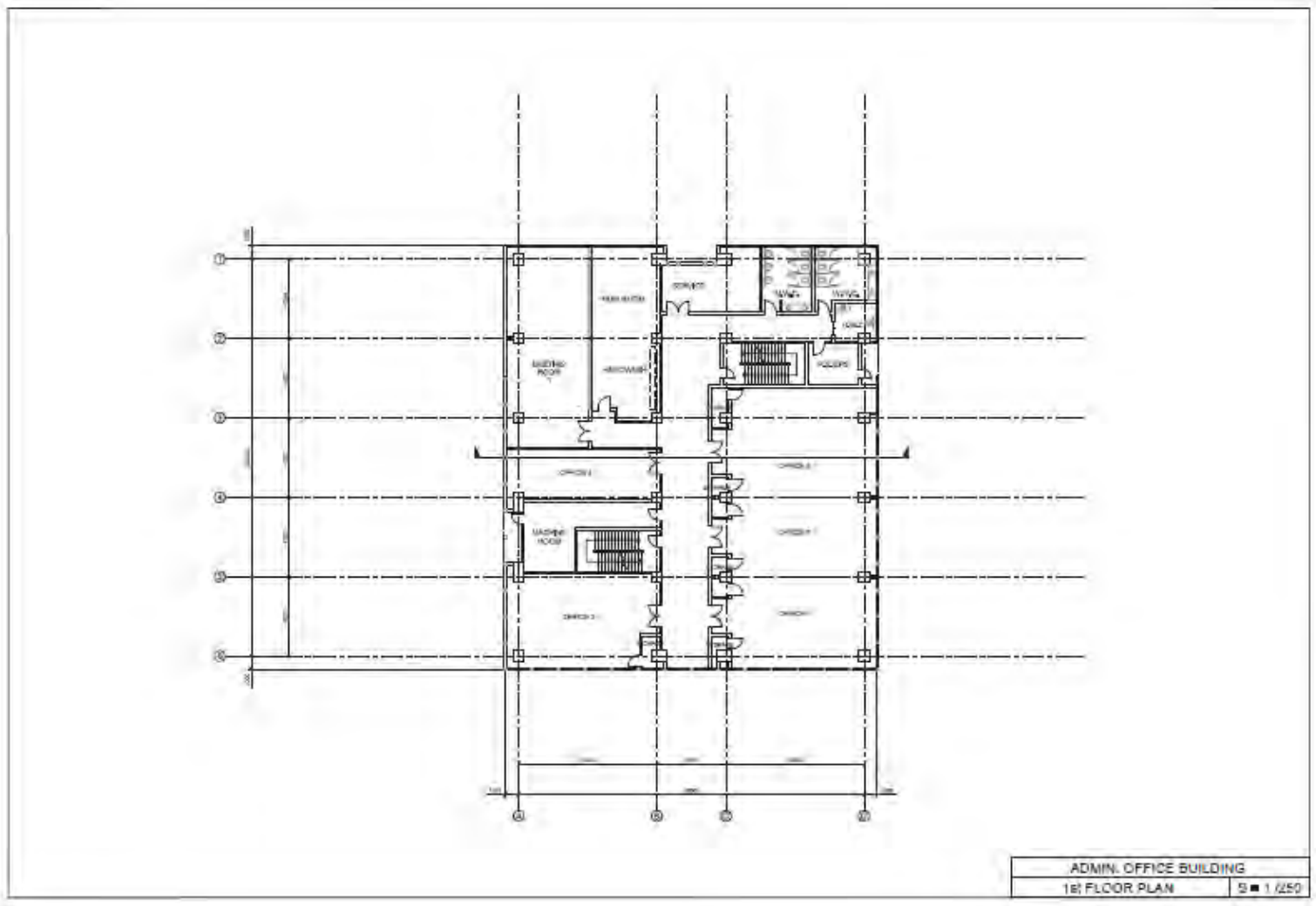
Source: JICA Study Team

APPENDIX-II 3 Type-C: Steel Sheet Pile (Hat-H) Type



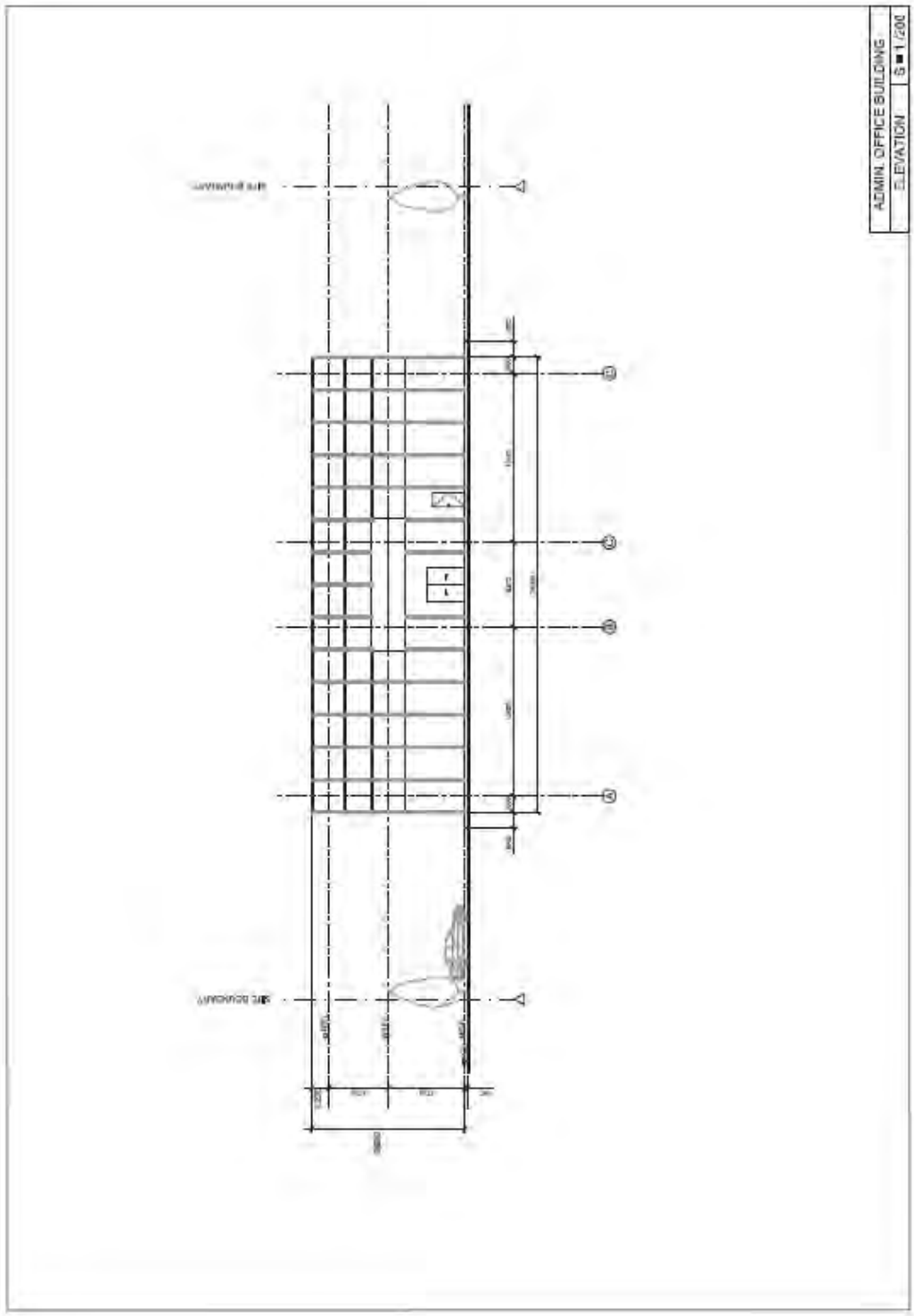
