



Traceca Corridor

Traffic and Feasibility Studies - TNREG 9803

Module E :

Transport of crude oil and oil products on the Caspian Sea

Pre-feasibility study for
Rehabilitation of Aktau oil berths n°4 and n°5

Final report, August 2001

Report Cover Page

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Module E Title : Transport of crude oil and oil products on the Caspian Sea
Project Number : TNREG 9803
Module E Countries : Azerbaijan, Kazakhstan and Turkmenistan

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1. Project synopsis for module E

(Revised version, updated in April 2001)

Project Title	: Traceca Corridor - Traffic and Feasibility Studies
Module E Title	: Transport of crude oil and oil products on the Caspian Sea
Project Number	: TNREG 9803
Module E Countries	: Azerbaijan, Kazakhstan and Turkmenistan

Wider objective:	To promote adequate and safe transport of crude oil and oil products on the Caspian Sea
Specific Objectives:	A traffic forecast for oil and oil products The condition of existing infrastructure for oil transport The feasibility of investments in Dubendi oil terminal A brief pre-feasibility study for Aktau oil berths n°4 and n°5
Planned outputs:	A detailed traffic forecast A detailed evaluation of the transport infrastructure (terminals and vessels) An overall feasibility study for rehabilitation of Dubendi oil terminal A specific pre-feasibility study for Aktau oil berths n°4 and n°5
Project activities:	Preparation of supply demand analysis for crude oil and oil products Preparation of traffic forecasts for crude oil and oil products Evaluation of terminals in Aktau, Dubendi and Turkmenbashi Evaluation of tanker fleet Feasibility study for rehabilitation of Dubendi oil terminal Brief pre-feasibility study for Aktau Oil Berths n°4 and n°5
Target group(s):	Ministries of Transport, Oil terminal operators, Tanker operators
Project start date:	15 March 2000 (Module E)
Expected completion date:	August 2001

2. Summary and conclusions

Aktau oil berths n°4 and n°5 are located on either side of a finger pier at the north end of the present general cargo quays, with berth n°5 on the seaward side. The pier is 20 m wide, 188 m long, and constructed of two sheet-pile walls with earth filling between them. Berth n°5 is subject to considerable wave action and has not been used for some years. Aktau has two other oil berths, namely n°9 and n°10, well designed and equipped with satisfactory facilities.

The infrastructure of berths n°4 and n°5 is owned by ACSP, as well as the fire-fighting equipment and the anti-pollution equipment, whilst the rest of the equipment belongs to three operators (the pipelines, the oil loading arms and the valves): KazTransOil, TransOil and the Nuclear Power Station Company.

Both berths n°4 and n°5 are in poor condition. The access causeway has settled, the steel sheet piling is badly corroded and fill material leaches through the joints, leading to settlement of the paved surfaced. The loading arms on berth n°4 are old and in bad condition, as well as most pipes and valves. Water depths along these berths are between 5.5 and 7.5 m, which only enables accommodation of small Caspian tankers (5,500 DWT).

Current capacity of oil berth n°4 can be estimated at 2.3 Mt per year, whilst oil berths n°9 and n°10 have an overall annual capacity of 5.7 Mt. Assuming that the rehabilitated ferry terminal will very soon allow to ship oil-carrying RTC on a daily basis towards Baku, current total port capacity can be estimated at 8.5 Mt per year. Full rehabilitation of berths n°4 and n°5 would allow to increase this figure up to 11.6 Mt per annum.

In year 2000, 3.3 Mt of oil and oil products were exported via ACSP. Projections prepared by the consultant stand in the ranges of 5.1 to 7.1 Mt for year 2010 and of 6.3 to 9.7 Mt for year 2020 - oil from Buzachi and Kumkol fields are expected to compensate for the loss of Tengiz oil -.

If no rehabilitation at all is undertaken the pier and its access causeway may soon collapse and the worst consequence would then be the loss of protection against north-western waves for all port berths. The minimum rehabilitation programme would therefore consist in restoring the sole breakwater function of the pier: repairing the causeway by core back-filling and placement of new armour stones, strengthening the pier structure by covering the upper part of the walls with reinforced concrete, protecting their underwater part with sacrificial zinc anodes, replacing steel tie rods and filling crushed stones between sheet-pile walls. The related investment cost is estimated by the consultant at USD 549,000.

In addition to the above minimum programme, continuation of traffic on berth n°4 requires complementary works to improve the capping beam, the pavement, the fenders, the fire-fighting system and the floodlighting equipment (this only covers ACSP share - from their side, operators have to renew their equipment -). Summed up with the amount of the minimum programme, the cost of this first phase amounts to USD 1.068 million.

A second phase has been prepared with the aim of making use of berth n°5, which should be needed around year 2012 in the pessimistic traffic growth case and around year 2005 in the optimistic scenario (when utilisation rate of available berths reaches 2/3). Related work costs are estimated at USD 1.967 million. This second phase covers deepening of berth n°5 down to 9 m below CD, to allow accommodation of all types of Caspian tankers, up to 12,300 DWT.

A third rehabilitation phase has been designed to prepare berth n°4 for accommodation of the largest Caspian tankers, which would only be needed in the optimistic traffic hypothesis, by year 2011. The expected cost amounts to USD 1.166 million.

The draft financial analysis which has been carried out on the basis of projected ACSP costs and revenues shows that all proposed works can easily be financed from the cash-flow, even within the case of the pessimistic traffic growth scenario. In an attempt to generate an IRR the consultant has undertaken to calculate the model under the assumption that the whole programme (USD 4.2 million) will be realised in the first year of the analysed period. In this case the port will obtain an IRR of about 80% if cargo volumes develop according to pessimistic conditions, and of about 180% under the optimistic environment. On the other hand, several parameters have been tuned to assess the sensitivity of the main results: levels of operating costs, rates of vessel dues or of cargo fees, and investment costs. Even under severely pessimistic assumptions the ACSP project remains profitable.

Lastly, this pre-feasibility study also provides some information regarding operators' costs and revenues, and concludes that operators should easily be able to renew their oil handling equipment.

3. Condition of berths

Before depicting the existing condition of the berths it should be stressed that the ACSP only owns the infrastructure, the fire-fighting equipment and the anti-pollution equipment, whilst the rest of the equipment belongs to three operators (the pipelines, the loading & unloading arms, the valves and the bunkering station): KazTransOil, TransOil and the Nuclear Power Station Company. Although the primary focus of this study is on the ACSP, condition of oil-handling equipment is also reported hereafter.

3.1 Access causeway

The causeway which gives access to the berths is a reclaimed embankment made of small-sized core material protected on both sides by sloped stone revetments (see figure 3 and drawing sheet). Due to wave action, which has been particularly severe over the past decade because of the high level of the Caspian¹, outer stone protections have been damaged and, as a consequence, part of core material has been washed out, entailing settlements, cracking of concrete pavement as well as destabilisation of pipeline bearings. On the other hand, the fire-fighting water intake facility which was located along the outer side of the causeway has been almost totally destroyed. Currently, water for fire-fighting purposes is supplied by a new pump station built at berth n°6 (see figure 3).

3.2 Berth infrastructure

The berths are situated on either side of a finger pier made of sheet-pile walls connected to each others by steel tie rods. The structure was designed by Caspmorniiproekt Marine Institute, Baku, and built in the sixties. Design dredge level is 6 m below CD. The drawing sheet provides with more details.

Sheet-pile steel is deeply corroded on the upper parts of the walls, above the water surface and in the splashing zone², which is quite normal for such old structures, whilst concrete capping beams have been largely destroyed by vessels impacts. Worst damages are on berth n°5, probably because this berth is more attacked by waves than berth n°4 (corrosion rates are higher and vessel shocks are stronger).

As fill material has leached through sheet-pile locks and through corrosion holes, the pier top now suffers from settlements, cracks and holes³.

Steel tie rods were not inspected but it may be assumed that they are in poor condition (corrosion and impact of core settlement).

Lastly, according to the hydrographic survey performed in November 2000, in the vicinity of berths waters depths are as follows:

- 5.5 to 7.5 m below CD along berth n°4,
- 6 to 7.5 m below CD along berth n°5.

In the navigation channel as well as in the area of berths n°9 and n°10 depths are in the range of 7.5 to 8 m. Current water depths alongside berth n°4 only allow accommodation of "G^{al} Shikhlinskiy" tankers⁴. Berth n°9 and n°10 accommodate all types of tankers, but "Kafur Mamedov" ones cannot load more than 8,500 tonnes.

¹ Caspian Sea level reached + 1.4 m CD in 1995, following a sharp increase which started in 1977 (the level was - 1.1 m CD at that time). It has been rather stable along the past three years, around + 1 m CD.

² Measurements performed in 1998 have shown that underwater steel thickness is still correct.

³ Urgent repair works were carried out in 2000, consisting in filling major voids along the capping beam and in welding steel plates to seal the most dangerous holes on the bulkhead.

⁴

"Kafur Mamedov" CSC tankers (12,300 DWT):	max. draught: 8.00 m
"Absheron" CSC tankers (7,400 DWT):	max. draught: 5.3 m
"G ^{al} Shikhlinskiy" CSC tankers (5,500 DWT):	max. draught: 4.15 m

3.3 Berth superstructure

The floodlighting mast at the end of the pier is operational but its lattice steel tower is deeply corroded, and its foundation is undermined (oil handling operations are also carried out at night). Several mooring bollards have disappeared, following destruction of capping beams, whereas the sole remaining fenders consist of poor rubber tyres hung by corroded cables and chains (only at berth n°4, berth n°5 is no longer operational).

3.4 Equipment

The existing fire-fighting equipment only consists of two water cannons fixed on top of short towers and fed by the sea-water pump recently installed at berth n°6. There is no water curtain system along the quay aprons, to avoid fire spreading between the pier and the vessels, and no foam system is available⁵.

The pier is currently served by nine pipelines:

- six pipes owned by KazTransOil (four pipes for crude oil, one pipe for ballast water and one pipe for kerosene);
- two pipes belonging to TransOil (one pipe for Kumkol oil, one line for mazout oil);
- one pipe belonging to the Nuclear Power Station Company, used for mazout oil.

All pipelines are in working conditions, but significant parts of their outer skins are corroded, and several concrete bearings are destabilised.

Oil handling facilities include five loading arms and a bunkering station standing along berth n°4, located on the attached figure 5. All arms are operational. However, they are not of very handy type, and they are slightly corroded.

No handling equipment is left at berth n°5.

An oil spill contingency plan has been developed for the ACSP, including exercises to be held once per year. The plan includes provision for the following:

- notification of spill,
- isolating the source of oil,
- evaluation of the spill,
- required actions contingent on the type and extent of the spill,
- capture of oil,
- protection of public beaches and recreation areas,
- protection of wildlife and resources,
- warning of a possible national emergency in the case of an unmanageable spill,
- oil recovery, storage and clean-up.

A loan was signed with the EBRD in 1999 related to provision of the required oil spill control equipment and, within the frame of a tender procedure, equipment supply has been contracted to the Norwegian "Lamor" company. Oil spill control equipment is now fully operational at the Port.

⁵ Only foam can efficiently fight against oil fires

4. Evaluation of handling capacity in Aktau port

The port's maximum capacity has been calculated under the assumption that the rehabilitated ferry terminal can be used for shipment of crude oil and derivatives in rail-tank cars, similar to the current practice between Turkmenbashi and Baku. Given the maximum capacity of a weekly service of 85,000 tonnes per annum (1,700 tonnes x 50 roundtrips), a daily service (6 days a week) would then have a theoretical maximum capacity of around 0.5 Mt per annum.

