Highlighted text shows you what is new, compared with the report dated February 2001

André Mersien
15 June 2001

Traceca Corridor

Traffic and Feasibility Studies - TNREG 9803

Module D :

Navigation Channel for Turkmenbashi Port

Part 2 :

Maintenance and improvement recommendations

Final report, June 2001

These Sheets allow you apart from the

REPORT COVER PAGE

Project Title	: Traceca Corridor - Traffic and Feasibility Studies
Module D Title	: Navigation Channel for Turkmenbashi Port
Project Number	: TNREG 9803
Module D Country	: Turkmenistan

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Date of report : 15 June 2001

Reporting period : 15 May to 15 June 2001

Author of report : André Merrien

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- Recommend and justify possible operational improvement measures with respect to safety and continuity of operations, costs, benefits, environmental aspects.
- Recommend and justify a maintenance policy and working maintenance plan, with justifications for any changes from the present situation. Provide budget estimates for such a plan and relate it to expected port revenues and expenditures.
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Project start date:	Main contract signature: 30 August 1999 Commencement of Module D activities: mid-August 2000
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2.6 Economic analysis

The economic analysis complements the financial assessment by stressing benefits expected from decrease in oil transportation costs, from re-use of dredged sands and from added value linked to channel improvement and maintenance works. Taking into account all project costs, the economic cost-benefit balance appears to be strongly positive: annual balance quickly reaches USD 1.8 million (USD 6.6 million when considering the black market currency exchange rate).

TML should apply for a permit covering all capital dredging works as well as further maintenance works foreseen in this project, including use of sand for creation and nourishment of beach(es) and dumping of mud on the sea-bed of the bay (otherwise at an offshore area located south of the channel throat).

7.7 Monitoring

A monitoring plan should be developed once the dredging plan and selection of the disposal site have been finalised. This plan must include specification of:

- Baseline conditions
- Monitoring during the course of the dredging and disposal operations
- Post-operational monitoring
- Feedback throughout the dredging operations and subsequent to completion of the same

The monitoring plan should include but not be limited to the following:

- Monitoring of turbidity in the area of the dredging and disposal operations
- Monitoring of physical and chemical characteristics of the dredged material
- Frequency and location of sampling
- Guidelines on management of data

8. Financing the works

8.1 Objectives and methodology

The objectives of the following analysis are to evaluate TML ability to self-support the channel rehabilitation works and to reimburse the loan that TML may contract to complete the rehabilitation.

A basic assumption is that rehabilitation works will be carried out according to the agreement which foresees that Tacis will provide a grant of approximately euro 341,000 for supply of navigation aids and sets of spare parts for their maintenance. The port of Turkmenbashi is supposed to finance the rest of the works, either by itself or through a loan. The anticipated sharing out of the works is shown in the first annex 3 table.

Throughout this financial analysis, the channel and the navigation aids are considered as a specific cost-centre called "Channel Centre" and all charges and revenues have been tentatively separated from the other port activities. This situation differs from the current one but it fits with all recent EBRD recommendations regarding Turkmenbashi port management.

All financial projections comply with prevailing port conditions and make use of past TML financial statements. Amounts are converted into USD according to the official exchange rate of 1 USD to 5,200 Manats (the black market rate is introduced in the following economic analysis).

The assessment includes three steps:

- Calculation of profit and loss statements over the ten coming years, which determines the capacity of channel services to be self-supporting.
- Estimation of projected cash-flow for the same period, in order to assess the capacity to finance the project and to refund a potential loan.
- Estimation of financial contribution of the Channel Centre to the overall financial performance of TML.

8.2 Project cost

The first annex 3 table details the investment cost and the financing allocation of the project elements. Capital dredging prices take into account amortisation of dredging equipment (USD 5.5 million, over 20 years) as well as costs for crew members (USD 30,000 per year) and for gas-oil and lubricants (USD 26,000 per year). Productivity of the dredger is supposed to be in the range of 1.5 to 2.0 million m3 per year, which is realistic after equipment overhaul and staff training (ref. report of November 2000). Yet, overall dredging productivity is limited to 1 to 1.5 million m3 per year because of the restricted capacity of barges.

Table 1: Investment and financing sources *(figures in USD, using 1 euro = 0.9 USD)*

Item description	Total	TRACECA grant	TML
A. Navigation aids and ancillary works	381,780	307,530	74,250
B. Survey equipment and survey works	17,280	0	17,280
C. Dredging equipment	87,840	0	87,840
D. Capital dredging works	1,458,000	0	1,458,000
Total	1,944,900	307,530	1,637,370

8.3 Profit and loss statement

a. Income statement

Operating revenues are based on the present tariff structure, taking into account the 50% discount agreed between TML and CSC for their ferries.

This table shows that net cash-flows are high and that consequently the Channel Centre should easily support the rehabilitation works.

8.5 Conclusion of the financial assessment

This financial assessment only shows the contribution of the so-called "Channel Centre" to TML overall activity. From this analysis it can be thought that the Channel Centre should be self-supporting and profitable. Its contribution should always be very positive, even in the "pessimistic & reduced" traffic hypothesis.

However, as it was pointed out in the report of November 2000, revenues from channel dues don't seem to be readily available for financing channel works, since recent TML accounts reveal global profits close to nil. The Port Institutional Development Programme, which is being implemented by Haskoning, recommends to set up an analytical accounting system which should enable to make the situation clearer.

9. Economic analysis

9.1 Economic benefits

The project would induce several economic benefits: decrease in transportation costs, added value by use of dredged sand and added value linked to improvement and maintenance of the channel.

a. Decrease in transportation costs

It can be assumed that in case the project is not implemented oil-tankers will soon have to reduce their cargo loads, say from 6,000 to 5,000 tonnes, as an average (ferries and other vessels have smaller draughts). Considering an average running cost of USD 1,500,000 per year and per tanker, increasing the average unit load by 1,000 tonnes is equivalent to saving 0.5 USD per tonne of transported oil (each tanker carries approximately 450,000 tonnes of oil per year).

b. Added value from sand

It will be advisable to use dredged sand either for beach construction in Turkmenbashi or for beach nourishment in Awaza, or for construction purposes (concrete or earth works). For the needs of the economic analysis it has been considered that the average value of re-used sand will be 0.1 USD per cubic meter. Related economic values are USD 175,000 during capital dredging works and, later on, USD 3,000 per year.

c. Added value from channel works

Expenses spent by TML equipment and employees total USD 1,526,000 during the investment period, and USD 317,000 per annum during the following years. These sums will directly or indirectly benefit to the Turkmen economy.

9.2 Economic costs

Economic costs are those of channel improvement and maintenance works:

Years	Works	Total amounts (USD)	Local currency share (USD)	Foreign currency share (USD)
2001	Dredging/nav. aids	182,000	142,000	40,000
2002	Dredging/nav. aids	729,000	569,000	160,000
2003	Dredging/nav. aids	729,000	569,000	160,000
2004	Dredging/nav. aids	305,000	238,000	67,000
2005	Maintenance	379,000	317,000	62,000
etc.				

9.3 Balance of costs and benefits

The following page table shows the balance of costs and benefits, as well as the resulting economic return on investment. Considering the official currency exchange rate (1 USD for 5,200 Manats), annual balance quickly reaches USD 1.8 million, which is considerably high. With the black market rate (approximately 1 USD for 20,000 Manats), the annual balance is even higher, exceeding USD 6.5 million from year 2007.

The project can therefore be considered as highly profitable for the Turkmen national economy.