Source: JICA Study Team

APPENDIX-II 4 Admin. Office Building 1



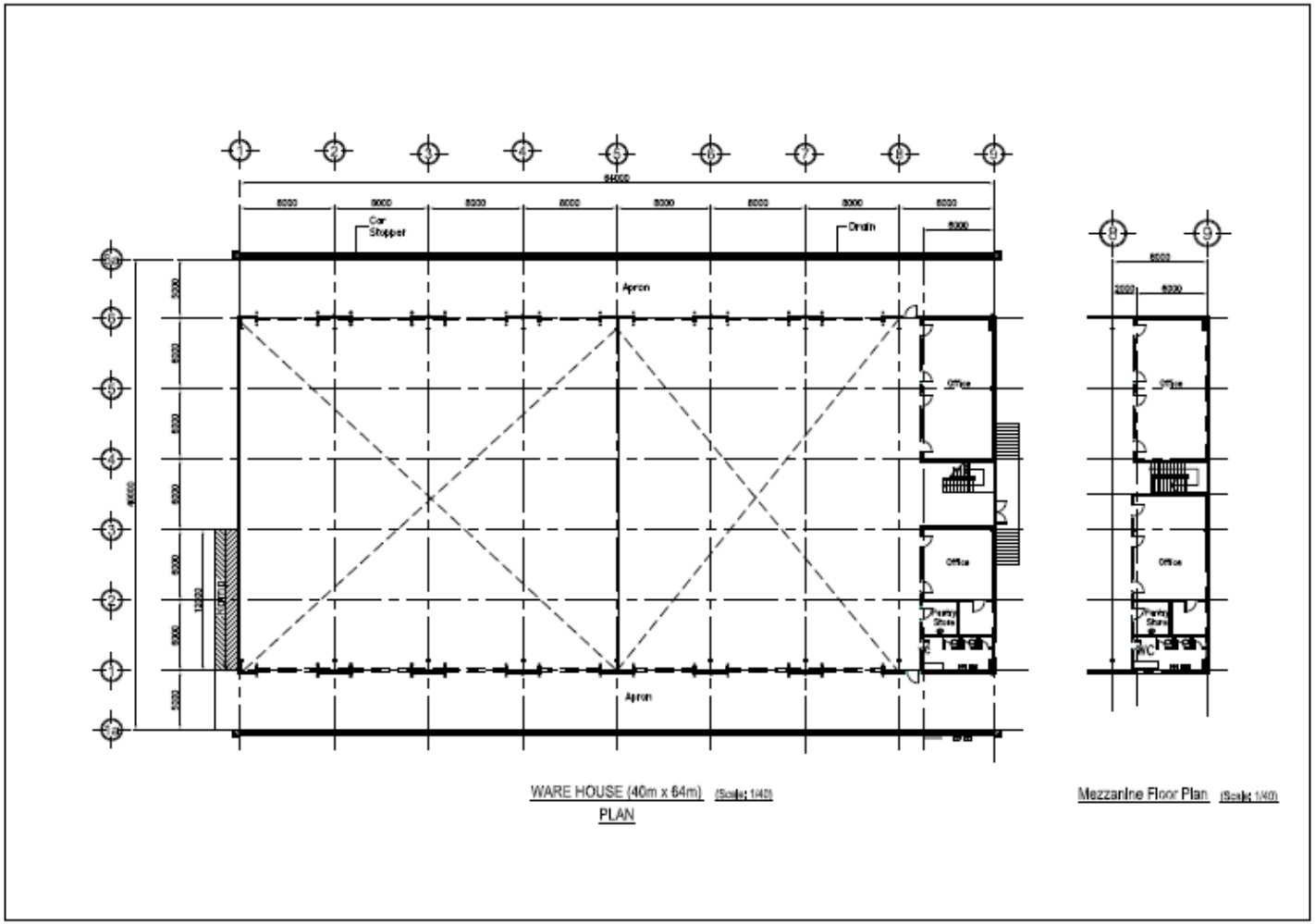
Source: JICA Study Team