Berths n°9 & n°10 can each handle on average 8,700 tonnes per day (i.e. three tankers in two days) and are operational 330 days a year (port downtime due to bad weather is about 30 days per year). Thus, under present conditions, berths n°9 & n°10 can handle about 2.85 Mt per annum each, while berth n°4 has an estimated lower maximum capacity of 2.3 Mt due to the bad condition of the infrastructure and to the limited draught alongside the berth. After reconstruction of berth n°5, this facility would only be available part time, around 9 months a year, since under north-western waves this berth is too much exposed. However, the expected maximum capacity on this berth is around 2.6 Mt since it will be able to accommodate larger tankers and thus realise economies of scale with respect to handling time. After dredging and modernising, berth n°4 will most like be able to handle 2.8 Mt per annum.

Consequently, the current maximum capacity of Aktau port is 8.5 million tonnes per annum (including the ferry terminal). After full reconstruction of berths n°4 & n°5, the maximum capacity of Aktau will increase to 11.6 Mt per annum. However, this would mean 100% capacity utilisation, which is only a theoretical case. In practice, a port can be considered congested if the capacity utilisation exceeds 66%. Thus, handling volumes above 5.5 Mt or in the final stage of the proposed programme 7.5 Mt may require a lot from the port management's ability to efficiently organise the water side.

Table 4-1: Oil Handling Capacities Derived from the Proposed Investment Programme

	2000		2005		2010		2015		2020	
	Port	Berths 4 & 5	Port	Berths 4 & 5	Port	Berths 4 & 5	Port	Berths 4 & 5	Port	Berths 4 & 5
Pessimistic	8.5	2.3	8.5	2.3	8.5	2.3	11.1	4.9	11.1	4.9
Optimistic	8.5	2.3	11.1	4.9	11.1	4.9	11.6	5.4	11.6	5.4

Current loading rate at berths n°9 & n°10 (Tengiz oil, blend of Buzachi and Zhanazhol oils) is 1000 t/h, at berth n°4 (Buzachi and Kumkol oils) it is up to 900 t/h.

Vessels operated by the Azeri Caspian Shipping Company should be able to ship around five million tonnes annually across the Caspian Sea (21 General Shikhlinskiy class vessels: oil carrying capacity 4800 t, 8 Absheron class vessels: 6200 t, 3 Kafur Mamedov class: 8500 t - all vessels can operate about 90 roundtrips per annum -). Moreover, the several Russian river-sea shipping companies operating on the Caspian Sea (e.g. Volgotanker) control a large fleet of handy-sized tankers which can be made available on short notice. Thus, even in the short term, there will be no problem to transfer 10 Mt per annum of crude oil and derivatives across the Caspian Sea.

5. Evaluation of the demand

The general pattern of present crude oil and oil products flows across the Caspian has been analysed in details in the Module E reports of the Traceca Traffic and Feasibility Studies TNREG 9803: Transport of Crude Oil and Oil Products on the Caspian Sea, Inception Report, Annexes 1 & 2 (June 2000), and Technical Report on Forecasts of Oil Flows (August 2000).

The following provides a short summary of the findings of the above mentioned studies together with an update of the current situation in Aktau port.

5.1 Present situation

5.1.1 Caspian

Since decades the Caspian region has been one of the world's largest oil and gas producers. However, its reserves are only now beginning to be fully developed. Especially after the disintegration of the Soviet Union the region's natural reserves and resources have attracted international attention. The development of these resources has resulted in competition both among companies to get contracts to develop this potential, and between nations to determine export routes.

Currently, proven oil reserves for the entire Caspian region are estimated at 2.5 to 4.8 billion tonnes. Moreover, estimates for the region's possible oil reserves range around another 32 billion tonnes. However, these reserves are located far from potential markets in relatively remote Kazakhstan, Turkmenistan and Uzbekistan. This distance from potential markets and the relative lack of sufficient export infrastructure makes it difficult for the Caspian riparian states to make full use of their natural wealth.

Table 5-1: Annual Production, Proven and Possible Oil Reserves of Selected Caspian States

	Ann. Production (in Mt)		Proven Oil Reserves (in billion tonnes)	Possible Oil Reserves (in billion tonnes)
	2000	2010		
Azerbaijan	14	60	0.5-1.7	4.4
Kazakhstan	35	100	1.4-2.4	12.6
Turkmenistan	7.5	10	0.2	11

Source: US Energy Information Agency, June 2000

Of the oil produced in Kazakhstan (year 2000: 35 million tonnes) and Turkmenistan (7.5 million tonnes), currently more than 200,000 tonnes per month, mainly from the Kazakh Tengiz oilfield, are being carried in Azeri and Russian tankers to Baku and discharged in Dubendi, about 45 km north of Baku. The oil is then transferred to rail tank cars and transported to the Black Sea port of Batumi. Capacity of this rail route is about 40 trains per day per direction. Currently more than 3 Mt per annum of crude oil are transported over this route which has a capacity of at least 5 Mt per annum, possibly even twice that figure with rail capacities not being the theoretical limiting factor. Maximum capacity of a train on this route is some 2000 tonnes, equalling 36 rail tank cars of 60 tonnes payload.

With the opening of the new CPC pipeline from Tengiz oilfield to Novorossiysk, Tengiz oil shipments across the Caspian Sea will be reduced. The gap will be filled by increased shipments of Kumkol oil (Central Kazakhstan) and Aktybinsk oil (north-west Kazakhstan), which arrives at Aktau by rail, for Dubendi discharge. The re-opening of the rail ferry terminal at Aktau is expected to attract further oil cargo volumes for shipment in tank wagons across the Caspian to Baku City Port.

Increasing quantities of crude oil (from Buzachi and other fields in the Mangyshlack area) and oil products move from Aktau to Makhachkala where they connect with the pipeline from Baku to Novorossiysk. In 2000, these quantities amounted to about 750,000 tonnes.

It should be noted though that the routing of cargo via Makhachkala and Astrakhan is tantamount to a routing through Dagestan (the same applies to the pipeline from Baku to Novorossiysk). At the present stage of the Chechnya conflict these routes can neither be considered reliable nor safe.

Turkmenistan crude oil is being shipped in rail tank cars carried by ferries from Turkmenbashi to Baku, and by tankers from Cheleken and Okarem to Dubendi, Makhachkala and Neka (Iran), while oil products go by tankers from Turkmenbashi to Baku.

In summer, i.e. when the Volga-Don Canal is open to navigation, there are occasional tanker transports (vessels of max. 3000 DWT, Russian flag) from Aktau and Turkmenbashi to Astrakhan and from there to Novorossiysk by rail or via the Canal to the Black Sea.

Carriage of oil across the Caspian Sea is dominated by the CSC, whose tankers moved about 5.7 million tonnes of crude oil and oil products across the Caspian Sea in 1999. CSC tankers serve the principal routes such as Aktau-Baku, Baku-Anzali, Turkmen ports-Makhachkala, Aktau-Makhachkala, and are also involved in domestic Turkmeni tanker transports (Okarem/Cheleken-Turkmenbashi). On the other hand, the Turkmenbashi-Iran oil trade appears to be firmly in the hands of Russian operators.

Regarding alternative routes or transport modes, a trans-Caspian pipeline from Aktau to Baku is under consideration, but not very likely to be realised in the foreseeable future, due i.a. to the unsettled status of the Caspian Sea. A project closer to reality is the construction of the MEP (main export pipeline, also known as the Baku-Ceyhan Scheme), which is to take Azeri (and possibly also Kazakh) oil to the Turkish Mediterranean coast. But it is not altogether certain at this stage whether any of those grand schemes will come to fruition in the short or medium term. The new pipeline from Tengiz Oilfield to Novorossiysk, however, has started operations recently.

One major obstacle in moving Caspian hydrocarbons to market is the Turkish reluctance to permit the transit through the Bosphorus of ever-increasing quantities of potentially hazardous cargo. At an estimated cost of USD 2.9 billion the Baku-Ceyhan pipeline is very expensive. One or several pipelines from the Caspian basin through Iran and to an Iranian Gulf port would be considerably cheaper but appear to be unrealistic at this juncture, purely for political reasons.

5.1.2 Kazakhstan

As mentioned above, Kazakhstan currently has up to 2.4 billion tonnes of on-shore oil reserves. The amount of prospected off-shore oil reserves is estimated at about 12 billion tonnes. Kazakhstan's oil production is concentrated in the western part of the country. The major share is transported by two pipeline systems leading to Russia, one of them towards the north is the oil-pipeline Atyrau-Samara with a Kazakh quota of 7.5 million tonnes annually. This pipeline transports oil from Kalamkas, Buzachi, Karazhambas, Zhetybay, Uzen and Tengiz (or a blend of these, the Uralsk blend) to Samara to join the Russia Druzhba pipeline. An alternative offers the deviation of the pipeline (with an annual capacity of 6.5 million tonnes) to the Russian refinery in Orsk.

However, the actual production of oil fields in Kazakhstan is limited by the transport system. Although Kazakhstan is a major producer of oil, its domestic transport network and refining system is insufficient with regard to the country's needs: the country's resources are located in the west while the major production centers are to be found in the east and north of the country, thus expensive Russian crude oil must be imported to Pavlodar refinery.

The regions dominate Kazakhstan's oil production:

- Mangyshlak/Buzachi area (8.1 million tonnes, main fields: Uzen, Kalamkas, Buzachi)
- Precaspian area (18.5 million tonnes, main fields: Karachaganak, Tengiz)
- Turgay area (3.4 million tonnes, main field: Kumkol)

The three biggest oil fields Karachaganak, Tengiz and Uzen account for about half of the Kazakh oil production. Main proven reserves in Western Kazakhstan are:

- Tengiz (1-1.5 billion tonnes). Production forecast: 10 million tonnes (1999), 12 million tonnes (2001), 35 million tonnes (2010, expected peak production).
- Karachaganak (1 trillion m³ of gas, 300 million tonnes of oil). Present production exported to Orenburg refinery. Operating structure projects the laying of a pipeline Karachaganak-Atyrau. Possible scenario: 3.3 million tonnes (1998), 7 million tonnes (2005), 12 million tonnes (2010).

Moreover, the recently explored off-shore Kashagan oil field is estimated at 5 billion tonnes.

The International Energy Agency has drafted the following forecast for Kazakhstan oil production and consumption (in million tonnes):

High Scenario	1999	2005	2010	2020
Production	30	70	100	160
Consumption	13	34	45	84
Exports	17	36	55	76

Low Scenario	1999	2005	2010	2020
Production	30	55	75	130
Consumption	13	24	32	52
Exports	17	31	43	78

5.1.3 Aktau Commercial Sea Port

In 2000, the port of Aktau handled about 3.4 Mt of oil and derivatives, 3.24 Mt of which crude oil and 0.16 Mt of oil products. The major share, 2.5 Mt, was shipped to Dubendi, the rest was destined to Makhachkala. Oil for Dubendi mainly came from Tengiz oilfield and was pumped at berth n°10 into vessels heading for Dubendi (2.35 Mt). Large quantities of crude oil also arrived from Buzachi and were transported mainly via berth n°4 to Makhachkala. However, berth n°4 is otherwise specialised in handling oil products.

Oil and oil products usually reach Aktau by rail, since Aktau is not connected to the main pipeline network and only a very limited number of oil fields have a direct pipeline connection to Aktau. E.g. from Buzachi North (Texaco) crude oil can be pumped to Aktau pumping station by a separate pipeline, while oil from Tengiz is transported by train (750km) from the field to a pump station close to the Port of Aktau. This pump station belongs to the State Oil Pumping Company Uzhnefteprovod. The station comprises a railroad unloading trestle, pumping equipment, storage tanks and an internal pipeline system connecting tanks to the port loading terminal.