* *

*

Enclosures: 1 table
4 annexes

TURKMENBASHI OIL TERMINAL **ECONOMIC ANALYSIS** **TRAFFIC SCENARIO: MEDIUM**

YEARS	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total oil products (in thousands tonnes)	2 700	2 700	2 754	2 809	2 865	2 923	2 981	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000
Crude oil (in thousands tonnes)	200	720	734	749	764	779	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795
ECONOMIC BENEFITS																									
Unit saving (in US$ per tonne)					0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Total savings (in thousands US$)					**1779**	**1815**	**1851**	**1888**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**
Dredged sand unit selling value (in US$)					0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Sand quantities (in thousands m3)					1750	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Sand value (in thousands US$)					**175**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Added value from works ('000 $)	**142**	**569**	**569**	**238**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**
TOTAL ECONOMIC BENEFITS ('000 $)	**142**	**569**	**569**	**238**	**2271**	**2134**	**2171**	**2208**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**
ECONOMIC COSTS																									
Investment in local currency ('000 $)	142	569	569	238																					
Investment in foreign currrency ('000 $)	40	160	160	67																					
Maintenance in local currency ('000 $)					317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317
Maintenance in foreign currency ('000 $)					62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
TOTAL ECONOMIC COSTS ('000 $)	**182**	**729**	**729**	**305**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**
Cost-benefit balance ('000 $)	**-40**	**-160**	**-160**	**-67**	**1892**	**1756**	**1792**	**1829**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**
Cost-benefit balance at shadow prices																									
- balance of local payments ('000 $)	0	0	0	0	175	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
- balance of foreign payments ('000 $)	-40	-160	-160	-67	1717	1753	1789	1826	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836
TOTAL BALANCE AT SHADOW PRICES	**-146**	**-583**	**-583**	**-244**	**6420**	**6378**	**6509,7**	**6644**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**

IRR at market prices **116%** **NPV** **$1,01**

IRR at shadow price **114%** **NPV** **$3,02**

Net present value

Int rate of return

Annex 3

financial tables (8)

Turkmenbashi navigation channel - Investment costs (in euro)

Item n°	Item description	Unit	Quantity	Unit price	Total price
	A. Navigation aids				
A1	*Supply of cardinal tail-tube buoys*	*lump sum*	*2*	*15 300*	*30 600*
A2	*Supply of a landfall tail-tube buoy fitted with Racon system*	*lump sum*	*1*	*55 300*	*55 300*
A3	Installation of tail-tube buoys	lump sum	3	3 000	9 000
A4	*Supply of channel gate buoys*	*lump sum*	*13*	*6 400*	*83 200*
A5	Supply of radio synchronisation systems for channel buoys	lump sum	6	1 800	10 800
A6	Installation of channel buoys	lump sum	13	2 000	26 000
A7	Rehabilitation of leading mark H1 (two beacons)	lump sum	1	1 500	1 500
A8	Rehabilitation of leading marks H2 & H3 (two beacons each)	lump sum	2	1 100	2 200
A9	Construction of radar antenna support	lump sum	1	9 000	9 000
A10	*Supply and installation of an Arpa radar with antenna*	*lump sum*	*1*	*110 000*	*110 000*
A11	*Supply and installation of a GMDSS receiver*	*lump sum*	*1*	*18 000*	*18 000*
A12	*Supply of VHF and MW radio receiver and transmitter*	*lump sum*	*1*	*5 000*	*5 000*
A13	*Supply of VHF hand radio sets*	*lump sum*	*3*	*900*	*2 700*
A14	*Supply and installation of equipment for wind measurement*	*lump sum*	*1*	*500*	*500*
A15	*Supply of barometer, thermometer, watch and binoculars*	*lump sum*	*1*	*1 300*	*1 300*
A16	*Supply of a tool set for maintenance and repair (shore-based)*	*lump sum*	*1*	*7 500*	*7 500*
A17	*Supply of a tool set for maintenance and repair (vessel-based)*	*lump sum*	*1*	*3 000*	*3 000*
A18	*Supply of spare parts*	*lump sum*	*1*	*20 000*	*20 000*
A19	*Supply and installation of computer equipment for the harbour master's office*	*lump sum*	*1*	*4 000*	*4 000*
A20	*Supply and installation of a GPS for the buoy tender*	*lump sum*	*1*	*600*	*600*
A21	Initial training of port staff for electronic navigation aids	lump sum	1	18 000	18 000
A22	Initial training of port staff for other navigation aids	lump sum	1	6 000	6 000
	Total A				**424 200**
	B. Survey equipment and survey works				
B1	Supply and installation of a GPS for the Ulker launch	lump sum	1	600	600
B2	Supply and installation of vessel-based hydrographic surveying equipment	lump sum	1	8 000	8 000
B3	Training of port staff for hydrographic surveys	lump sum	1	2 000	2 000
B4	Environmental investigations (sampling and chemical analyses)	lump sum	1	5 300	5 300
B5	Surveying the channel hydrography	day	22	150	3 300
	Total B				**19 200**
	C. Dredging equipment				
C1	Tugging the Sagadam dredger to Baku by CSC tug (and return)	lump sum	1	2 000	2 000
C2	Dry-docking the Sagadam dredger in Baku (CSC dry-dock)	lump sum	1	55 000	55 000
C3	Underwater inspection / overhaul of the barges	lump sum	2	7 000	14 000
C4	Replacement of electrical panels onboard the Sagadam dredger	lump sum	1	5 000	5 000
C5	Supply and installation of a GPS for the Sagadam dredger	lump sum	1	600	600
C6	Overhaul of the anchor boat	lump sum	1	6 000	6 000
C12	Inspection & technical assistance for the dredger	lump sum	1	15 000	15 000
	Total C				**97 600**
	D. Capital dredging works				
D1	Dredging of 1 750 000 m3 of sand in the spit area	month	14	33 000	462 000
D2	Dredging of 4 000 000 m3 of mud inside the bay	month	32	36 200	1 158 400
	Total D				**1 620 000**
	Traceca funding				341 700
	Other funding				1 819 300
	Total all works				2 161 000

Notes:

Italicized items are covered by a Traceca grant

Group D unit price covers annual amortization of dredging equipment as well as costs of personnel and of consumables

Traceca Corridor

Traffic and Feasibility Studies - TNREG 9803

Module D :

Navigation Channel for Turkmenbashi Port

Part 2 :

Maintenance and improvement recommendations

Final report, June 2001

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Module D Title : Navigation Channel for Turkmenbashi Port

Project Number : TNREG 9803

Module D Country : Turkmenistan

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Date of report : 15 June 2001

Reporting period : 15 May to 15 June 2001

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1. Project synopsis for module D

(Adjusted by the Monitoring Team in December 2000)

Project Title	: Traceca Corridor - Traffic and Feasibility Studies
Module D Title	: Navigation Channel for Turkmenbashi Port
Project Number	: TNREG 9803 / D
Module D Country	: Turkmenistan

Overall objective: To ensure continued accessibility to the Port of Turkmenbashi

Project purpose:

- To carry out a situation study of the access channel.
- To propose a maintenance plan for the channel.
- To prepare investment proposals for capital dredging and/or (navigational or dredging) equipment.

Planned outputs: A regular dredging maintenance plan, to be accepted by the Beneficiary, including investment recommendations.

Project activities:

Determination of the existing situation and the environment including a.o.