APPENDIX-II 5 Admin. Office Building 2



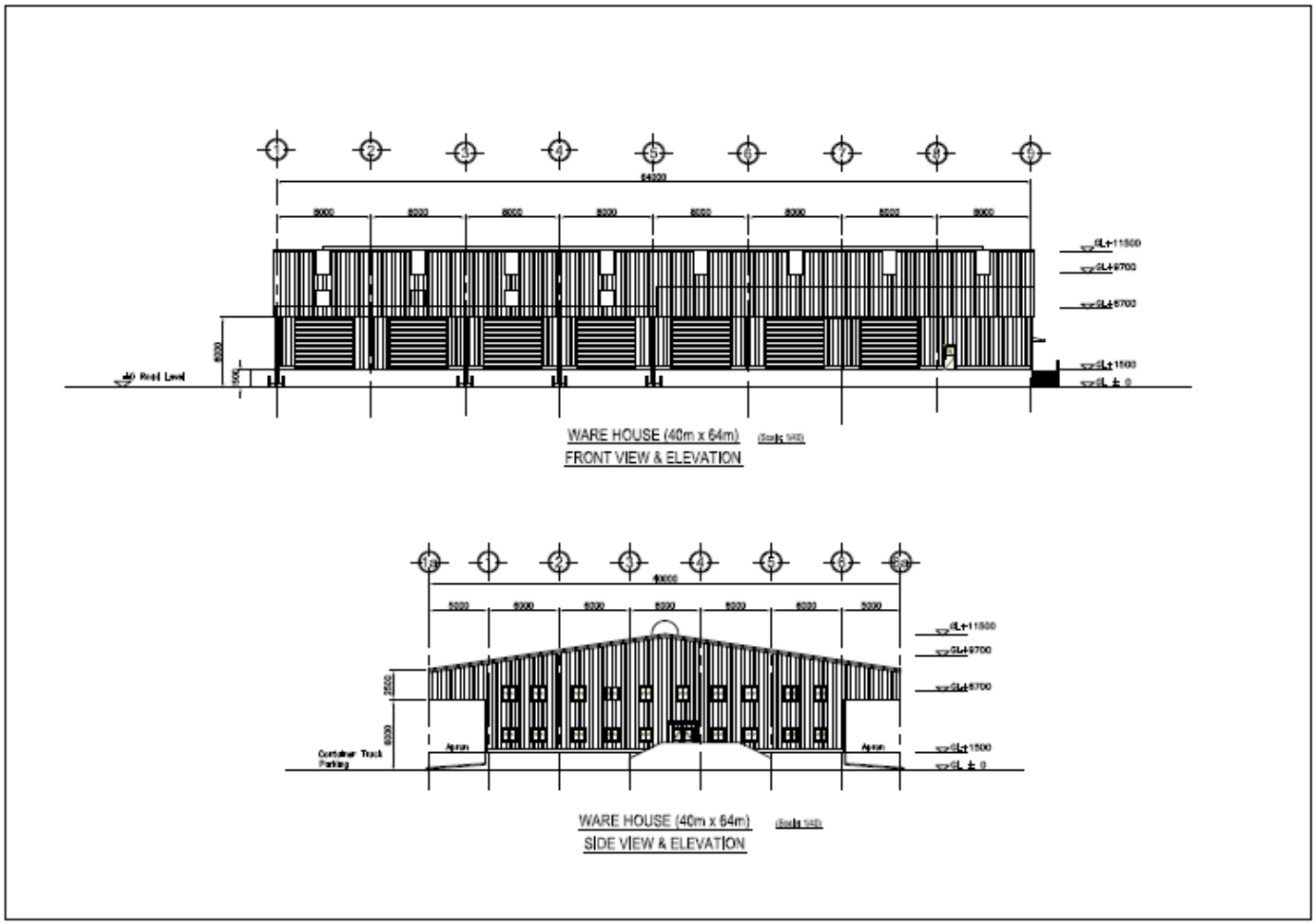
APPENDIX-II 6 Admin. Office Building 3

Source: JICA Study Team