Table 5-2: Volumes Handled at Aktau Oil Berths

Type	1999	2000	handled at berth n°
Tengiz oil	1,455,459	2,254,321	10
Buzachi oil	600,440	677,856	4
		153,440	9
		20,467	10
Kumkol oil		48,875	4
Zhanazhol/Buzachi blend		70,109	9,10
Oil products	10,853	4,591	4
Mazout		155,882	4
Total	2,066,752	3,385,541	

Due to draught limitations, the large 12,000 DWT tankers are only handled at berth n°10. However, even there these tankers cannot be loaded to full capacity and usually leave the port with about 8,500 tonnes instead of 11,500 tonnes.

Table 5-3: Vessels Sizes Handled at Aktau Oil Berths

Berth	5,500 DWT		7,400 DWT		12,300 DWT	
	1999	2000	1999	2000	1999	2000
n°4	35	82	62	99		
n°9	5	46	39	119		
n°10		5	3	26	157	147
Total	40	133	104	244	157	147

Main clients for an improved oil terminal at Aktau would be Mangistau Munaigas, Kazakoil, Arman, Central Asia Petroleum, Texaco (which is involved in a joint-venture from Kashagan oil field to the Mangistau Peninsula), AktybinskOil and KumkolOil. TengizChevroil, the present main client of Aktau port, has declared to stop shipments via Aktau and concentrate its export efforts on the CPC pipeline to Novorossiysk. However, in the present situation it is unclear whether TengizChevroil will really completely withdraw from Aktau or route some minor quantities via this itinerary to keep up this route for strategic reasons. In any case, the above mentioned three oil handling companies as owner of the oil transportation infrastructure would be involved.

5.2 Forecast of shipment volumes via Aktau

5.2.1 Assumptions

The traffic forecast elaborated by the consultant makes use of the results of Module E (Transport of Crude Oil and Oil Products on the Caspian Sea) to a maximum possible extent. However, the experts have adjusted this forecast according to their own expectations and information gained during the field visit in Aktau in June 2001. The consultant's forecast is based on the following assumptions:

- A pipeline through the Caspian Sea does not seem feasible due to ecological as well as political reasons. However, it is necessary to have a variety of different itineraries for oil shipment.
- A 50/50 Kalamkas-Tengiz blend is suitable for export to Iran (for Teheran refinery) on a swap basis. The pessimistic scenario assumes a relatively moderate development of these shipments due to the moderate development of political ties. The optimistic scenario sees a considerable larger potential for the swap trade.
- For the pessimistic scenario it is assumed that Tengiz will phase out its shipments via Aktau, while the optimistic scenario assumes a continuation of these transports on low level for strategic reasons.
- Buzachi and Aktybinsk oil field will make up for the gap left by Tengiz oil field. However, in the pessimistic scenario the joint volumes of the former oilfields will not completely fill the gap before 2015, while in the optimistic scenario this gap is closed by 2010 already.
- Kumkol, which only started its shipments via Aktau in 2000 will become the major customer of Aktau.
- Berth n°4 will remain the only handling facility for oil products.

5.2.2 Results

Oil handling volumes forecasted for the Port of Aktau and especially at berths n°4 and n°5 are summarised in below table.

Table 5-4: Forecast of Oil Handling Volumes for the Port of Aktau in total, and Berths n°4 and n°5

	2000		2005		2010		2015		2020	
	Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5
Pessimistic	3,4	0,9	4,4	1,4	5,1	1,7	5,8	2,2	6,3	2,5
Optimistic	3,4	0,9	5,7	2,6	7,1	3,2	8,5	3,8	9,7	4,3

Even though Tengiz oilfield, which presently is Aktau's main customer for shipments of crude oil, will focus more and more on the pipeline connection to Novorossiysk, the port's oil handling business is expected to still experience considerable growth until 2020.

Even under the pessimistic assumption that Tengiz-Chevron oil will completely stop using Aktau from 2003, the port will, compared to the year-2000 volumes, have doubled its handling volumes towards the end of the present study's time horizon. Buzachi and Kumkol oilfields are expected to more than compensate for the loss of Tengiz oilfield.

However, even in the optimistic scenario, where Tengiz-Chevron for strategic reasons keeps the route via Aktau open with some 50,000 tonnes per month, growth is mainly determined by Buzachi and Kumkol, which together account for more than 50% of Aktau's total oil handling volumes in 2020. Moreover, the swap business with the Iran takes up speed, with a considerable amount of Tengiz-Kalamkas blend for the Teheran refinery shipped to the Iranian port of Neka.

Table 5-5: Detailed Oil Handling Volumes through the Port of Aktau (in Mt)

Pessimistic Scenario	2000	2005	2010	2015	2020
Crude					
Tengiz oil	2.25	0.00	0.00	0.00	0.00
Buzachi oil	0.85	1.50	1.50	1.50	1.50
Kumkol oil	0.04	2.00	2.00	2.00	2.00
Zhanazhol/Buzachi blend	0.07	0.19	0.30	0.41	0.50
Tengiz/Kalamkas blend	0.00	0.15	0.38	0.61	0.80
Aktybinsk oil	0.00	0.27	0.35	0.43	0.50
Products					
Mazout	0.15	0.23	0.33	0.42	0.50
Gas-oil	0.01	0.12	0.26	0.39	0.50
Total	3.37	4.45	5.11	5.77	6.30

Optimistic Scenario	2000	2005	2010	2015	2020
Crude					
Tengiz oil	2.25	0.60	0.60	0.60	0.60
Buzachi oil	0.85	1.77	1.85	1.93	2.00
Kumkol oil	0.04	2.17	2.44	2.72	3.00
Zhanazhol/Buzachi blend	0.07	0.26	0.45	0.64	0.80
Tengiz/Kalamkas blend	0.00	0.19	0.66	1.13	1.50
Aktybinsk oil	0.00	0.33	0.50	0.67	0.80
Products					
Mazout	0.15	0.23	0.33	0.42	0.50
Gas-oil	0.01	0.12	0.26	0.39	0.50
Total	3.37	5.66	7.08	8.51	9.70

Table 5-6: Detailed Oil Handling Volumes for Berths n°4 and n°5 (in Mt)

Pessimistic	2000	2005	2010	2015	2020
Crude					
Buzachi oil	0.68	0.00	0.00	0.00	0.00
Kumkol oil	0.05	0.80	0.80	1.00	1.00
Aktybinsk oil	0.00	0.27	0.35	0.43	0.50
Products					
Mazut (ex.)	0.15	0.23	0.33	0.42	0.50
Gas-oil (ex.)	0.01	0.12	0.26	0.39	0.50
Gas-oil (im.)					
Total	0.89	1.41	1.73	2.25	2.50

Optimistic

Crude					
Buzachi oil	0.68	0.88	0.93	0.97	1.00
Kumkol oil	0.05	1.08	1.22	1.36	1.50
Aktybinsk oil	0.00	0.33	0.50	0.67	0.80
Products					
Mazut (ex.)	0.15	0.23	0.33	0.42	0.50
Gas-oil (ex.)	0.01	0.12	0.26	0.39	0.50
Gas-oil (im.)					
Total	0.89	2.65	3.23	3.81	4.30

There will be a slight change in the tanker fleet structure throughout the time horizon of the analysis. The average carrying capacity of tankers will slightly increase by the introduction of new-buildings in the medium size class (carrying capacity around 6,500 tonnes). In order to ship the forecasted amount of crude oil and derivatives across the Caspian to Baku, Makhachkala and Iran the following number of vessels calls at Aktau will be necessary.

Table 5-7: Tanker Traffic Forecast for Aktau Port and for Oil Berths n°4 and n°5 (numbers of vessels)

Scenario	DWT	2000		2005		2010		2015		2020	
		Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5	Port	Berths 4&5
Pessimistic	12 300	147	0	191	19	267	27	275	102	372	141
	7 400	244	99	282	110	274	94	252	70	200	20
	5 000	133	82	228	115	243	189	282	172	247	212
Optimistic	12 300	147	0	250	117	395	242	574	371	650	430
	7 400	244	99	360	187	380	160	371	60	308	68
	5 000	133	82	167	101	120	30	227	51	426	37

It should be noted that the tanker size distribution presented in the above table is depending on the extension of facilities, which goes hand in hand with the expected handling business. The optimistic scenario assumes that rehabilitation of berths n°4 and n°5 as well as proposed dredging measures will be initiated in due time before congestion of facilities become acute. Especially the timing of the dredging determines to what extend the larger 12,300 DWT tankers operating in the Caspian will be calling at Aktau, and in how far Caspian shipping operators will be willing to invest in new tanker tonnage.

6. Rehabilitation designs

6.1 Minimum programme

If no rehabilitation at all is undertaken the pier and its access causeway should collapse rather soon and the worst consequence would then be the loss of protection against north-western waves for all port berths. A minimum programme has therefore been prepared with the aim of restoring the sole breakwater function of the pier. It consists in:

- repairing the causeway by core back-filling and placement of new armour stones;
- strengthening the pier structure by covering the upper part of the walls with reinforced concrete, protecting their underwater part with sacrificial zinc anodes, replacing steel tie rods and filling crushed stones between sheet-pile walls.

The related investment cost is estimated by the Consultant at USD 549,000 (see details in the investment cost estimate table, annex 3).

6.2 Short term programme

Implementation of the above minimum programme would not allow to accommodate any tanker at the pier. The proposed short term programme not only covers restoring of the breakwater function, it also includes rehabilitation of berth n°4 for safe and reliable oil operations. Compared to the minimum programme the short term option comprises the following extra works:

- reconstruction of a capping beam along berth n°4 and along the inner part of the pier head;
- reconstruction of pavements on the causeway and on the whole pier;
- supply and placement of rubber-tyre fenders along berth n°4;
- installation of a water-curtain fire-fighting system along berth n°4 apron;
- installation of fire hoses and of a complete foam fire-fighting system at berth n°4;
- supply and placement of two new floodlighting masts;
- supply and placement of a small red navigation light at the pier head⁶.

The related complete investment cost is estimated by the Consultant at USD 1,068,000 (see details in the investment cost estimate table, annex 3).

All equipment has to be dismantled prior to implementation of this programme, to enable proper rehabilitation of the pier core (fill material, replacement of tie rods): pipelines and oil loading / unloading arms. Operators seem ready to co-operate with the Port during such works: KazTransOil intends to replace all its equipment by a new one; TransOil and the Nuclear Power Station Company are simply willing to remove their equipment during the required time period and to place it again upon works completion.

⁶ Currently the pier head is not marked by any light

6.3 Medium term programme

The medium term programme is supposed to be implemented when the Aktau overall demand exceeds the capacity provided by berths n°4, n°9 and n°10. Its objective is to rehabilitate berth n°5 for oil operations with a 9 m water depth, to enable accommodation of all types of Caspian tankers. It includes the following works:

- dredging of sea-bed down to 9 m below CD in berth n°5 area;
- deepening of berth n°5 quay-wall toe (see attached drawing sheet);
- reconstruction of a capping beam along berth n°5 and along the outer part of the pier head;
- supply and placement of rubber-tyre fenders along berth n°5;
- installation of a water curtain fire-fighting system along berth n°5 apron;
- installation of fire hoses and of a complete foam fire-fighting system at berth n°4;
- supply and placement of two additional floodlighting masts.

The related investment cost is estimated by the Consultant at USD 1,967,000 including participation to the navigation channel deepening costs (see details in the investment cost estimate table, annex 3).

6.4 Long term programme

The objective of the long term programme is to deepen berth n°4 down to 9 m below CD, to allow it to accommodate all types of Caspian tankers. Its implementation requires the following works:

- dredging of sea-bed down to 9 m below CD in berth n°4 area;
- deepening of berth n°4 quay-wall toe (see attached drawing sheet).

The related investment cost is estimated by the Consultant at USD 1,166,000 (see details in the investment cost estimate table, annex 3).