- Review of previous consultants' reports and mission notes.
- Collecting of existing charts and maps to describe the geography of the bay and the channel system.
- Collection and verification of existing data to determine natural conditions (hydraulic, meteorological, geophysical).
- Review of the adequacy of the channel system, including layout, navigational aids, buoys, etc.
- Review of operational practices for channel navigation, including the ports services and equipment.
- Review the port's capacity to correctly maintain and dredge the access channel.
- Interviews with vessel operators.
- Identification of port services and equipment for assisting vessels during passage of the channel (pilot service, pilot vessels, radio equipment....).
- Identification of alternative options for carrying out dredging operations.
- Past, present and forecast traffic and revenues for the port.
- Analysis of the possible impact of fluctuating Caspian Sea water levels.
- Relevance of international standards in so far as they concern Turkmenbashi port access, including water depth parameters, lighting requirements, etc.

Maintenance and improvement recommendations

- Recommend and justify possible operational improvement measures with respect to safety and continuity of operations, costs, benefits, environmental aspects.
- Recommend and justify a maintenance policy and working maintenance plan, with justifications for any changes from the present situation. Provide budget estimates for such a plan and relate it to expected port revenues and expenditures.
- Recommend and justify capital works or equipment procurement, if required, including costs, benefits, safety and environmental considerations.
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Target group(s):	Users of Turkmenbashi Port
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2. Conclusion and summary: investment and maintenance plan

2.1 Dredging requirements

To comply with international standards the Turkmenbashi navigation channel should be 110 m wide and 6.5 m deep, following dimensions of CSC ferries and those of large oil-tankers calling at Ufra. Current cross-sections in the channel are bowl-shaped with maximum depths in the range of 7 to 9 m along a narrow strip, whereas depths are generally limited to 4-5 m close to navigation buoys. Capital dredging works are therefore required.

In the channel mouth actions of oblique currents, of waves and of powerful sediment drift lead the Consultant to recommend a channel width much larger than 110 m, close to 300 m.

Besides, to provide a slight safety margin in case of decrease in the Caspian Sea level, a design water depth of 7 m looks preferable. The Caspian level has been rather stable since 1995; should it drop in the coming years, then the channel bottom should be deepened accordingly.

On such bases initial amounts of sediment to be dredged are approximately 1,750,000 m3 of sand, in the mouth area, and 4,000,000 m3 of silt mud, in the bay area. Maintenance requirements should be around 30,000 m3 of sand in the mouth and 10,000 m3 of mud in the bay.

A complete hydrographic survey is to be performed before planning capital dredging works, by the mean of a dedicated equipment which is depicted farther. After completion of the initial dredging campaign, hydrographic surveys ought to be carried out on a quarterly interval basis, and after any storm likely to drift significant quantities of sand inside the channel throat. Dredging maintenance operations should be decided as soon as hydrographic surveys reveal any significant restriction of channel cross-section (say more than 15% obstruction).

2.2 Navigation aids

Serious improvements are urgently needed in the field of navigation aids. Old buoys have to be replaced, as well as alignment beacons. A radar is also desirable, to enable efficient control of vessel traffic, whilst several ancillary appliances should be supplied, such as a GMDSS receiver and modern VHF sets. This entails implementation of on-site training courses for the attention of operating and maintenance staff.

Most of the equipment will be covered by a grant issued by the European Commission. The equipment is scheduled to be supplied in 2001.

2.3 Dredging and surveying equipment

The port already owns a bucket excavator and two barges which are adequate for carrying out the required dredging works. However, condition of the equipment is not satisfactory and all vessels have to be overhauled. The dredger also needs some additional electrical and positioning appliances.

Nothing is currently available in Turkmenbashi for performing hydrographic surveys; as a consequence a complete set of bathymetric equipment is to be provided. It will consist of vessel-based equipment (which can be installed onboard the Ulker launch), of a modern tidal gauge and of office computer system enabling to plot hydrographic charts. Channel charts will not only be useful for the port, they should also be forwarded to the relevant Authorities to update nautical charts which are used by vessel navigators.

2.4 Environmental aspects

In the past all dredged material was dumped into the open sea in an official dedicated area north of the channel mouth. As the study showed that sediments to be dredged in the channel throat are clean sands, the Consultant advises to use them to create a beach close to Turkmenbashi city, and/or to take advantage of these sands to reinforce the Awaza beach, outside the bay. As far as bay mud is concerned, it should be proposed to dump it into the bay, since the material indeed originates from the bay; in case this cannot be accepted by the Ministry in charge of Environmental Affairs, a suitable offshore dumping site should be investigated (the former one, being located north-west of the mouth, allows too rapid transfer of dumped material towards the channel).

The following chapter 7 also contains recommendations to the port regarding additional surveys to be undertaken prior to issuance of the dredging permit, mainly focussing on potential pollution of sediments.

2.5 Financing the works

The investment cost of improvement works has been estimated as follows:

Item	Cost in USD
Renewal & improvement of navigation aids (mainly buoys, alignment beacons & radar)	381,780
Hydrographic survey equipment, hydrographic and environmental surveys	17,280
Overhaul of dredging equipment (dredger, barges & anchor boat)	87,840
Capital dredging works (5 to 6 million m3 of sand and mud)	1,458,000
Total	1,944,900

The European Commission, under its Tacis-Traceca Programme, has already committed to finance the major part of the navigation aid improvement, for an amount of USD 307,530, which leaves USD 1,637,370 to be funded by TML (however, mainly consisting of dredging works to be carried out by the port own equipment).

Besides, the annual cost for maintaining and operating of the channel should be close to USD 467,385, including depreciation (amortisation).

Considering the rates levied by TML for channel maintenance and for navigation aids, on the one hand, and the projected vessel traffic, on the other hand, TML should recover the following annual incomes from this accounting source (in USD):

	in year 2001	in year 2005	in year 2010
low traffic hypothesis	1,072,000	1,239,000	1,305,000
high traffic hypothesis	1,080,000	1,562,000	1,824,000
medium traffic hypothesis	1,078,000	1,493,000	1,643,000

Comparative computations made on the basis of these costs and revenues lead to the conclusion that TML should be able to improve and to maintain Turkmenbashi navigation channel on its own, taking into consideration the European Commission grant.

However, for the time being channel revenues are used to cover expenses which are not related to channel maintenance, and recent TML annual accounts even show global profits close to zero. The Port Institutional Development Programme, which is being implemented by Haskoning, recommends to set up an analytical accounting system which should enable to make the situation clearer.

2.6 Economic analysis

The economic analysis complements the financial assessment by stressing benefits expected from decrease in oil transportation costs, from re-use of dredged sands and from added value linked to channel improvement and maintenance works. Taking into account all project costs, the economic cost-benefit balance appears to be strongly positive: annual balance quickly reaches USD 1.8 million (USD 6.6 million when considering the black market currency exchange rate).

3. Improvement and maintenance of the channel mouth

3.1 General

Improvement of navigation conditions in the channel mouth may consider that the average quantity of sand drifting along the outer coast of the spit is close to 30,000 m3 per annum, and that most of that material comes from the north.
Any mean to alleviate the impact of that drift is to be considered, including systems likely to partly block sand drift, such as traps and groins. In 1990 Caspmorniiproekt already discussed these issues (ref. 3) but no further action was undertaken, partly because of the rising sea level, partly because of the collapse of the Soviet Union.

3.2 Sand traps

Two designs were proposed by Caspmorniiproekt in 1990; both can still be considered. The first one, which is referred to as a "side pocket" is a pit dug out on the northern bank of the channel mouth, aiming at receiving enough sand to entail a reduced dredging maintenance (see figure 1). The second one, "sand traps", consists in digging two pits along the channel banks in order to trap drifting material out of the guaranteed navigation width of the channel (see figure 2), therefore increasing the time period between dredging operations.