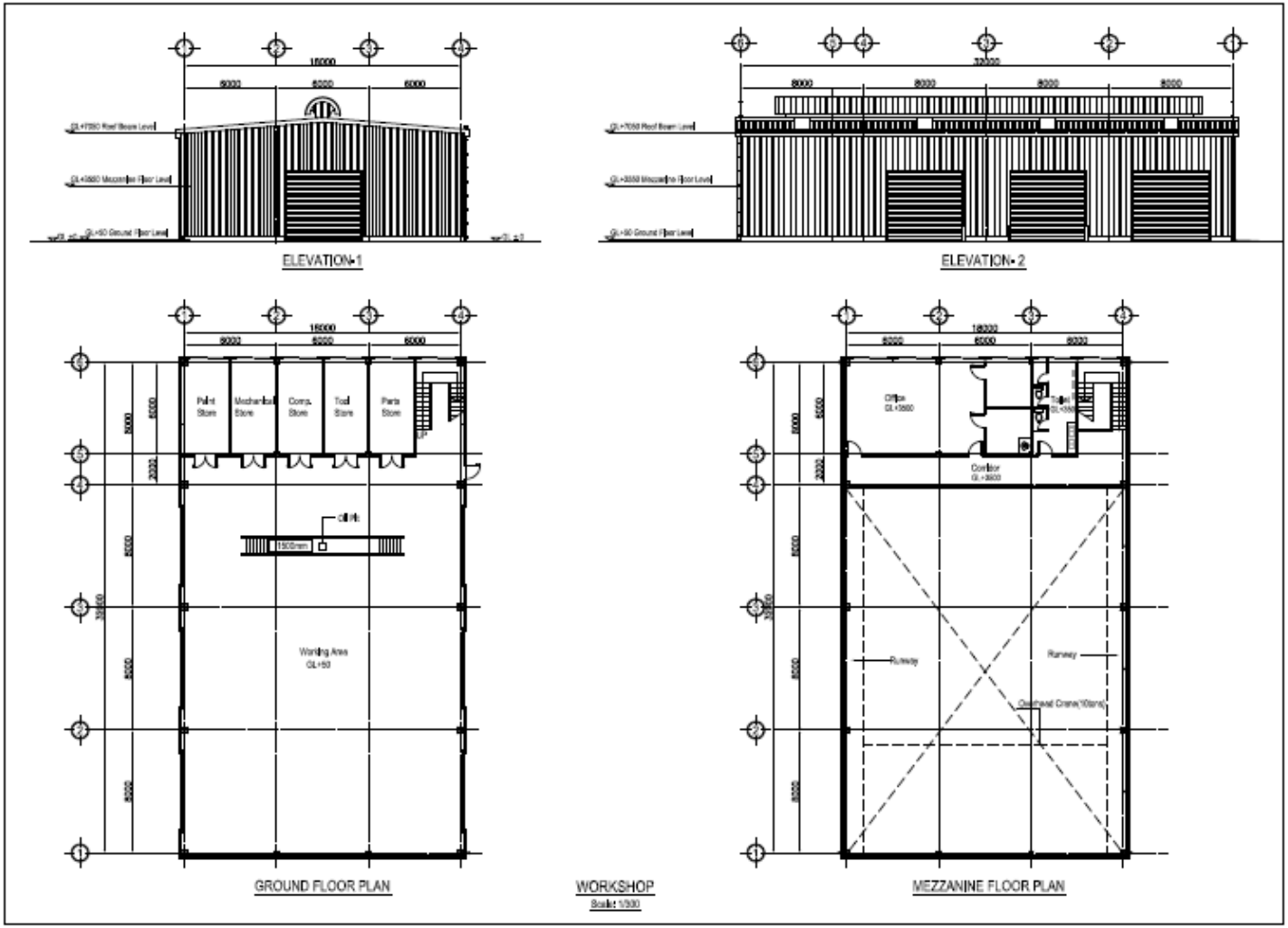
Source: JICA Study Team

APPENDIX-II 7 Warehouse plan & Elevations 1



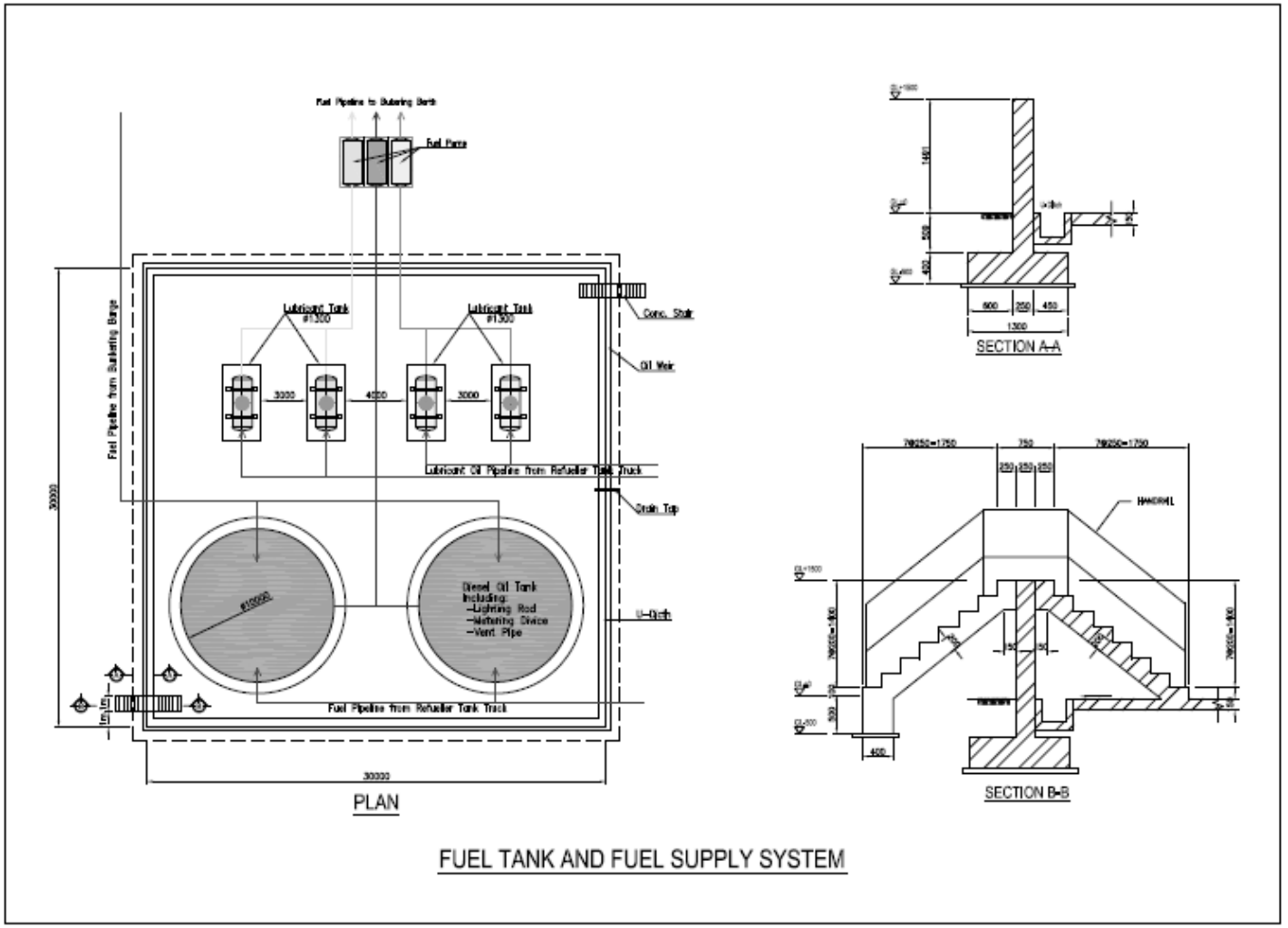