7. Preliminary financial analysis

The EBRD's primary focus is on the ACSP. Therefore the following analysis is mainly concerned about the costs and revenues relevant for the port. A brief investigation into the cost and revenue situation of the terminal operators will be provided in chapter 8.

7.1 General principles

To assess the commercial viability of the project, the most commonly used financial indicators are to be calculated: (1) internal rate of return (IRR), and (2) payback period.

(1) The internal rate of return (IRR) is the discount rate at which the present value of all outflows of cash (e.g. investment cost, operational expenses) is exactly equal to the present value of all inflows of cash. It indicates the actual return of the total investment outlay and is a good indicator of the profitability of the project. It offers the investor the possibility to compare projects quantitatively, and the higher the IRR the higher the profitability of the project. The IRR calculated from the project cash flow is an indicator for the overall viability of the project. It can also be used to determine the maximum interest the project can bear without incurring any losses to the investor.

(2) The payback period is the time required to recover the original investment outlay through the profits earned by the project. It is sometimes interpreted as an indicator of the degree of risk attached to a project, though this should be treated with caution since it does not take adequate account of any reward for the shouldering of the risk. It should therefore be regarded only as an additional indicator.

Normally, the financial analysis of a transport project covers an operational period of about 20 years, in order to as accurately as possible take into account the life cycle of port investments. Thus, for the purpose of the present analysis the consultants have made use of the above-presented traffic forecast up to 2020. However, reconstruction of the pier is expected to start in 2002, re-opening of berth n°4 is then scheduled for 2003. Consequently, the time horizon of the analysis is restricted to 18/19 years. Of course, this by no means reduces the validity of the results and conclusions derived from the following financial analysis.

Any assumptions regarding real price changes over a long period of time are highly speculative and open to manipulation. Thus, the financial viability of the project activities has been calculated on constant price basis, whereby current prices are applied.

Financial evaluations are based on the projected investment programme and on the expected cash flow development. The analysis is done on project level, i.e. without financing and before taxes. In other words, the financial analysis has been carried out as if the project were funded entirely by equity. At the present stage, this approach is suitable to assess the financial viability of the operator's business in principle. It is assumed that a "private operator" will accept the project if he can earn an IRR, which is higher than an alternative investment, say on the financial markets. In the transport sector a private investor usually would require an IRR around 20 percent (before taxes and financing). If the financial analysis reveals an IRR below this level, the private provision of the terminal infrastructure can be assessed as not financially viable (i.e. taking into account only the revenues and costs borne by the private investor).

All calculations are based on USD, since most commonly this currency is used for calculation and settlement of financial obligations not only in the Caspian but also in the world-wide maritime business.

Finally, in order to assess the possible impacts of risks on the project profitability, a risk analysis has been carried out, and a sensitivity analysis investigates the degree to which the revenue and cost parameters (1) need to improve (to meet the financial acceptance of a private operator), or (2) can deteriorate to cover the risks.

7.2 Revenues

Even though ACSP is not directly involved in oil handling, the port has two sources of revenues from the oil business. First, the port profits from levying a cargo fee on every tonne of crude oil and derivatives that passes the port. The cargo fee is deemed a kind of compensation for not being able to charge a terminal leasing rate for providing the oil terminal infrastructure from the companies engaged in loading and discharging tankers. The cargo fee is only paid by the cargo owner, not by the terminal or tanker operator.

The tariff for the cargo fee determined by the Kazakh Anti-Monopoly Commission in co-operation with the Ministry of Transport and Communication and the Ministry of Energy. The usual fee is 0.9 USD/tonne, which has recently been increased to 1.5 USD/tonne in a national effort to reduce the export of Kazakh oil. Seemingly, the Kazakh refineries were temporarily suffering from a shortage in crude oil. As soon as the supply of Kazakh refineries has been secured, it is expected that the cargo fee will be reduced to the previous level again.

Secondly, the port collects port dues from tanker vessels calling at the port of Aktau. Currently, a 12,300 DWT vessel pays about 15,000 USD per call, while the rate for 7,400 and 5,500 DWT tankers are roughly 9,000 and 6,000 USD respectively. It is assumed that the tariff structure will remain constant throughout the analysis. Also that there will be no flag discrimination.

Below tables summarise the oil-related revenues as derived from the expected cargo and vessel traffic development for the pessimistic and optimistic scenario.

Table 7-2: Revenue Split for Oil-related Revenues on Berths n°4 & n°5 (in million USD)

	2000		2005		2010		2015		2020	
	Cargo Fee	Port Dues	Cargo Fee	Port Dues	Cargo Fee	Port Dues	Cargo Fee	Port Dues	Cargo Fee	Port Dues
pessimistic	799	1,383	1,272	1,968	1,557	2,384	2,562	4,187	2,790	4,622
optimistic	799	1,383	2,382	4,038	2,905	5,244	3,427	6,410	3,870	7,279

Table 7-3: Total Oil-related Revenues on Berths n°4 & n°5 (in million USD)

	2000	2005	2010	2015	2020
pessimistic	2,182	3,240	3,941	5,210	5,806
optimistic	2,182	6,420	8,149	9,837	11,149

The distribution of revenues clearly indicates that the provision of tanker-related services are the dominating source of port income from the oil business.

7.3 Costs

Since ACSP is not directly involved in oil handling, apart from investment cost, cost items of the port's oil business restrict to some categories related to the provision of cargo handling infrastructure (e.g. terminal infrastructure) and vessel handling services.

7.3.1 Investment costs

The phasing of above full investment programme to a large extent depends on the (expected) development of cargo volumes. However, in order to secure the present operating capacity of berth n°4, apart from the minimum programme, which is indispensable to re-establish the breakwater function of the pier, also the additional measures short-term programme must be initiated independent of any scenario. The mere infrastructure measures for this first phase will thus sum to 1.068 million USD.

In addition, the operators of berth n°4 will have to bear the cost for the removal of the existing oil handling equipment during reconstruction. KazTransOil is planning to completely replaced its six pipelines and three loading arms, which should amount to an investment of 630,000 USD. TransOil and Nuclear Power Station

Company will just remove and later re-install the existing equipment, which is expected to cost them 21,000 and 11,000 USD respectively.

In order to avoid losses of business during reconstruction time, some of the handling business may be transferred to berth n°8 (mainly used as ferry berth), where there are existing pipeline connections (owned by KazTransOil). However, it needs to be investigated more thoroughly, if this solution could really be a reliable alternative (handling arms could be borrowed from berth n°4).

In the investment plan it is foreseen to initiate the next phase in good time prior to an expected capacity utilisation of 66%, which is deemed to indicate acute congestion of facilities. Thus, new or improved facilities should start operation the very moment this formal criterion has been met in order to guarantee efficient handling conditions in the port of Aktau. In the optimistic scenario this is already the case in 2005, while in the pessimistic scenario the second stage (medium term) of the programme should not be considered before 2012. The second stage will significantly increase the port's handling capacities by rehabilitating the today idle berth n°5. However, as mentioned above, berth n°5 can only be used about 9 months annually due to weather conditions, and thus has a rather limited capacity compared to the other berths. This stage can be executed without major disturbances to operations on berth n°4 and amounts to investment costs of about 1.967 million USD, excluding new loading equipment (e.g. loading arms) to be paid by private operators.

The third phase (long-term) of the programme should be realised within the timeframe of the current analysis only in case the optimistic scenario materialises. Then, the consultants propose to prepare berth n°4 for large-tanker operations by 2011 at the latest. The expected cost would be close to 1.166 million USD.

It cannot be overemphasised that towards the end of the forecasting horizon the optimistic scenario foresees cargo volumes posing an ambitious task for efficient and timely handling of products and vessels. The consultants propose to initiate a timely port expansion planning to meet the future demand of oil handling facilities in Aktau.

7.3.2 Operating costs

The major share of port cost items are fixed costs, thus overall operating cost for the provision of oil-business related services are basically not depending on utilisation of respective facilities, except for some minor items like fuel cost for tugboat operations etc. The ACSP allocates its total costs on its different sectors of activities according to a system of key allocation parameters developed within the frame of a previous EBRD project.

For the purpose of the present financial analysis the consultants have assumed that the port cost share for the provision of tanker-handling related services only moderately increase from an annual 3 million USD to about 3.6 million USD in 2020, while the (theoretical) share for the provision of cargo-related services notches up from around 1.7 million USD to 2 million USD. The share of berths n°4 & n°5 in these cost items is calculated according to their share in overall tonnes and vessels handled (vessel related items comprise cost for channel and harbour basin maintenance, tugboat operation, environmental services, aids to navigation services, quarantine and veterinarian services).

Table 7-4: Oil-related Port Operating Costs (in million USD)

		2000	2005	2010	2015	2020
Pessimistic	Share on overall cost for the provision of tanker vessel related services	725	754	900	1,016	1,141
	Share on overall cost for the provision of oil cargo related services	449	556	623	753	807
	Contingencies (in % of total cost)	117	131	152	177	195
	Total	1,292	1,441	1,675	1,946	2,143
Optimistic	Share on overall cost for the provision of tanker vessel related services	725	1,126	1,098	982	970
	Share on overall cost for the provision of oil cargo related services	449	819	839	866	901
	Contingencies (in % of total cost)	117	195	194	185	187
	Total	1,292	2,140	2,131	2,033	2,059

In the pessimistic scenario, the share of berths n°4 & n°5 in total operating costs is slowly but steadily increasing since due to the moderate development in cargo volumes the second phase of the proposed investment does not come before 2014. Consequently, additional cargo and vessel handling facilities almost matching the capacities on oil berths n°9 & n°10 cannot be provided before that date. The relative increased in importance as indicated by the slight increase in cost share is due to the improvement of today's low capacity utilisation on berth n°4.

In the optimistic scenario, operating cost jump start around 2005 to over 2 million USD to stay around this level until the end of the forecasting horizon. This significant increase towards the beginning of the forecasting horizon is caused by the necessity to realise the second stage of the proposed investment programme in 2005 already. The new capacities are much awaited by customers and lead to a shift in business from berths n°9 & n°10 to berths n°4 & n°5, where now the largest tankers can be handled.

7.4 Results

Even a very rough comparison of above figures on revenues and costs reveals that the port of Aktau profits from a considerable cash-flow surplus. In fact, under the condition of a phased investment programme it is formally not possible to generate any IRR or Pay-back Period since the whole projected investment can be easily financed from the cash-flow even within the frame of the pessimistic traffic scenario.

Here, in 2003, the "first" year of operation the port has a cash-flow surplus from the operation of berth n°4 of about 1.85 million USD, which is by far sufficient to cover an initial investment of 1.07 million USD as projected for the first stage of the investment programme. The surplus steadily increases over time to reach a remarkable 3.75 million USD in 2020. In every year of the analysed time period, the port will be able to finance any of the proposed measures entirely from the cash-flow.

In a first attempt to generate an IRR the consultants have undertaken to calculate the model under the condition that the whole programme (4.2 million USD) will be realised in the first year of the analysed period. In this case the port will obtain an IRR of about 80% if cargo volumes develop according to pessimistic assumptions, and of about 180% under the optimistic environment.

Since in the optimistic scenario the cash-flow surplus develops from 2.2 million USD in 2003 to over 9 million USD in 2020, the consultants have concentrated their efforts to investigate the downrisks of the above very positive results. Consequently, all further analysis focuses on the pessimistic scenario.

In order to assess the sensitivity of the main results, the consultants have varied some parameters of their model, which may have an impact on the outcome of the analysis. The major objective was to create an environment which would render the investment not financially viable, and comment on the likelihood of such an environment to come into existence.