The design of the side pocket widens the channel on its northern bank, the trapezoidal hollow receiving drifted sand straight from the northern coast. Proposed length, width and depth of the pit would allow holding back of 64,000 m3. Assuming that about 70% of drifted material would be blocked in that pocket, required maintenance dredging would be reduced to 10,000 m3 per year, whilst the pit should be emptied each three years. Initial dredging of such a pocket would depend on real hydrography, which is still to be thoroughly investigated; an amount of 100,000 m3 is a rough estimate, 10% more than the quantity foreseen in 1990. Should such works be undertaken, then a huge volume of high quality sand would be made available, which might mitigate the cost of the operation.

Sand traps on both sides of the channel aim at a similar result, sand coming back from the southern part of the spit being equally blocked out of the navigation area. It can be assumed that 80% of drifted sand would thus be kept out of the channel, therefore reducing annual dredging to 6,000 m3. On the other hand excavation of these traps would also generate 100,000 m3 of good sand, emptying of the pits should be carried out each three years.

These traps, which would undoubtedly reduce maintenance works in this sensitive part of the channel, would however require significant initial earthworks as well as regular scrapping out.

3.3 Protection groin in the open sea

A groin, reaching water depths of 3 m and running out of the northern shoreline of the spit as shown on figure 3, would intercept a significant part of the long-shore sediment drift.
The design proposed in 1990 by Caspmorniiproekt shows a 500 m long dam rooted on the spit and jutting towards south/south-east with a 20° angle with the channel axis. Groin slopes were designed with a protection made of quarry stones weighing up to 500 kg, which seems a bit light. Groin length was apparently designed according to wave heights, close to 2.3 m near the shore.
It can be assumed that this groin would divert or block 60% of the drifted sand, allowing to reduce annual dredging to 10,000 m3 in the mouth area.
It can also be considered that the groin would partly shelter the mouth from wave action, which would benefit to navigation safety.
Unfortunately such a huge groin would not only be expensive but would become sand-saturated after a few years of lifetime. Then the channel would lose its sediment protection, unless sand is regularly removed from the northern side of the groin (which is not easy with a 3.6 m draft dredger).

Another groin design had been proposed by Caspmorniiproekt, consisting of a short detached groin which was supposed to be connected to the shore by the mean of a sand tombolo. Such a weak structure would quickly be endangered by storms.

3.4 Recommendation

The Consultant is of the opinion that feasibility of these sand pockets, sand traps and groins faces a major adverse problem: any construction which would be planned in this area would have to be built on top of thick layers of recent and unconsolidated sands, and along an unstable shoreline. There is probably no bed-rock at a reasonable depth. Groin foundation would be over-expensive and unreliable, as proved by movements of sunk vessels in the vicinity of the channel mouth, as well as by collapsed navigation aid buildings (photo n°2).

Instead of implementing such projects the Consultant recommends to widen the slit in the spit area, and to carry out regular maintenance dredging. Because of the actual possibilities of intensive and repeated dredging along the slit already performed through the spit, it would be possible to alleviate the inconvenient of the permanent accumulation of drifting sands in this part of the channel. This could be achieved using the existing dredger and its annexes, provided that adequate overhaul, training programme and maintenance are undertaken.

According to international standards, width of the channel bottom should be 110 m for a one-way traffic lane (6 times the beam of the widest vessels, the Dagestan ferries, which beam is 18.3 m) and 165 m for a two-way traffic lane (9 times the biggest beam). However, in such a dangerous throat, with untidy waves and currents, and high tendency to lateral migration, it is advisable to design a much safer width, say 300 m, and to prohibit vessel crossings. A design minimum depth of 7 m will provide with a reasonable keel clearance (max. vessel draught is 5.3 m).

Increasing the effective width of the channel up to 300 meters over 1,5 km length through the spit would provide a buffer to the inconvenience linked to the instability of the banks along the present narrow slit. The effect would be similar to the one which may be provided by a sand-trap, yet with a substantial increase in navigation safety.

Initial dredging works, assuming a widening of 150 additional meters along the 1,5 km length of the section, and the fact that half part of the material has to be taken out of the spit shore at an average level of +2 and of -2 for the second half of the length, would represent amounts of 1350 and 750 cubic meters per linear meter of channel. Construction of a convenient slope, say 1/2 in the medium size sand, would add 81 and 25 m3 per linear meter to these figures. Such a rough estimate leads to a total amount of 1,750,000 m3.

Obviously such a solution implies development of a regular maintenance dredging programme of about 30,000 m3 per year, failing which the morphology of the mouth would come back to the current one after a few years.

On the other hand it has to be kept in mind that all the material considered in this section is a medium sized sand of high geotechnical quality, fully devoid of fine particles: it is a very clean beach sand, and dumping it into the open sea as waste deposit would be an aberration. The cost of initial dredging as well as of maintenance dredging would be mitigated if the extracted material could be used to create and maintain a beach within the bay, for instance in front of the western part of the city of Turkmenbashi, where young people already use to bath. It may be added that this sand would not only remain along the coast in the city area, due to absence of drifting currents on the northern shore of the bay, but also would be kept in a reasonably unpolluted condition, due to action of short breaking waves. The amount of dredged material made available by maintenance works would allow to regularly refill the new beach.

Apart from beach creation and nourishment, this sand could be used for building purposes (production of concrete, among others), bearing in mind that salinity of Caspian waters and sands is very low.

4. Improvement of the channel inside the bay

4.1 General

Within the bay area, i.e. on the muddy part of the channel bottom, widening works along the existing track have to be taken in account since the fully available width is only in the range of 50 to 90 m whereas, according to international standards, width of the channel bottom should be 110 m for a one-way traffic lane (see § 3.4)*. Given the current Caspian Sea level, water depths along the channel axis are everywhere sufficient, in the range of 7.0 to 8.8 m (max. vessel draught is only 5.3 m). A design depth of 7 m will provide a comfortable keel clearance, as well as some margin in case of slight drop in the sea level. Should the average sea level decrease by more than 0.7 m, then the channel would need additional deepening (for the time being the level is stable).

Except in the vicinity of the bay entrance, where sands are scattered by currents, the whole length of the channel bottom is dug out in a fine muddy material, subject to slow sedimentation due to settling down of suspended particles originating from remote areas within the bay.

Improvement of navigability in this section should therefore be easier than in the sand spit area, a greater stability of bottom depths being likely to be forecast after completion of capital dredging works, despite a natural tendency to creeping and slumping on the silty banks.

Apart from widening the existing channel, the following chapter comments on possibilities of rehabilitating the existing southern route, as well as designing a new southern access.

** It doesn't seem worth designing a two-way lane, first because of the low traffic level (around ten vessels per day, in and out), then because of crossing-collision risks, lastly because of quantities of capital dredging.*

4.2 Widening the existing channel

At least in the bay area, from the port sites up to the vicinity of the sand spit, any increase in the width of the channel should not entail any significant change in the required maintenance rates, provided that slope of channel banks do not exceed the stability limit of the bottom material, which should be approximately 1 to 4.

As for the initial volume of sediment to be extracted, assuming that the current average channel width is 70 m and that the future width will be 110 m, the required dredging volume should be close to 4,000,000 m3, including the two port branches.