Source: JICA Study Team

APPENDIX-II 8 Warehouse plan & Elevations 2



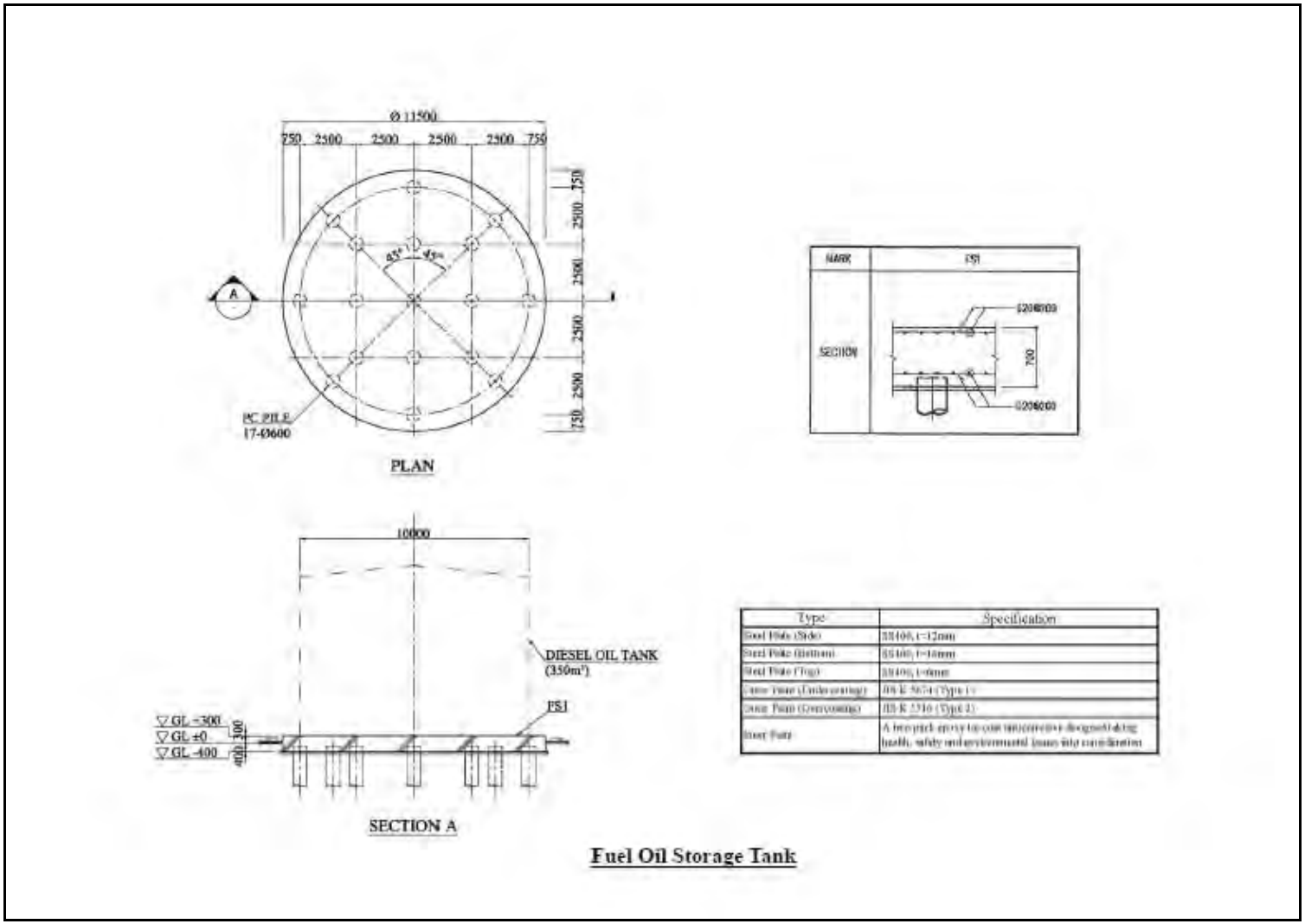
Source: JICA Study Team