The following cases have been investigated:

- **Variation of Operating Costs:** The variation of the parameter for operating costs revealed that even a doubling of operation costs generates an IRR sufficient to attract any private investor (44%). However, an increase of more than 115% would render the investment non-financially viable as measured against a key-IRR of 20%. As mentioned above, the operating cost have been derived as a(n estimated) share of the cost of the oil-handling business on total port cost. Since the key according to which the port distributes overall port cost to the single port business activities has been developed within the frame of an EBRD project, the consultants assume that a more than doubling of the oil-related cost due to the correction of a possible former mis-assignment of cost items is quite unlikely. Moreover, a cost explosion due to external factors can, given the assumed stability of the political and economic environment, which forms the base for the expected cargo and traffic development, be ruled out.
- **Variation of Vessel Dues:** Given the current level vessel dues a tanker calling at Aktau is charged with, a reduction of more than 83% would be necessary to render the proposed investment even under the pessimistic cargo scenario financially unattractive. This would reduce the amount collected per vessel to range from 1,000 USD for a 5,000 DWT tanker to 2,500 USD for a 12,000 DWT tanker. This is rather a low level even under a more competitive international environment.
- **Though the port itself has little direct influence on the tariffs for vessel-related services since these tariffs are decided upon by the Kazakh Anti-Monopoly Commission, the port however has the right to propose a suitable tariff system. Since in the absence of any direct revenues from oil handling operations vessel dues are the major source of income for the port, the consultants fail to see the reason why the port itself should propose a system which would significantly reduce port income.**
- **Variation of the Cargo Fee Rate:** Similar to vessel dues, the tariff for the cargo fee is determined by the Anti-Monopoly Commission, and thus not directly influencible by the port. However, the sensivity analysis has revealed that even the abolition of cargo fees will not deter a private investor. The IRR will still be in the range of 80%.
- **Doubling of the Investment Cost of Phase One:** Undoubtedly, this is probably the most unlikely case, since the consultants' estimate of investment cost has be elaborated with due care. Just to be complete, the consultants have calculated the effect of a doubling of investment cost proposed for the first phase of the programme. The result is an IRR of 580%, which the consultants do not want to comment further.
- **Full Programme in the First Year of the Analysed Period and Doubling of Total Investment Cost:** Nothing demonstrates the robustness of the present financial calculations more than the result of this sensitivity analysis. Even if the whole investment programme is realised under pessimistic assumptions in 2003 with twice the investment costs estimated, the IRR will still be well above 25%.

To sum up, the results of the financial analysis has proven to be very robust against all major pitfalls of an investor's life.

8. The role of terminal operators

The present study also provides some information about costs and revenues related to the operation of berths n°4 and n°5, to be confident that the respective operators obtain a reasonable return on their investment. Since the port of Aktau does not receive any leasing rate or fixed concession for the provision of the terminal infrastructure but is more or less directly profiting from the operational business of the oil handling companies via cargo fee and vessel dues, it is of vital importance for the port that the handling companies attain an attractive return on their operations. If rates of return are insufficient the operators may scale down their business activities or even withdraw from Aktau port. Since oil-handling equipment belongs to the present operators, a decision to limit or end business activities may lead to a considerable idle time of the terminal infrastructure and along with it major losses of revenues for the port.

Furthermore, the following information shall contribute to a later economic evaluation conducted by the EBRD, which has to consider all costs and benefits which are generated by increased oil handling in Aktau.

8.1 KazTransOil

KazTransOil is affiliated with the Kazakh national oil company KazakhOil and engaged in the major share of oil shipments on Kazakh territory. In Aktau, the company is the sole user of berths n°9 & n°10 since it owns all handling equipment on this pier. Moreover, KazTransOil is the main user of berth n°4, on which the company owns six pipelines (four for oil, one for gas-oil, one for ballast water) and three loading arms.

Furthermore, KazTransOil operates a tank-farm in about three-kilometre's distance to the piers it operates. The tank-farm has a storage capacity of 4.9 million tonnes annually (20 x 5000 m³, 2 x 20,000 m³, turnover rate of 35). The capacity of the rail tank car (RTC) unloading station is reportedly 4 million tonnes (4 x 15 wagons, 6 hours unloading).

In 2000, KazTransOil pumped about 3 million tonnes of oil from its tank farm to the port facilities (670,000 tonnes to berth n°4) for shipments to Baku and Makhachkala. Information on revenues were difficult to obtain but, reportedly, the company charges about 4 USD/tonne, which seems to be a market rate, for its services. Services included in this rate comprise the unloading of the rail-tank car, pumping of the oil to the port and then into the vessel. Storage of oil cargo volumes is charged extra.

KazTransOil operates its facilities in four shifts of 12 hours each. Four workers, each earning about 300 USD per month, form one shift. Further costs comprise energy for pumping and heating of the oil, and cleaning of the pipe. Reportedly, these costs are as low as 3 USD per 1000 tonnes. Cleaning is actually not very frequently executed, since KazTransOil manages enough capacities to have a dedicated pipeline for all different types of oil handled at Aktau.

The present value of the handling facilities relevant for activities on berths n°4 & n°5 and owned by KazTransOil (about 18 km of pipelines, three loading arms, pumping and heater station) are roughly estimated at around 4.5 million USD (about 3.6 million USD for pipelines and loading arms, 900,000 USD for pumping and heating station). The consultants assume about an annual 3% of this present value for maintenance and repair works (M&R).

This very rough and preliminary survey indicates that KazTransOil in 2000 had revenues from handling operations on berths n°4 of around 2,7 million USD. Cost items (M&R, share of staff and energy cost according to the share of berth n°4 on total handling volumes plus a mark-up of thirty percent for overheads) amounted to just about 322,000 USD. Thus, there remains a considerable part of revenues for the coverage of depreciation of handling and pumping facilities.

8.2 TransOil

TransOil exclusively operates on berth n°4, where the company owns two pipelines and one loading arm. The company is mainly engaged in pumping mazout from its small storage facilities in two kilometre's distance of the port to vessels waiting at berth n°4. In 2000, TransOil handled around 60,000 tonnes. In the past, TransOil also received some minor quantities of gas-oil for local consumption on berth n°4, which were then pumped to a small storage facility owned by another private company. But so far in 2001, Aktau has not yet received any import volumes of oil and derivatives.

TransOil has no permanent staff for handling operations. The company hires staff on demand and pays per hour worked. Pumping cost per tonne should be at a similar level as of KazTransOil. However, the company claims to have no expenses for heating and cleaning of the pipe. The 6 km-pipeline system has been modernised in 1996 and is self-cleaning.

The consultants estimate that the existing equipment has a present value of about 1.5 million USD (1.2 million USD for the pipeline and handling system, 300,000 USD for the pumping station).

Given a market price of 4 USD/tonne, TransOil in 2000 had revenues of around 240,000 USD, which is just enough to cover operating cost of 72,000 USD and the depreciation for equipment.

8.3 Nuclear Power Station Company

For the Aktau Nuclear Power Station (NPS) the oil handling business is a chance to shift business activities from the mere production of energy to trading of energy. The Power Plant is currently operated with oil and gas. The ability to use oil derivatives as input for the production of energy explains why NPS owns a one-km pipeline and a loading arm at berth n°4. Today, NPS markets this pipeline for the transport of gas-oil and mazout coming from e.g. Chimkent refinery by rail. In 2000, NPS reportedly handled 155,000 tonnes at berth n°4.

NPS executes its terminal handling operations with permanent staff otherwise employed in energy production. Cost for pumping of one tonne is at about the same level as of NPS' competitors. Steam for the heating of mazout is provided by the power plant. Cleaning of the pipeline with compressed air is done at the end of every loading process.

The consultants estimate that the existing equipment of NPS has a present value of about 700,000 USD (200,000 USD for the pipeline and handling system, 500,000 USD for the pumping station).

Given a market price of 4 USD/tonne, NPS in 2000 had revenues of around 620,000 USD, which is more than enough to cover operating cost of 30,000 USD and the depreciation for equipment.

Table 8-5: Business Activities of Oil Handling Companies in the Port of Aktau (year 2000)

	USD per pumped tonne	Pumped volumes (t)	Revenues (USD)
KazTransOil	4.0	3,000	12,000
Nuclear Power Station	4.0	155	620
TransOil	4.0	60	240

Table 8-6: Staff Cost Parameters of Oil Handling Companies in the Port of Aktau

Staff	No. of Shifts	Workers/shift	No. of workers	Avg. wage/month	Op. Days/year
KazTransOil	4	4	16	300	330
Nuclear Power Station	1	4	4	130	33
TransOil	3	5	15	400*	40

Paid per working hour: approximately 2 USD

Table 8-7: Energy Cost Parameters of Oil Handling Companies in the Port of Aktau

Energy	Pumping KWh/1000 t	Heating KWh/1000 t	KWh/cleaning	Cleaning/year	USD/KWh
KazTransOil	100	50	50	10	0.018
Nuclear Power Station	100	0	50	33	0.015
TransOil	100	0	0	0	0.018

Table 8-8: Total Cost of Companies from Oil Handling Activities in the Port of Aktau

	Operating Costs			Overheads	Total Cost
	Op. Staff	Energy	M&R	30%	
KazTransOil	82,643	8,145	156,900	74,307	321,995
Nuclear Power Station	895	257	21,330	6,745	29,227
TransOil	9,600	108	45,660	18,410	71,978

* *

*

Enclosures: Annex 1 to annex 4

Annex 1

Abbreviations & Acronyms, References and Staff List

ABBREVIATIONS AND ACRONYMS

- ACSP Aktau Commercial Sea Port
- AFT Aktau Ferry Terminal
- BSL Baltic Sea Level (Elevation Reference)
- CD Caspian Chart Datum (28 m below BSL)
- CPC Caspian Pipeline Consortium (from western Kazakhstan to Novorossiysk)
- CSC Caspian Shipping Company
- DWT Dead Weight Tonnage (vessel carrying capacity)
- EBRD European Bank for Reconstruction and Development
- EC European Commission
- IMDG International Maritime Dangerous Goods Code
- Inogate Interstate Oil and Gas Transmission to Europe (an EC programme)
- IRR Internal Rate of Return
- km kilometre
- kV kilo Volts
- m metre
- MARPOL International Convention for Prevention of Marine Pollution
- MEP Main Export Pipeline (from Baku to Ceyhan)
- MREA Mangistau Regional Environmental Agency
- Mt Million tonnes
- RTC Rail Tank Car
- t metric tonne
- ToR Terms of Reference
- Traceca Transport Corridor Europe-Caucasus-Asia
- USD United States dollar

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5. Aktau Port Terminal Visit, Shell Group, March 1999
6. Design water levels for Baku and Turkmenbashi Ferry Terminals, DHI / Ramboll, August 1996
7. Business Plan 1999 - 2003 for Aktau Commercial Sea Port, ACSP, 1999
8. Forwarding Multimodal Transport Systems on Traceca Route, Bceom, May 1997
9. Regional traffic database and forecasting model, WS Atkins, September 1997

STAFF LIST

1. BENEFICIARY (ACSP)

Mr. Abylgazin, Director
Mr. Glock, Deputy Director for Finance & Capital Construction
Mr. Konstantinov, Chief Engineer

2. TACIS - TRACECA

Task Manager:

Mr. Daniel Stroobants - Brussels, Belgium

Co-ordinator:

Mr. Marc Graille - Baku, Azerbaijan

Monitor:

Mr. Pieter Melissen - Tashkent, Uzbekistan

3. CONSULTANT

BCEOM

Mr. André Merrien, Civil Engineer

UNICONSULT

Mr. Marcel Sames, Transport Economist

AZQIPRONEFTECHIM

Mr. Valeriy Aleksandrov, Oil Handling Expert

4. OTHER STAFF MET

In Aktau:

- Aktau Commercial Sea Port Captain Lamzin, Harbour Master
Mr. Bulat Zhansvgurov, Head of Marketing Department
Mr. Soloviev, Capital Construction Department
Mrs. Nurzhamal Daulenova, Foreign Relation Department
- KasTransOil, Western Branch Mr. Serikkali Murinov, Deputy Director
Mr. Baltabeck Dzhaileebayev
- Nuclear Power Station Company Mr. Alexander Zinoviev, Deputy Director
Mr. Sergey Kitienko, Head of Fuel Transportation Department
- TransOil Mr. Kornienko

In Baku:

- Caspian TransCo Inc. Mr. Bekir Vural, Operation Co-ordinator
Mr. Sinan Tunali, Marketing Co-ordinator

Annex 2

10 photographs



1. Alongside berth n°4, in June 2001



2. Fenders hanging from pier head, inner side (June 2001)



3. Corroded sheet-piles at berth n°5 (June 2001)



4. Corroded sheet-piles and worn out capping beam - berth n°5, June 2001



5. Perforated sheet-pile at berth n°5 (year 2000, prior to temporary repair works)



6. Cavity behind berth n°5's bulkhead (year 2000, prior to temporary repair works)



7. On pier top: pipelines, loading arms and water cannon (June 2001)



8. Head of pier: second water cannon and floodlighting lattice tower in the back (June 2001)



9. Access causeway, towards the pier (June 2001)



10. Remaining parts of former sea-water intake station, north of pier n°5 (June 2001)

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Annex 3

Financial tables (3 sheets)

Rehabilitation of Aktau oil berths n°4 and n°5 - Financial analysis - Pessimistic scenario

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Handling volumes on berths n°4 & n°5			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Outgoing cargo	888	1 440	1 823	1 587	1 350	1 413	1 477	1 540	1 603	1 667	1 730	1 993	2 057	2 120	2 183	2 247	2 310	2 373	2 437	2 500	2 500
Incoming cargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cargo fee per tonne of handling (USD)	
Outgoing cargo	0,90
Incoming cargo	0,90

Forecast	Vessel type	Average size (DWT)	N° of vessels																			
Numbers of vessel calls	Tanker	12 300	0	0	0	18	19	20	22	23	25	27	28	30	32	93	102	110	119	127	135	141
	Tanker	7 400	99	126	159	139	112	110	106	103	99	94	100	93	86	78	70	61	52	42	32	20
	Tanker	5 000	82	141	178	155	104	115	128	142	157	173	189	235	254	274	165	172	179	188	197	207

Cost of port call (USD)	
12,300 DWT (Kafur Mamedov Class)	15 000
7,400 DWT (Absheron Class)	9 000
5,000 DWT (Volganeft & Gal Shikhinsky Class)	6 000

Total revenues (in USD)																						
	2 182	3 273	4 144	3 806	3 110	3 240	3 381	3 521	3 661	3 801	3 941	4 528	4 666	4 804	5 060	5 210	5 359	5 508	5 657	5 805	5 806	

Cash Operating Costs (in USD)		Share																					
Share on overall cost for the provision of tanker vessel related services			725	779	962	946	731	754	782	811	840	870	900	1 044	1 075	1 106	990	1 016	1 043	1 070	1 098	1 126	1 141
Share on overall cost for the provision of oil cargo related services			449	549	667	659	542	556	570	584	597	610	623	707	719	730	742	753	765	776	788	799	807
Contingencies (in % of total cost)	10%		117	133	162	161	127	131	135	140	144	148	152	175	179	184	173	177	181	185	189	193	195
			1 292	1 461	1 782	1 766	1 401	1 441	1 488	1 535	1 581	1 628	1 675	1 926	1 973	2 020	1 906	1 946	1 988	2 030	2 074	2 118	2 143

Investment Costs (in USD)																							
Infrastructure					Phase 1					Replacement				Repl.	Phase 2					Replacement			
	Dredging				0										740								
	Access causeway works				150										0								
	Quay wall works				361										820								
	Capping beam works				173										173						173		
Superstructure																							
	Pavement and drainage on access causeway				78										78	0							
	Pavement and drainage on pier top				129										129	0							
Equipment																							
	Fender and bollards				26					26					26	26							
	Fire-fighting equipment				47										47						47		
	Floodlight equipment				30										30								
	Navigation light at pier head				2										0								
Planning					70										128								
					0	0	0	1 068	0	0	0	0	0	0	28	0	0	0	0	0	235	1 968	0
					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220	0	

Annual Cash-Flow (in USD)																						
Pessimistic scenario			1 812	2 362	772	1 709	1 799	1 893	1 987	2 052	2 173	2 285	2 602	2 693	2 549	1 188	3 263	3 371	3 478	3 363	3 687	3 683

Cumulative Cash-Flow (in USD)																						
Pessimistic scenario			1 812	4 174	772	2 480	4 279	6 172	8 158	10 210	12 383	14 648	17 250	19 944	22 493	23 681	26 945	30 316	33 794	37 157	40 844	44 507

Internal Rate of Return 2003-2020 (IRR)	
Pessimistic scenario	#DIV/0!

No IRR can be calculated since the cash-flow time series does not include any negative value

Rehabilitation of Aktau oil berths n°4 and n°5 - Financial analysis - Optimistic scenario

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Handling volumes on berths n° 4& n°5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Outgoing cargo		888	1 440	1 927	1 657	2 531	2 647	2 763	2 879	2 995	3 111	3 227	3 343	3 459	3 576	3 692	3 808	3 924	4 040	4 156	4 272	4 300
Incoming cargo		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cargo fee per tonne of handling (USD)		
Outgoing cargo		0,90
Incoming cargo		0,90

Forecast	Vessel type	Average size (dwt)	No. of vessels																			
Numbers of vessel calls	Tanker	12 300	0	0	0	22	117	179	198	214	229	242	267	273	357	364	371	408	412	418	424	430
	Tanker	7 400	99	126	180	131	189	187	183	179	173	167	160	151	142	57	59	60	62	64	66	68
	Tanker	5 000	62	141	200	181	250	101	15	10	12	20	30	20	46	30	40	51	7	16	30	42

Cost of port call (USD)		
12 300 dwt (Kafir Mamedov Class)		15 000
7 400 dwt (Absheron Class)		9 000
5 000 dwt (Volganef & Gal Shikhlinitskiy Class)		6 000

Total revenues (in USD)																						
		2 182	3 273	4 372	3 754	5 808	6 420	6 906	7 232	7 544	7 849	8 149	8 492	8 766	9 271	9 555	9 837	10 227	10 508	10 788	11 067	11 149

Cash Operating Costs (in USD)		Share																					
Share on overall cost for the provision of tanker vessel related services			725	779	952	946	731	754	782	811	840	870	900	1 044	1 075	1 106	990	1 016	1 043	1 070	1 098	1 126	1 141
Share on overall cost for the provision of oil cargo related services			449	549	667	659	542	556	570	584	597	610	623	707	719	730	742	753	765	776	788	799	807
Contingencies (in % of total cost)	10%		117	133	162	161	127	131	135	140	144	148	152	175	179	184	173	177	181	185	189	193	195
			1 282	1 461	1 782	1 766	1 401	1 441	1 488	1 535	1 581	1 628	1 675	1 926	1 973	2 020	1 905	1 946	1 988	2 030	2 074	2 118	2 143

Investment Costs (in USD)					Phase 1	Phase 2		Replacement		Phase 3	Replacement	Replacement	Replacement									
Infrastructure					0	740				270												
	Dredging				150	0																
	Access causeway works				361	620																
	Quay wall works				173	173				620												
	Capping beam works											173										
Superstructure					78	0																
	Reinforcement and drainage on access causeway				129	0						78										
	Pavement and drainage on pier top										129											
Equipment					28	28		28			28		28									
	Fender and bollards				47	47						47										
	Fire-fighting equipment				30	30						30										
	Floodlight equipment				2	0							47									
	Navigation light at pier head				70	128				76		128										
Planning																						
					0	0	0	28	0	0	1 166	0	235	0	406	0	0	220	0	0	0	0

Annual Cash-Flow (in USD)																						
Optimistic scenario			1 812	2 578	1 175	3 638	2 314	4 745	5 094	5 388	5 722	6 018	5 184	6 616	7 014	7 528	7 397	8 205	8 477	8 527	9 015	9 090

Cumulative Cash-Flow (in USD)																						
Optimistic scenario			1 812	4 389	1 175	4 813	7 127	11 872	16 965	22 353	28 076	34 094	39 278	45 893	52 907	60 435	67 832	76 038	84 515	93 042	102 057	111 147

Internal Rate of Return (IRR)	#DIV/0!
Optimistic scenario	

No IRR can be calculated since the cash-flow time series does not include any negative value

Annex 4

Figures and drawings (6 sheets)