Unlike sand of the spit area, all bay material is poor quality silty mud which should be dumped as far as possible from the channel: in the southern part of the bay if a deposition area can be accepted, or outside the bay, in the open sea, despite the length of the transport route. In this latter case, selection of a new dumping area has to be carefully studied since the existing one, north of the channel entrance, is inadequate. To reduce the possibility of recycling of the material, that area must be situated clearly south of the channel and at a depth preventing from remobilization of silt, the instability of such material increasing enormously under open sea wave conditions.

4.3 Rehabilitating the existing southern route

Still occasionally used in stormy conditions, the southern channel uses the natural aperture between the south of the Turkmenbashi spit and the Cheleken spit as a way out to the open sea, despite the increase in sailing time (to/from Baku: 35 extra nautical miles, to be added to a total journey of 180 miles). This way was the only access to Krasnovodsk port prior to the construction of the present channel, opened through the peninsula in 1956.

Because this channel was entirely dug out in the bay silts and in the middle of smoothly and regularly increasing natural depths towards the south, its maintenance, free of any drift process, would be easier than that of the present main channel.

However, although this option would be more adequate from a pure sedimentological point of view, the additional sailing time it would entail has already pushed the Turkmenbashi Port Authority and the main Shipping Companies (CSC and TML) to reject it.

4.4 A new southern access

Following the same tendency, it is worth pointing out that in the southern part of the bay no hindrance is to be found between the port facilities and the 18 km wide strait which is the natural entry of the bay.

It could therefore be possible to design an entirely new channel running straight from the port down to the 7 m contour line, close to the bay entrance, avoiding the bend of the present channel as well as the bend at the connection with the existing southern route.

No different problem than in the inner part of the existing channel would arise as for maintenance of this new channel, whilst continuous earthworks on the slit through the sand spit would be avoided, like in the former option.

However, such a straight route inside the bay would run over less favourable depths than the existing southern channel and happens to be closer to continental sediment sources. Siltation rates would therefore be higher.

5. Improvement to navigation aids

A tender dossier was recently completed regarding improvement of navigation aids for the ports of Baku, Dubendi, Aktau and Turkmenbashi. The present project takes into account the equipment included in this dossier and complements it when needed. Following items, which were not in the tender, were included into the project:

- Placement of buoys, including concrete sinkers and steel chains (this should be covered by TML).
- Synchronisation of gate buoys (by the mean of radio links between connected buoy lights).
- Rehabilitation of leading marks.
- Construction of the radar antenna support.
- Training of port staff for operation and maintenance of navigation aids.

5.1 Buoys

Existing buoys are in such bad condition (corrosion, lights) that it is advisable to replaced them. They can be replaced by bigger units allowing to reduce the quantity of buoys: according to the attached scheme, the existing 39 buoys can be replaced by 16 buoys:

- Two cardinal buoys (a north one and a south one) marking the entrance of the traffic separation system.
- A landfall buoy at the exit of the traffic separation system, fitted with Racon (Racon allows vessel radars to identify the buoy by a Morse code letter).
- Three pairs of lateral buoys along section 1 of the channel, inside the bay.
- A junction buoy at the cross-road between section 2 and section 3.
- Six lateral buoys on sections 2 and 3.

Cardinal buoys and landfall buoy should be of a similar type as the "tail-tube buoy" shown in the attachments, made of polyethylene, focal height being 4.5 m above sea level and day-night visibility range of 4 miles.

Other buoys should be similar to the "proximity" type shown in the attachments, made of polyethylene, focal height being 2.3 m above sea level and day-night visibility range of 4 miles.

The 4 mile visibility range has been selected to allow captains to catch sight of a pair of buoys as soon as they reach the previous one. Moreover, to make the gates more visible at night, each pair of buoys will be fitted with synchronised lights flashing simultaneously.

Buoy maintenance should include quarterly inspections (wiping solar panels and lenses, battery control, lamp replacement on lamp changers), annual checking of mooring lines and five-year complete overhauls (replacement of mooring lines, replacement of batteries, buoy cleaning and repainting of steel parts).

The Racon requires a specific quarterly inspection for checking its battery and its connections.

5.2 Leading marks

It doesn't look necessary to rehabilitate all initial leading marks (see attached figure). Lines H2' and H3' may be deleted, provided that lines H1, H2 and H3 are properly fitted with day-mark panels, as depicted on the "daymarks" attachment. Lights of H1, H2 and H3 are already in operating condition, they can be re-used.

5.3 Radar

At the moment the harbour master's watchmen are not able to control the whole channel, they can simply watch a short stretch in the vicinity of the city. The only way to overcome the problem is to install a radar system.

As far as the antenna is concerned, from a technical point of view the best location is on the slope of Ufra hill, close to H1 northern beacon, since this would permit to easily elevate the antenna up to approximately 30 m above sea level, which is the required height to reach the traffic separation system, 15 nautical miles away (see attached scheme, with 15 mile radius circle). Besides, the territory is secured and electricity is available. However, it seems that the Port Authority would prefer to place the antenna on top of the future administrative four-storey building, or at the ferry terminal, to have it closer. It must be stressed that the latter locations would require supporting towers and, should the administrative building be selected, two portal cranes and a lighting tower would create some radar shadows.

The radar system which is proposed in the tender dossier is of Arpa type, 3 cm X-band (same type as vessel-based radars), which is an economical option. A VTS radar, able to be connected to a computer and allowing to identify vessels equipped with AIS*, would have been more convenient but also significantly more expensive (euro 290,000 instead of euro 110,000).

The radar display monitor must be installed inside the harbour master's premises.

** AIS will soon be imposed by the IMO, and all riparian States of the Caspian are members of the IMO*

5.4 Other navigation aid related equipment

In addition to the above essential items, miscellaneous equipment items are worth being included in the project. A first set is to be installed in the harbour master's premises:

- A GMDSS receiver.
- A new VHF-MW radio receiver.
- A complete computer equipment, notably to record vessel moves.
- Wind measurement equipment (speed and direction).
- A barometer, a thermometer, a marine watch and binoculars.

Other items consist of portable VHF sets, tool sets, various spare parts and a GPS for the buoy tender.

5.5 Spare parts and staff training

A complete set of spare parts has to be supplied, especially for buoy maintenance: lamps, lanterns, solar panels, batteries, charge regulators, radar reflectors, photocells, lamp changers, flashers, flash synchronisers and mooring lines.

Lastly, a training programme is needed for employees who will operate and maintain navigation aid equipment. These courses should cover on-site training of operational staff during installation of equipment, as well as training of maintenance technicians in the port workshop.

6. Dredging and surveying equipment

6.1 Dredging equipment

As the Sagadam dredger was seldom used since it arrived in Turkmenbashi, in 1994, and because of the frequent problems encountered by the crew during operations, the Consultant recommends that the dredger manufacturer (Leninskaya Kuznitsa Shipyard, Kiev) carries out an inspection of the vessel and provides technical assistance to the captain, to the chief electrician and to the chief mechanic prior to any overhaul or new dredging operation.
It can already be foreseen that dry-docking the vessel will be advised, as it was never dry-docked since its delivery, in 1994. It is certainly required to clean and to repaint the hull, as well as to inspect and overhaul all underwater appliances. For such purpose the vessel will have to be tugged to Baku, because the capacity of the Turkmenbashi dry-dock (around 300 tonnes) is too weak to accommodate the dredger, which gross tonnage reaches 1,100 tonnes.
It is also known that some electric panels have to be replaced and that a GPS system is needed (no positioning system is currently available onboard).

The two barges and the anchor boat also need to be inspected and overhauled. This can easily be carried out in the Turkmenbashi shipyard.