APPENDIX-II 9 Workshop plan & Elevation



Source: JICA Study Team

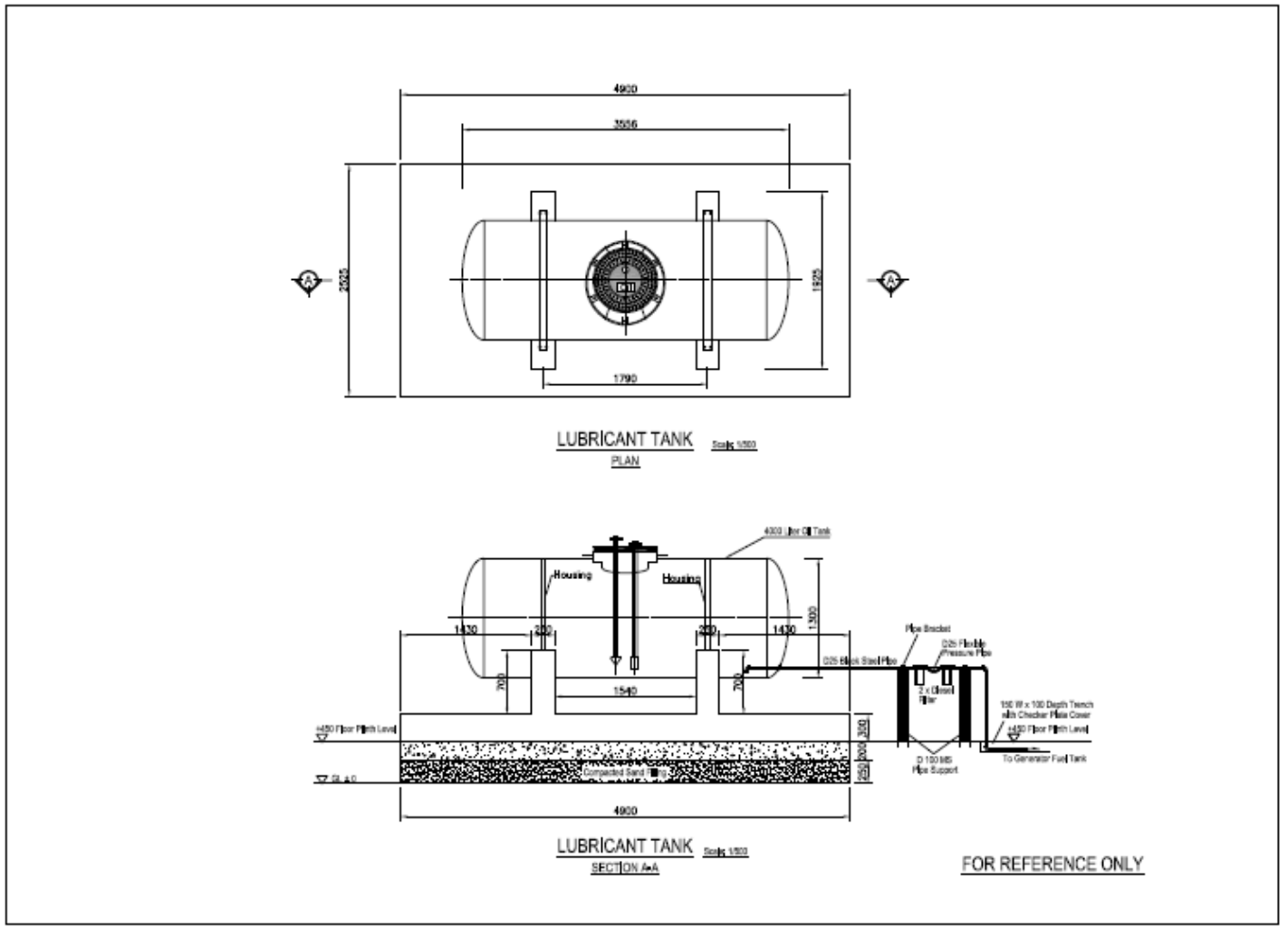
APPENDIX-II 10 Fuel Tank & Fuel Supply System 1