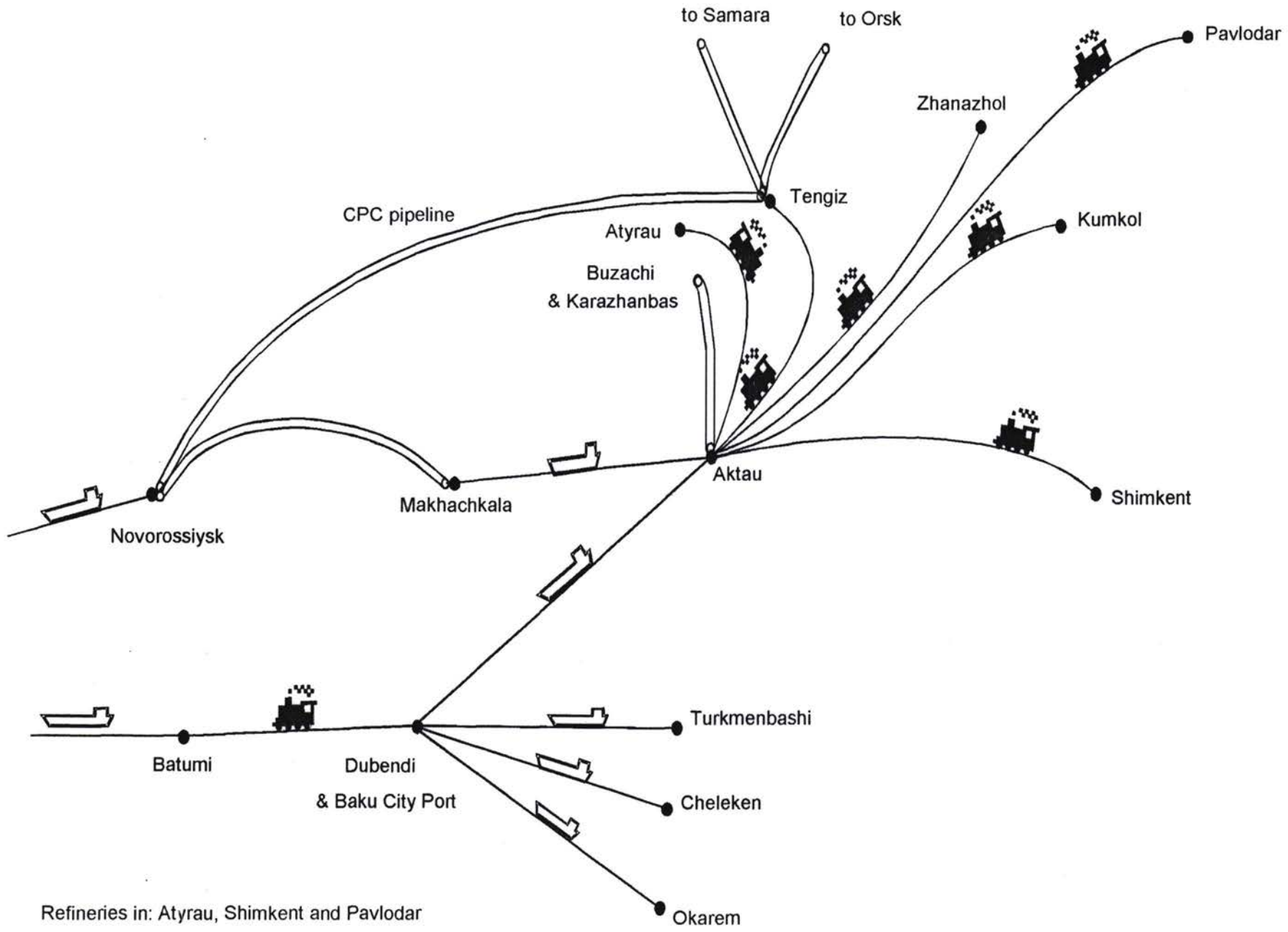


Figure 1

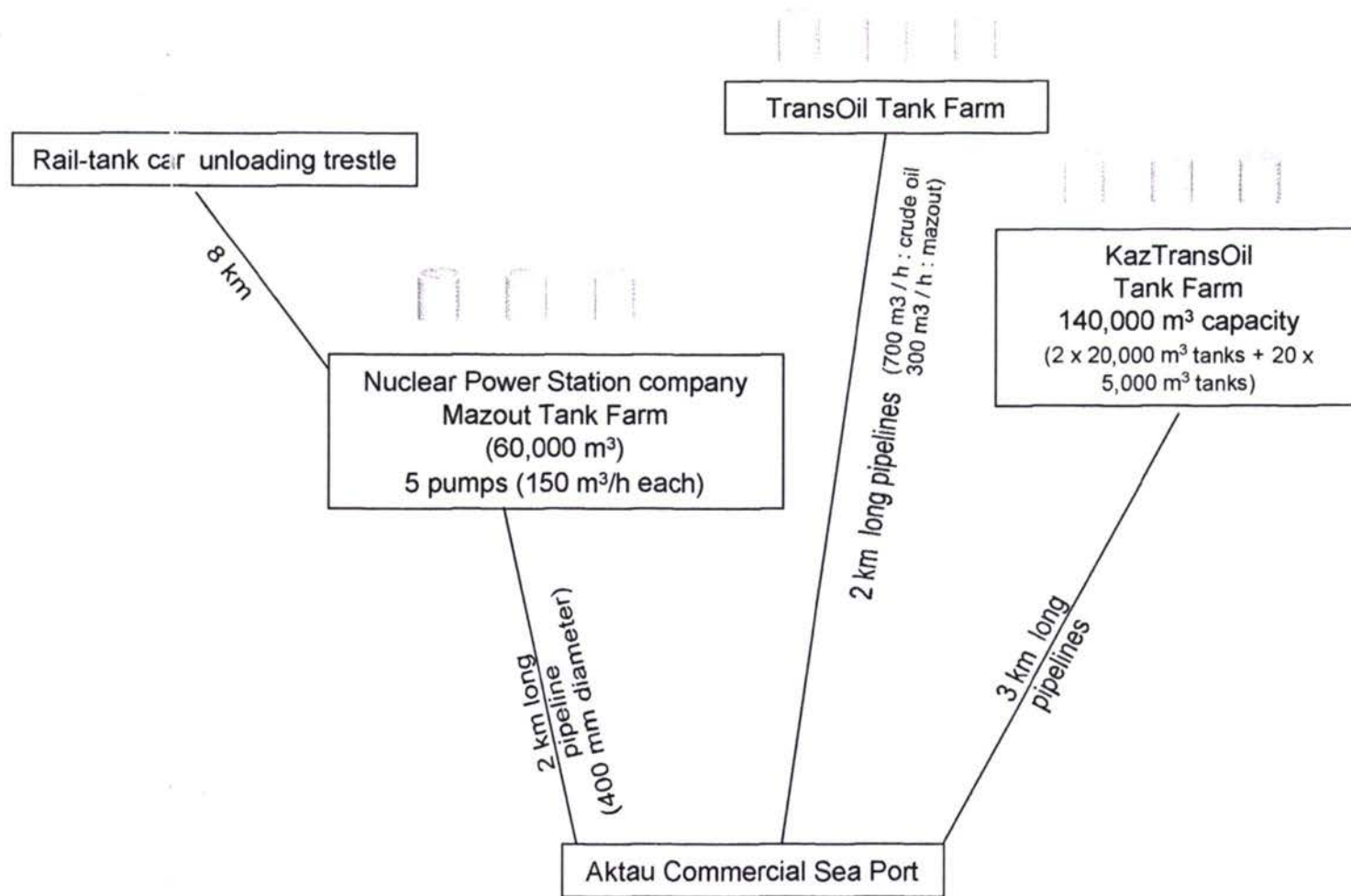
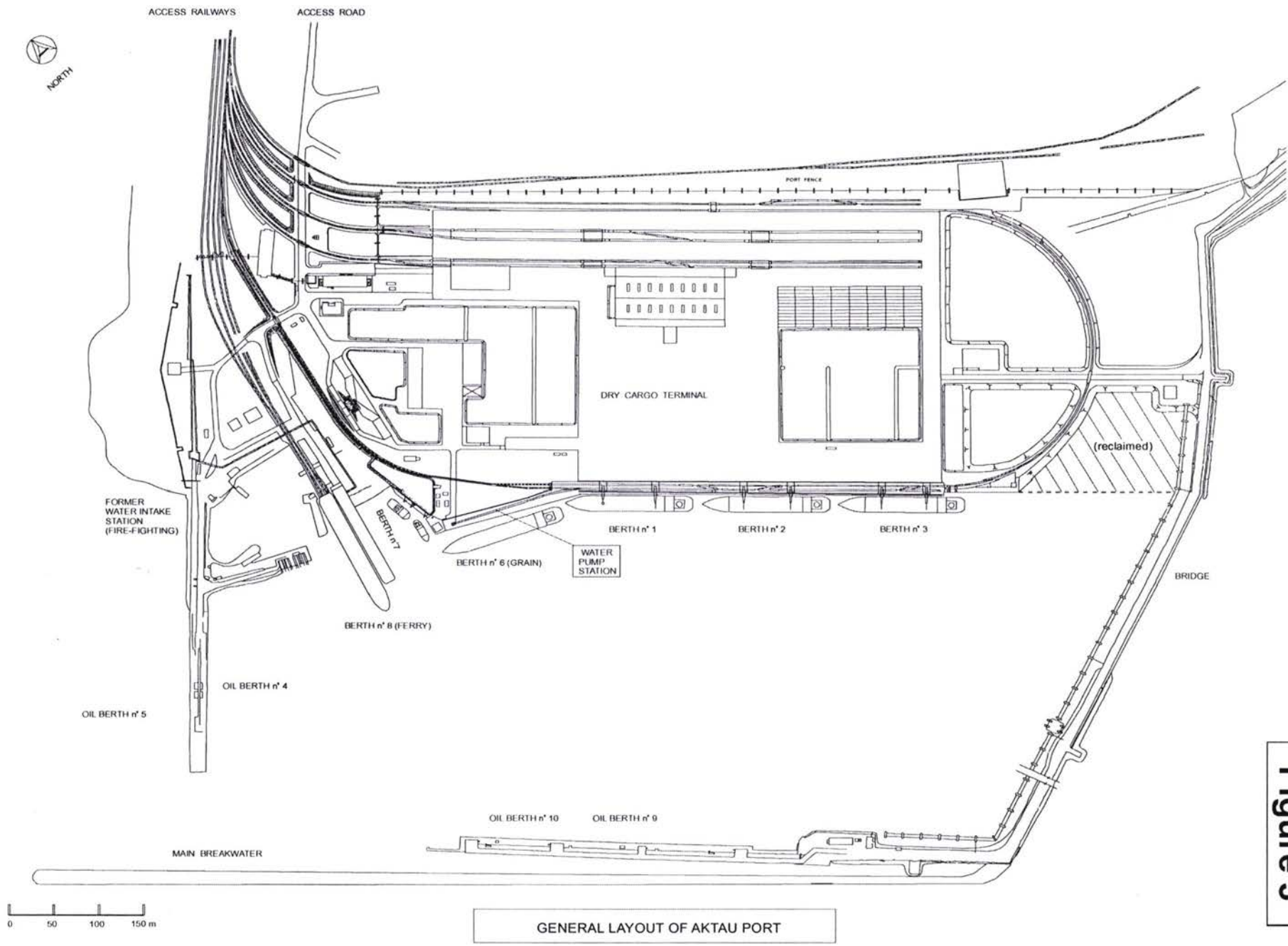
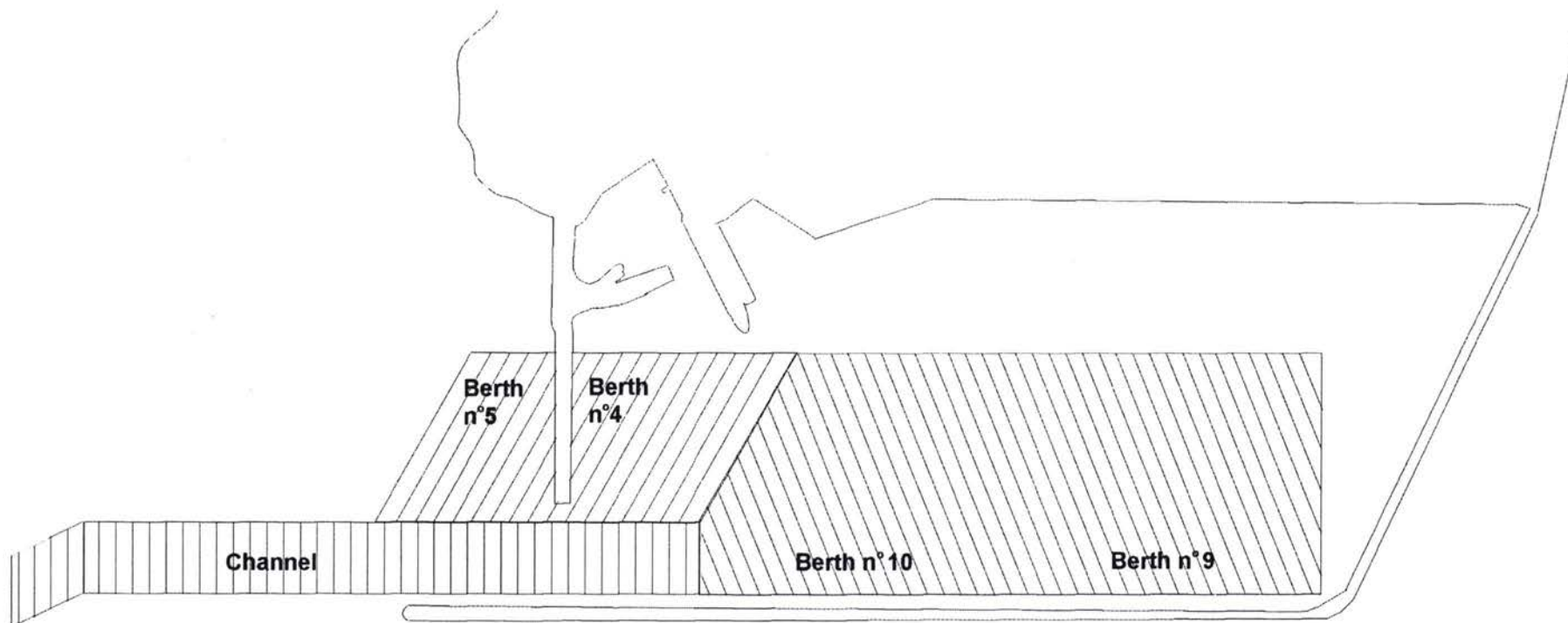


Figure 2



GENERAL LAYOUT OF AKTAU PORT

Figure 3



Aktau port dredging programme

- Future water depth: 9 m below Chart Datum
- Overall quantity to be dredged: 1,000,000 m³
- Breakdown:
 - channel: 500,000 m³
 - berths n° 4 & n° 5 area: 170,000 m³
 - berths n° 9 & n° 10 area: 330,000 m³