6.2 Surveying equipment

Currently the port of Turkmenbashi doesn't own any piece of equipment allowing to perform hydrographic surveys. In the future the port needs to be equipped with a complete surveying equipment to allow proper planning of dredging operations, control of dredging results as well as regular surveillance of water depths in the whole navigation channel. This includes vessel-based equipment, a modern port tidal gauge and suitable office facilities.

The Ulker launch looks perfect for carrying out hydrographic surveys. It should be fitted with the following new appliances:

- An echo-sounder able to measure water depths with 10 cm accuracy, suitable for hard and soft sea-beds. A wave compensator is not required; this is an expensive device which may be avoided since surveys can be planned during calm periods.
- A GPS positioning system. This relatively cheap equipment, which operates with satellites and offers a positioning accuracy of a few decimetres, has recently become the standard electronic positioning system.
- A computer system correlating digitised depth data with positional data.

The port tidal gauge has to be connected by radio link to the vessel-based system in order to enable real-time correction of measured water depths.

Lastly, the port engineering department has to be equipped with computer hardware and software allowing to draw bathymetric maps and channel cross-sections, as well as to compute required dredging volumes.

Provision for initial staff training is included in the cost estimates.

7. Environmental recommendations

In the absence of international conventions fully covering inland waterways, such as the Caspian, the International Dredged Material Assessment Framework (DMAF) is recommended for evaluation of the proposed dredging and disposal operations. The following sections follow the DMAF.

7.1 Evaluation of the need for dredging and disposal

The major part of the proposed dredging project is within the so-called 'capital' dredging category, and will be implemented particularly to improve navigation through the Turkmenbashi spit and within Turkmenbashi bay. Safety of shipping in the bay, especially regarding manoeuvring room, requires widening of the dredged channels to the Port of Turkmenbashi and the Ufra Oil Terminal. The proposed project does not appear to meet any of the criteria listed in the OSPAR (Oslo-Paris Convention) Guidelines for the Management of Dredged Material for exempting the material from further characterisation.

The Consultant estimated that approximately 4 million m3 of silt bottom sediment must be removed from the bay. Furthermore, regular annual maintenance dredging will remove 10,000 m3 of silt sediment. The spit area must also be widened, through initial removal of 1.5 to 2 million m3 of clean sand, and annual maintenance dredging of 30,000 m3 of sand.

This material can possibly be disposed in the bay itself, most of which is part of the Khazar Nature Preserve. Alternatives include disposal at current shore sites around the bay, and a site on the sea side of the spit. The current disposal site on the sea side to the west of the spit is inappropriate, as prevailing wave action carries the sediments back to the area of the channel through the spit.

7.2 Dredged material characterisation

Migration of contaminants in the dredged material to surrounding waters, soil and air, endangering aquatic and terrestrial ecosystems and human health, may occur during the dredging operations as well as subsequent to disposal. This underlines the need for reliable characterisation of this material. The following factors support the need for more precise characterisation (particularly chemical) of the dredged material in the spit area and the bay:

- Confirmed presence of oily substances in the sediments.

- Possible presence of phenols and other substances based on traffic of crude oil and petroleum products to/from the Ufra Oil Terminal. This concern is heightened by the absence of any treatment facility for ballast and bilge water at the Port of Turkmenbashi, and the inadequate capacity and poor state of the oil/water separator and waste water treatment station for ballast and bilge water at the Ufra Oil Terminal.
- Questions regarding the analytical methods used for the previous characterisation efforts, in 1990, with respect to chemical analysis, and related to whether the samples taken are representative.
- Possible threats to the Khazar Nature Preserve or possible shoreline disposal sites if concentrations of various pollutants are found to be high. If the presence of pollutants are below safe limits, the threats to the preserve are likely to be minimal, as there is little or no current in the bay that might otherwise carry sediments disturbed by the dredging operations to sensitive parts of the bay.
- There is little 'flushing' of contaminants in the water and sediment in the bay, which would normally lead to long term build up of the same. However, there is significant water flow in the area of the spit, and thus more mixing of clean and contaminated sediments, which could mean lower overall concentration of contaminants in that area.

In addition to testing for oily substances and phenols, tests should be considered for polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and heavy metals. These contaminants, which are relatively insoluble and immobile in the anaerobic alkaline environment common to most sediments, tend to become more mobile and soluble during dredging operations. Tests for pH, calcium carbonate equivalent, cation exchange capacity, salinity, sodium adsorption ratio, and electrical conductivity should be considered, as appropriate.

Biological tests should be conducted if necessary, and depending on the presence of chemical contaminants and the disposal options. They might include the following:

- Acute toxicity
- Chronic toxicity
- Potential for bio-accumulation
- Potential for tainting

If the above assessment results in findings indicating high levels of contaminants, Government Authorities should consider implementing evaluation of the sources of these contaminants and methods for controlling the same.

7.3 Evaluation of disposal options

In addition to the possibility of finding a more appropriate sea disposal site, south of the channel mouth, the dredged material from the bay, which has been characterised as silty and muddy sediment, may be dispersed in the bay itself, where the relative lack of current would ensure that the material does not return to the dredged channel. The material could also be used for restoration and establishment of wetlands, terrestrial habitats, nesting islands and fisheries.

As bathing takes place around the bay, the dredged material from the spit area, which consists of clean sandy material, could be used for land creation and improvement, beach nourishment (in the vicinity of Turkmenbashi city or in Awaza), offshore berms, capping material or fill. Any of these alternatives would have the added benefit of mitigating the costs of dredging (the dredging is expected to take 2 to 3 years). However, a significant part of the coastal zone around the bay consists of wetlands that may support fish breeding and breeding of sea birds and other bird species, even those close to the port of Turkmenbashi. Alternatively the sand could be used for construction purposes, especially for concrete production.

Pending characterisation of the dredged sediments, further investigation is recommended as follows:

- The possible impacts on wildlife in and around the bay, should bay dredged material be disposed in the bay itself. Promising sites should be selected and investigated.
- The status of wetlands around the bay, particularly around the port of Turkmenbashi and Ufra Oil Terminal (regarding their function as breeding grounds for fauna and flora).
- Current bathing areas and the possible impacts of adding artificial beach area on flora and fauna at these sites and in adjoining areas. Physical impacts should also be examined, for example changes in the water regime.
- Possible use of sand for concrete production, as well as costs and benefits, of using the dredged material removed from the spit area in concrete production. Assessment of the possible use of the material for other construction purposes should also be implemented. Any impacts related to the transport of the sediments should be examined.
- Assessment of the need for treatment of the dredged material, dependent on the intended management option (including disposal). Treatment would be required for reducing the amount of contaminants in the dredged material to satisfy regulatory or other applicable standards and guidelines. It ranges from separation techniques, for example separation of contaminated fine-grained fractions from relatively clean sand, to incineration.

7.4 Sea disposal site selection

Alternative sea disposal sites to the current site should be evaluated. Open sea disposal generally includes unrestricted placement on flat or gently sloping sea beds in the form of mounds or placement within depressions for lateral containment. The evaluation of possible sites should take into account the following in order to ascertain the possible fate and effects of the disposed material:

- Potential impact of wave action on the disposed sediments.
- Physical and chemical characterisation of the dredged sediments (physical data is already available, whilst chemical parameters are to be investigated). Open water disposal generally involves clean or mildly contaminated material. Highly contaminated material might also be considered for open sea disposal if appropriate control measures are applied (for example providing a cap of clean material to provide isolation from the benthic environment).
- The physical, chemical and biological characteristics of the sea bed at the proposed sites (including hydrography, redox status, benthic biota).