Fuel Oil Storage Tank

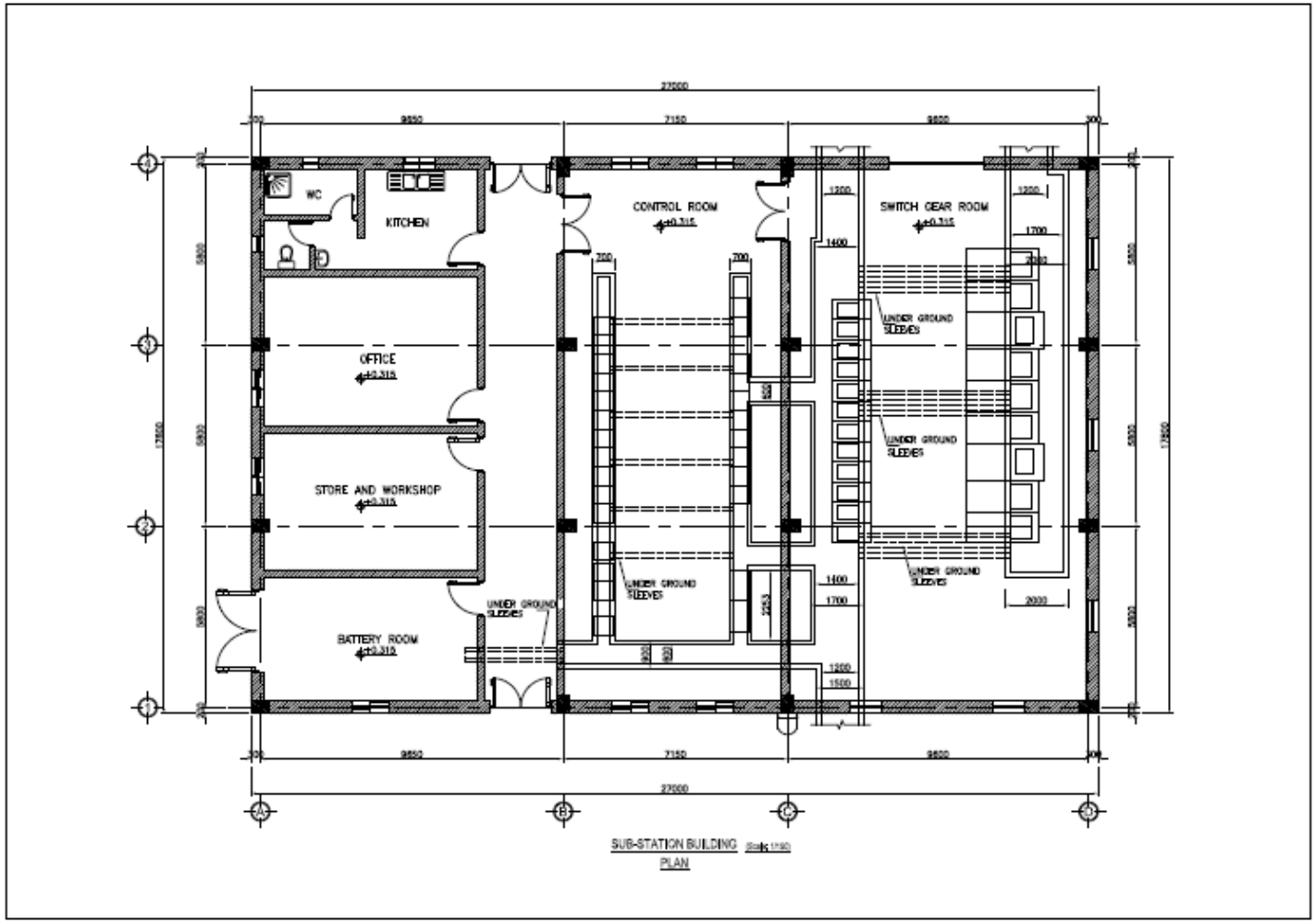
Source: JICA Study Team

APPENDIX-II 11 Fuel Tank & Fuel Supply System 2



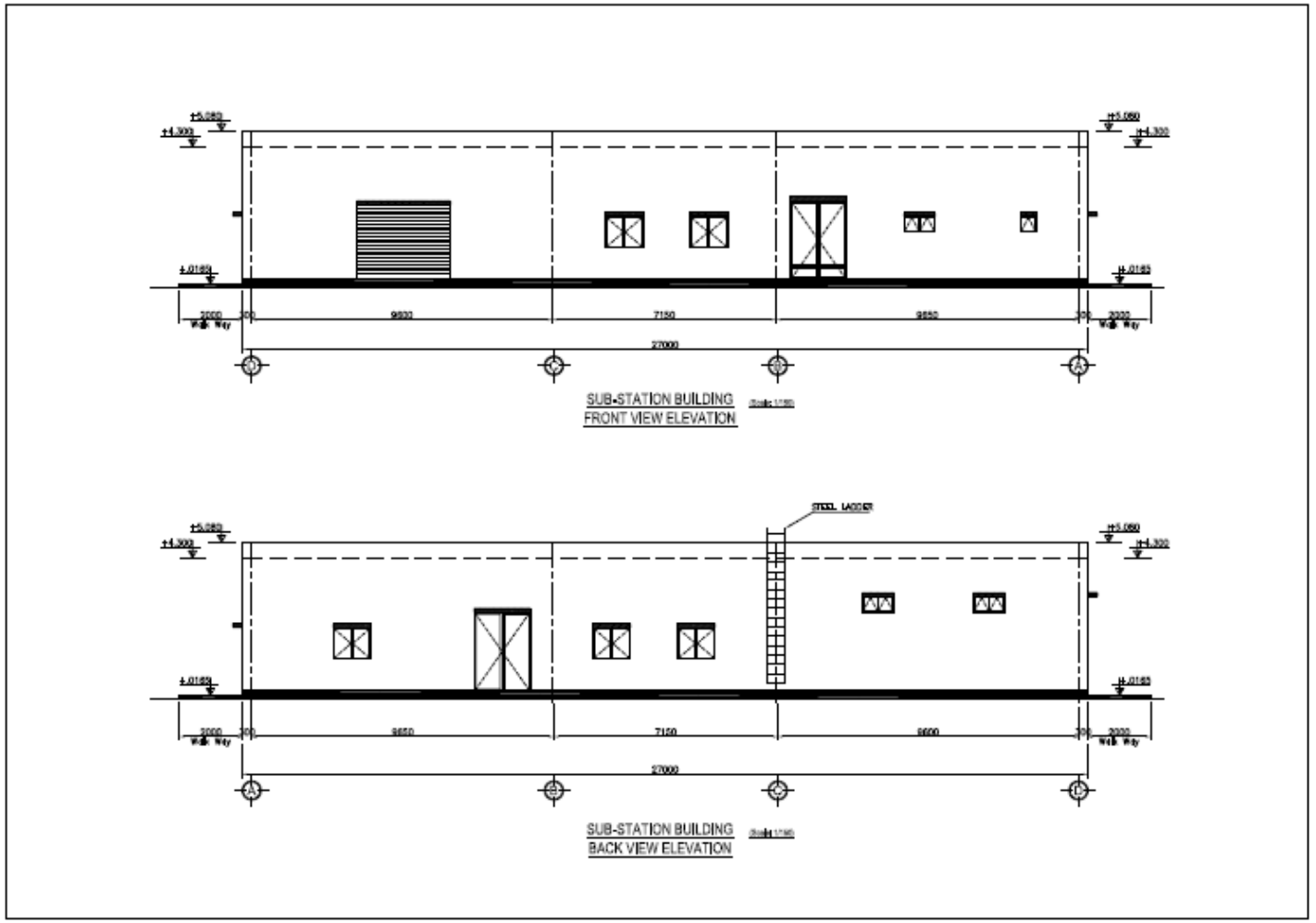
Source: JICA Study Team

APPENDIX-II 12 Fuel Tank & Fuel Supply System 3