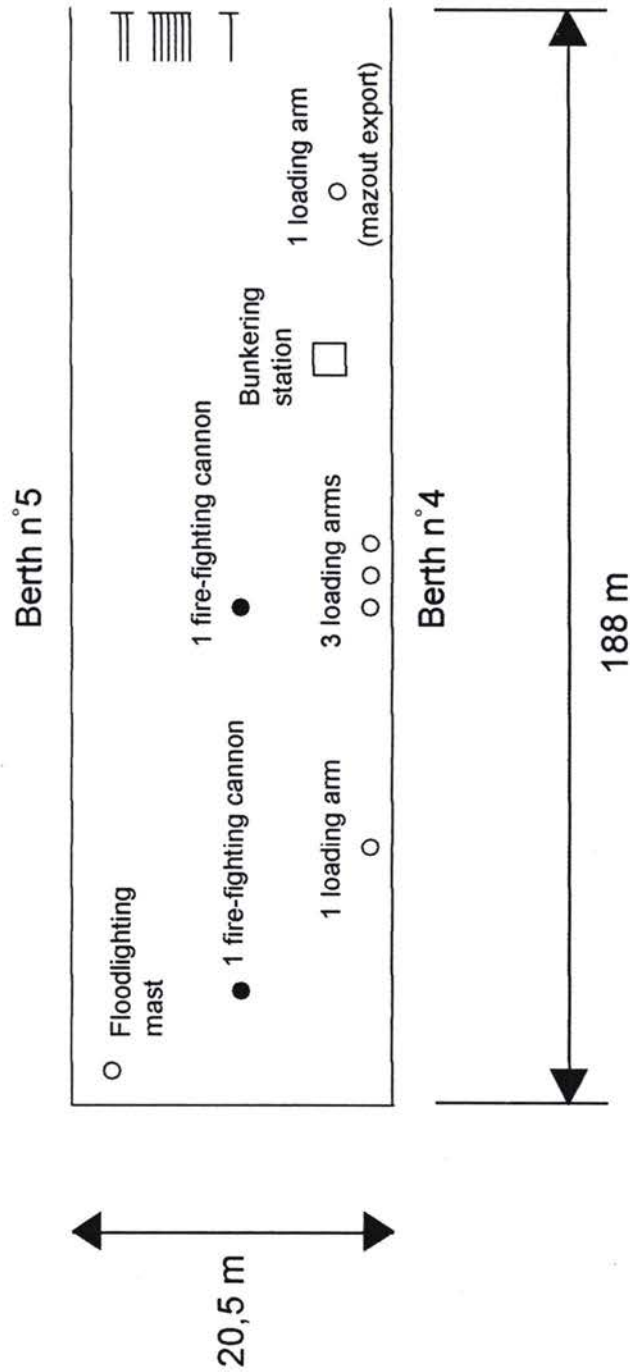
Figure 4

Figure 5

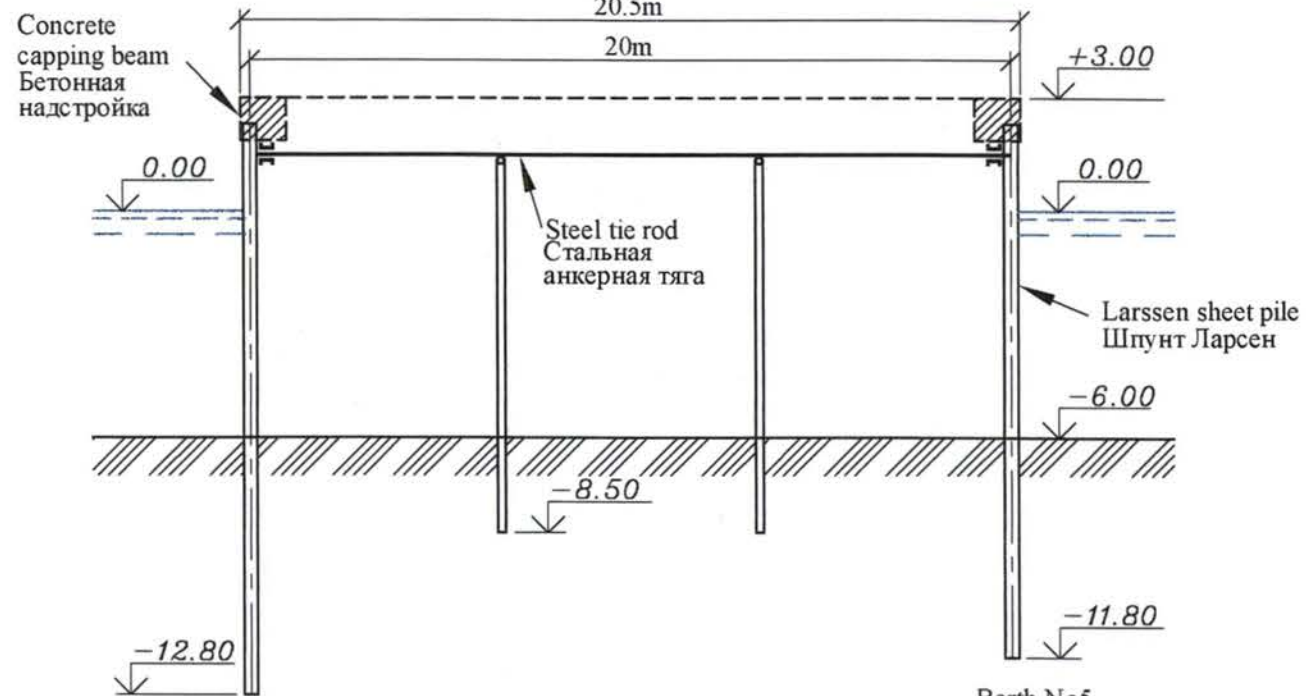
Transoil
1 line for Kumkol oil
1 line for mazout oil

KazTransOil
4 pipelines for crude oil
1 pipeline for ballast water
1 pipeline for kerosene

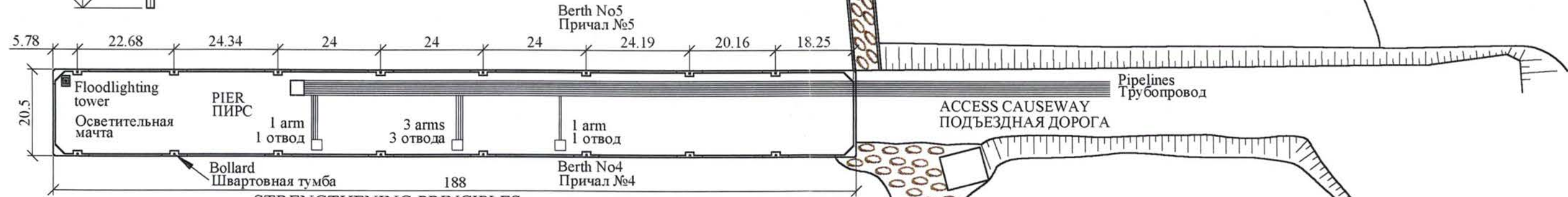
"Nuclear Power Station" Company
1 pipeline for mazout oil



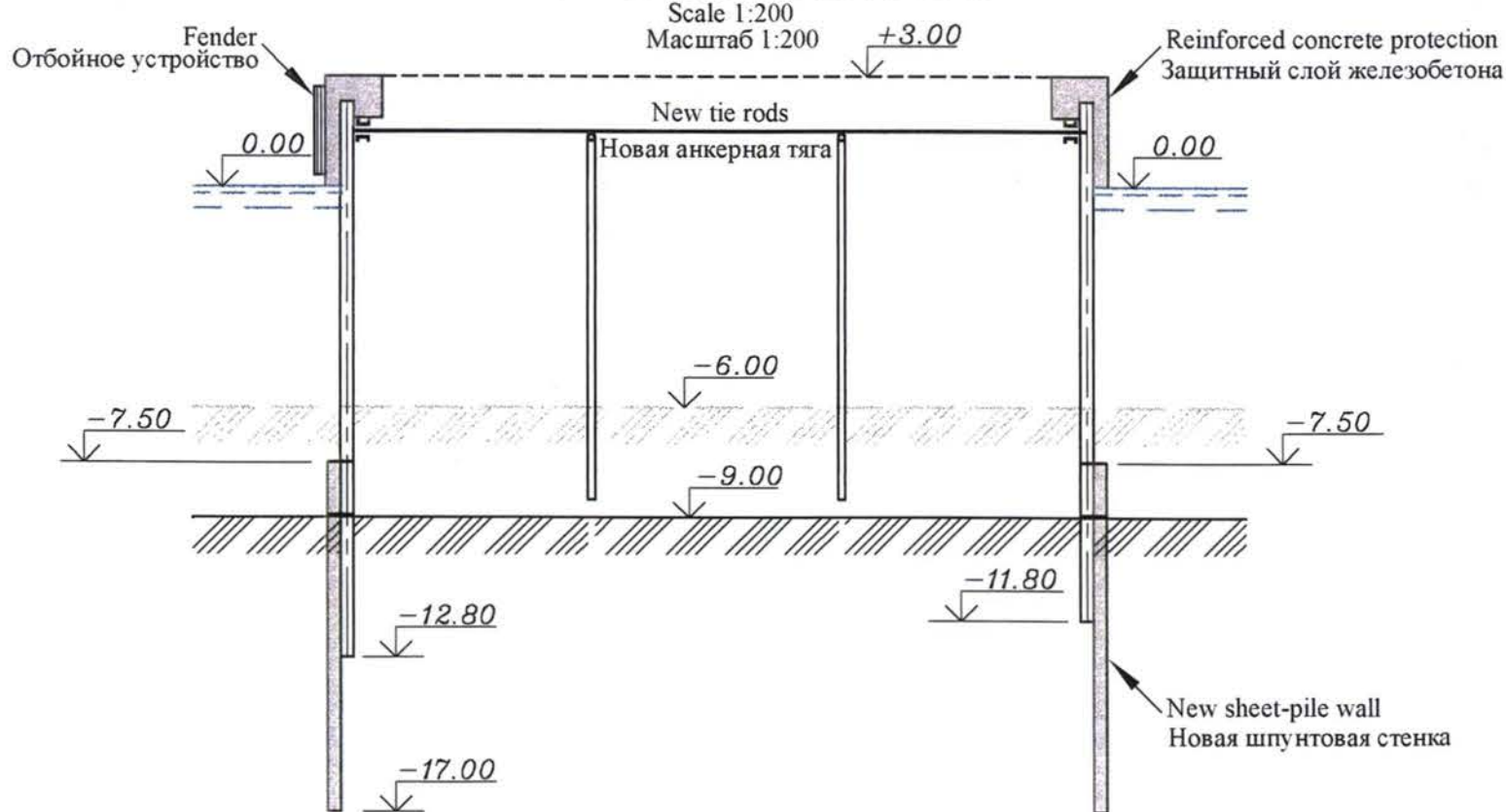
INITIAL PIER
 СУЩЕСТВУЮЩИЙ ПИРС
 CROSS SECTION
 РАЗРЕЗ
 Scale 1:200
 Масштаб 1:200



GENERAL LAYOUT
 ГЕНЕРАЛЬНЫЙ ПЛАН
 Scale 1:1000
 Масштаб 1:1000



STRENGTHENING PRINCIPLES
 ПРИНЦИПИАЛЬНАЯ СХЕМА УСИЛЕНИЯ
 Scale 1:200
 Масштаб 1:200



Rehabilitation of
 Aktau Oil berths No4 and No5
 Реконструкция нефтепричалов №4, №5
 порта Актау
 Drawings
 Чертежи
 August 2001
 Август 2001