- Proximity to areas of natural beauty, recreation, subsistence (especially fishing), spawning, shipping lanes.

7.5 Environmental impact assessment

The expected consequences of the dredging and disposal options must be outlined in order to provide the basis for approval or rejection of the project, and if approval, for defining environmental monitoring requirements. This assessment should integrate findings regarding characteristics of the dredged material and conditions at the proposed disposal site. The assessment must take into account the possible impacts on human health, sensitive ecological zones and economic activities.

A baseline survey is essential for this analysis. Possible impacts are measured against the baseline state of areas effected by the dredging operations and disposal of the dredged material. Information regarding whether the disposal site is retentive (that is, disposed material will remain within the vicinity of the site) or dispersive are critical to the choice of sea bed disposal sites. The impacts of disposal on suspended solids levels and the possibility of smothering benthic organisms in the dumping area must also be considered. Substances may undergo physical or chemical changes when disposed at a particular site, with resulting impacts. Impacts can be minimised by ensuring that the dredged material and the sediments in the receiving area are similar.

The Consultant notes that the relatively new and unused bucket dredger present at the port, which will be used for the proposed dredging activities, should have relatively low impacts on the environment in terms of disturbing the surrounding sediments and dispersing sediment and contaminants in the bay. Nevertheless, a review of possible applicable and feasible dredging technologies and their relative impacts on the environment ought to be implemented. Furthermore, the existing bucket dredger should be assessed to determine whether modifications might be made that would reduce overdredging, minimise the suspension of bed material, and in general reduce the impacts on the surrounding environment. This is particularly critical for the dredging operations in the spit area, where currents exist, as opposed to the bay, which is more or less stagnant.

7.6 Permit issue

The permit is an important tool for sea disposal or other uses of dredged material, in addition to management of dredging operations. The permit normally requires that:

- Only those materials that have been characterised and found acceptable for the designated disposal option, based on impact assessment, may be dumped.
- The material must be disposed at the selected site.
- Any preferred dredging or disposal management techniques identified during the impact analysis are carried out.
- Any monitoring requirements are fulfilled and the results reported to the permitting Authority.

TML should apply for a permit covering all capital dredging works as well as further maintenance works foreseen in this project, including use of sand for creation and nourishment of beach(es) and dumping of mud on the sea-bed of the bay (otherwise at an offshore area located south of the channel throat).

7.7 Monitoring

A monitoring plan should be developed once the dredging plan and selection of the disposal site have been finalised. This plan must include specification of:

- Baseline conditions
- Monitoring during the course of the dredging and disposal operations
- Post-operational monitoring
- Feedback throughout the dredging operations and subsequent to completion of the same

The monitoring plan should include but not be limited to the following:

- Monitoring of turbidity in the area of the dredging and disposal operations
- Monitoring of physical and chemical characteristics of the dredged material
- Frequency and location of sampling
- Guidelines on management of data

8. Financing the works

8.1 Objectives and methodology

The objectives of the following analysis are to evaluate TML ability to self-support the channel rehabilitation works and to reimburse the loan that TML may contract to complete the rehabilitation.

A basic assumption is that rehabilitation works will be carried out according to the agreement which foresees that Tacis will provide a grant of approximately euro 341,000 for supply of navigation aids and sets of spare parts for their maintenance. The port of Turkmenbashi is supposed to finance the rest of the works, either by itself or through a loan. The anticipated sharing out of the works is shown in the first annex 3 table.

Throughout this financial analysis, the channel and the navigation aids are considered as a specific cost-centre called "Channel Centre" and all charges and revenues have been tentatively separated from the other port activities. This situation differs from the current one but it fits with all recent EBRD recommendations regarding Turkmenbashi port management.

All financial projections comply with prevailing port conditions and make use of past TML financial statements. Amounts are converted into USD according to the official exchange rate of 1 USD to 5,200 Manats (the black market rate is introduced in the following economic analysis).

The assessment includes three steps:

- Calculation of profit and loss statements over the ten coming years, which determines the capacity of channel services to be self-supporting.
- Estimation of projected cash-flow for the same period, in order to assess the capacity to finance the project and to refund a potential loan.
- Estimation of financial contribution of the Channel Centre to the overall financial performance of TML.

8.2 Project cost

The first annex 3 table details the investment cost and the financing allocation of the project elements. Capital dredging prices take into account amortisation of dredging equipment (USD 5.5 million, over 20 years) as well as costs for crew members (USD 30,000 per year) and for gas-oil and lubricants (USD 26,000 per year). Productivity of the dredger is supposed to be in the range of 1.5 to 2.0 million m3 per year, which is realistic after equipment overhaul and staff training (ref. report of November 2000). Yet, overall dredging productivity is limited to 1 to 1.5 million m3 per year because of the restricted capacity of barges.

Table 1: Investment and financing sources *(figures in USD, using 1 euro = 0.9 USD)*

Item description	Total	TRACECA grant	TML
A. Navigation aids and ancillary works	381,780	307,530	74,250
B. Survey equipment and survey works	17,280	0	17,280
C. Dredging equipment	87,840	0	87,840
D. Capital dredging works	1,458,000	0	1,458,000
Total	1,944,900	307,530	1,637,370

8.3 Profit and loss statement

a. Income statement

Operating revenues are based on the present tariff structure, taking into account the 50% discount agreed between TML and CSC for their ferries.

The Channel Centre is supposed to get two sources of income:

- Channel maintenance fees. The new tariff is USD 0.027 per m3 as proposed in the recent Scott Wilson's Port Tariff Study. This tariff is based on the ship volume, multiplying the overall length by the breadth and by the moulded depth.

- Buoy maintenance fees. The new tariff is USD 0.014 per m3, the volume being computerised in the same way as above.

Income figures have been computed for each traffic scenario (see details in the annex 3 tables).

Table 2: Income statements in thousands USD

Sources of income	Year 2001	Year 2005	Year 2010
Pessimistic scenario			
From ferries	358	380	400
From general cargo vessels	57	62	68
From tankers	657	797	837
Total	1,072	1,239	1,305
Optimistic scenario			
From ferries	365	644	752
From general cargo vessels	58	73	92
From tankers	657	845	980
Total	1,080	1,562	1,824
Medium scenario			
From ferries	364	602	652
From general cargo vessels	57	71	84
From tankers	657	820	907
Total	1,078	1,493	1,643

In year 2010 the annual income should thus be in the range of USD 1.3 to 1.6 million.

Note: compared to the contents of the report of November 2000, present traffic figures slightly differ. This is due to correction of some arithmetic mistakes, also to correction of average ferry loads (1800 tonnes per call instead of 2000 tonnes).

b. Operating expenses

Charges include maintenance of channel depths and of navigation aids, financial charges related to the potential loan that might be needed to balance the lack of cash-flow during the investment period, as well as overheads and depreciation of the equipment.

- Maintenance and operating costs

The annual maintenance cost is not depending on the traffic and is considered as a fixed cost. It includes the labour cost of workers and crew members, the cost of repair and spare parts for navigation aids, that of maintenance for the dredger and the barges, of bathymetric surveys and of annual dredging activity to maintain channel depths. Depreciation of equipment parts is computed separately, assuming that depreciation is linear and based on a 20 year lifetime.