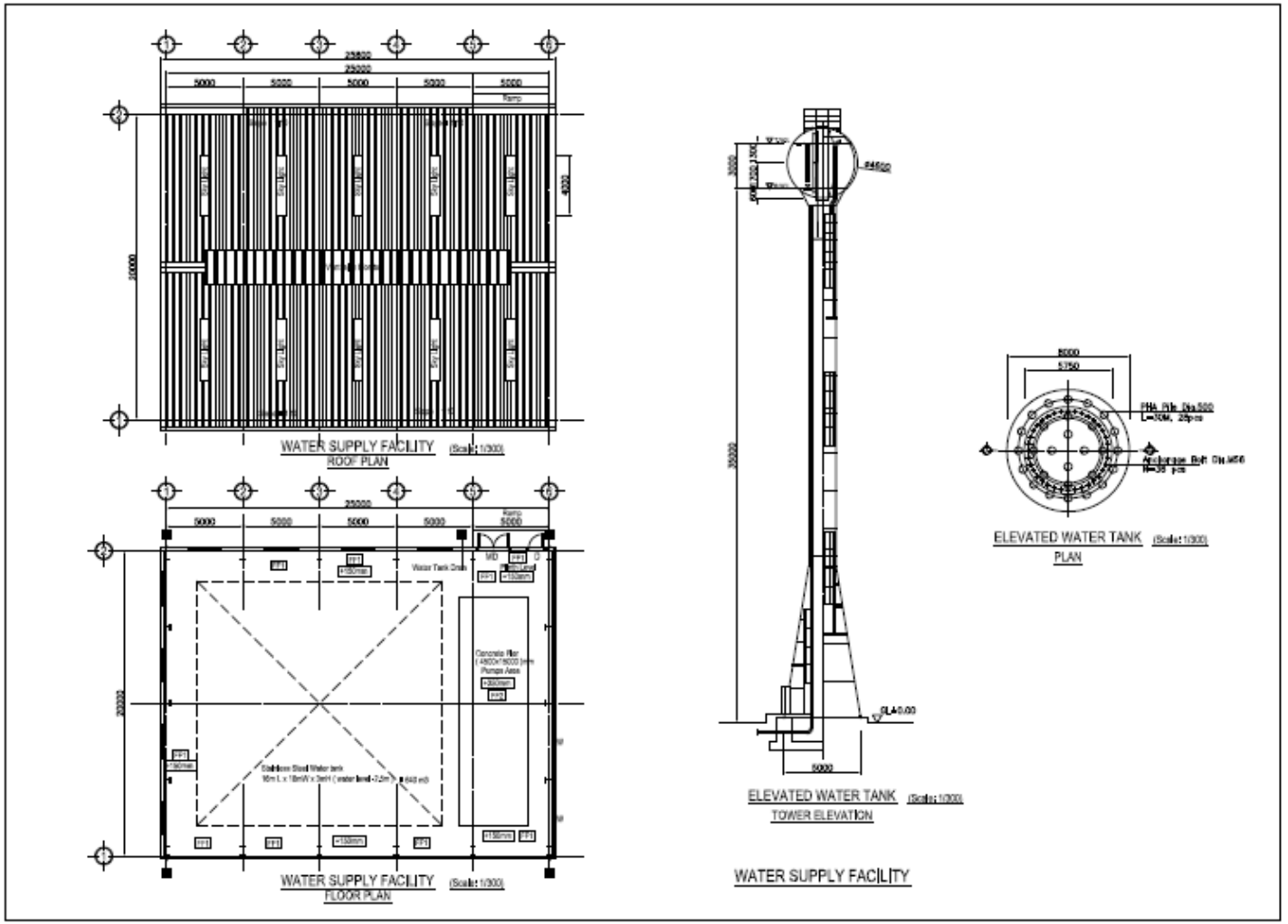
Source: JICA Study Team

APPENDIX-II 13 Sub-station Building Plan & Elevations 1



Source: JICA Study Team

APPENDIX-II 14 Sub-station Building Plan & Elevations 2



Source: JICA Study Team

APPENDIX-II 15 Water Supply Facility