Table 3: Annual maintenance cost of the channel and navigation aids (see details in annex 3)

Item description	Cost in USD
Maintenance of navigation aids	14,130
Maintenance of survey equipment and annual survey works	24,300
Maintenance of dredging equipment	23,175
Annual dredging works	38,800
Depreciation of dredging equipment	275,000
Depreciation of navigation aids	19,080
Depreciation of capital dredging works	72,900
Total operating costs (depreciation excluded)	*100,405*
Total operating costs (depreciation included)	467,385

- Overhead expenses

10% of TML administrative and management expenses are allocated to the Channel Centre, taking the labour force distribution as key parameter. In 1999 the total amount of administrative expenses was USD 1,241,000, therefore USD 125,000 are allocated to initial overhead expenses for the Channel Centre (further allocations are assumed to grow together with the traffic).

- Financial charges

The Consultant considers that most of the works can be carried out by TML staff and equipment. However, in some traffic hypotheses negative cash-flows can occur and the Channel Centre may need a loan to support the deficit. It is assumed that the conditions of this loan would be as follows:

Duration: 10 years
Interest rate: 6.5 %

- Total expenses

Table 4: Projected yearly expenses (in thousands USD)

Item description	2001	2005	2010
Total operating costs (depreciation excluded)	100,405	100,405	100,405
Overheads	128,750	145,000	168,000
Depreciation	275,000	366,980	366,980
Total operating expenses	229,155	612,385	635,385

c. Gross operating profit before taxes

The following table 5 compares operating profits before taxes.

Table 5: Gross operating profits (in thousands USD)

Scenario / Year	2001	2005	2010
Pessimistic	843	627	670
Optimistic	851	950	1,189
Medium	850	880	1,007

This table clearly shows that the Channel Centre is potentially able to generate high profits.

8.4 Projected cash-flow

Projected yearly cash-flow has been computed for each traffic scenario.

a. Gross potential cash-flow

The gross potential cash-flow before taxes is the sum of the gross operating profit and of depreciation. It is positive for all traffic scenarios. Taxes on profit and possible loan repayments have been deducted from this gross potential cash-flow.

b. Taxes on profits

Taxes on profit were computed according to the existing fiscal rules that set the taxes to 50 % of the profit amount. Actually, this allocation of taxes to the Channel Centre will depend on TML global financial results. Calculating such tax out of the Channel Centre activity supposes that overall TML activity is profitable.

c. Investment cost

The following annual expenses have been considered, taking into account the required implementation time period:

in 2001: USD 327,474
in 2002: USD 654,948
in 2003: USD 654,948

d. Loan refunding

In case of negative net cash-flow it is assumed that the Channel Centre receives a loan to finance the deficit. Actually this only happens in the sensitivity test.

e. Net potential cash-flow

Deducting taxes on profit, investment costs and loan refunding from the gross cash-flow, the net potential cash-flow is calculated.

f. Sensitivity test

As a sensitivity test it was considered that ferry traffic might be restricted because of lack of cargo originating from Uzbekistan. Because of the competition with Aktau port, in connection with the projected railway line linking Aktau to the Uzbek cotton region, there might be a diversion of cotton traffic in favour of Aktau. In this case it was considered that year 2010 ferry calls would respectively be limited to 400, 520 and 490 calls in the pessimistic, optimistic and medium scenarios (instead of 510, 960 and 835 calls). These restricted cases are called "reduced scenarios". Reduced net profits are shown in table 6. The only case requiring a loan is the pessimistic one.

Table 6: net cash-flows (in thousands USD)

Cash-flow elements	2001	2002	2003	2004	2005	2010
Pessimistic scenario						
full	93	9	15	675	680	702
reduced	*93*	*- 17*	*- 16*	*640*	*642*	*654*
Optimistic scenario						
full	98	17	35	709	842	961
reduced	*98*	*17*	*35*	*709*	*723*	*788*
Medium scenario						
full	97	14	24	689	807	871
reduced	*97*	*14*	*24*	*689*	*698*	*736*

This table shows that net cash-flows are high and that consequently the Channel Centre should easily support the rehabilitation works.

8.5 Conclusion of the financial assessment

This financial assessment only shows the contribution of the so-called "Channel Centre" to TML overall activity. From this analysis it can be thought that the Channel Centre should be self-supporting and profitable. Its contribution should always be very positive, even in the "pessimistic & reduced" traffic hypothesis.

However, as it was pointed out in the report of November 2000, revenues from channel dues don't seem to be readily available for financing channel works, since recent TML accounts reveal global profits close to nil. The Port Institutional Development Programme, which is being implemented by Haskoning, recommends to set up an analytical accounting system which should enable to make the situation clearer.

9. Economic analysis

9.1 Economic benefits

The project would induce several economic benefits: decrease in transportation costs, added value by use of dredged sand and added value linked to improvement and maintenance of the channel.

a. Decrease in transportation costs

It can be assumed that in case the project is not implemented oil-tankers will soon have to reduce their cargo loads, say from 6,000 to 5,000 tonnes, as an average (ferries and other vessels have smaller draughts). Considering an average running cost of USD 1,500,000 per year and per tanker, increasing the average unit load by 1,000 tonnes is equivalent to saving 0.5 USD per tonne of transported oil (each tanker carries approximately 450,000 tonnes of oil per year).

b. Added value from sand

It will be advisable to use dredged sand either for beach construction in Turkmenbashi or for beach nourishment in Awaza, or for construction purposes (concrete or earth works). For the needs of the economic analysis it has been considered that the average value of re-used sand will be 0.1 USD per cubic meter. Related economic values are USD 175,000 during capital dredging works and, later on, USD 3,000 per year.

c. Added value from channel works

Expenses spent by TML equipment and employees total USD 1,526,000 during the investment period, and USD 317,000 per annum during the following years. These sums will directly or indirectly benefit to the Turkmen economy.

9.2 Economic costs

Economic costs are those of channel improvement and maintenance works:

Years	Works	Total amounts (USD)	Local currency share (USD)	Foreign currency share (USD)
2001	Dredging/nav. aids	182,000	142,000	40,000
2002	Dredging/nav. aids	729,000	569,000	160,000
2003	Dredging/nav. aids	729,000	569,000	160,000
2004	Dredging/nav. aids	305,000	238,000	67,000
2005	Maintenance	379,000	317,000	62,000
etc.				

9.3 Balance of costs and benefits

The following page table shows the balance of costs and benefits, as well as the resulting economic return on investment. Considering the official currency exchange rate (1 USD for 5,200 Manats), annual balance quickly reaches USD 1.8 million, which is considerably high. With the black market rate (approximately 1 USD for 20,000 Manats), the annual balance is even higher, exceeding USD 6.5 million from year 2007.

The project can therefore be considered as highly profitable for the Turkmen national economy.

* *

*

Enclosures: 1 table
4 annexes

TURKMENBASHI OIL TERMINAL **ECONOMIC ANALYSIS** **TRAFFIC SCENARIO: MEDIUM**

YEARS	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total oil products (in thousands tonnes)	2 700	2 700	2 754	2 809	2 865	2 923	2 981	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000
Crude oil (in thousands tonnes)	200	720	734	749	764	779	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795
ECONOMIC BENEFITS																									
Unit saving (in US$ per tonne)					0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Total savings (in thousands US$)					**1779**	**1815**	**1851**	**1888**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**	**1897**
Dredged sand unit selling value (in US$)					0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Sand quantities (in thousands m3)					1750	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Sand value (in thousands US$)					**175**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Added value from works ('000 $)	**142**	**569**	**569**	**238**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**	**317**
TOTAL ECONOMIC BENEFITS ('000 $)	**142**	**569**	**569**	**238**	**2271**	**2134**	**2171**	**2208**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**	**2217**
ECONOMIC COSTS																									
Investment in local currency ('000 $)	142	569	569	238																					
Investment in foreign currrency ('000 $)	40	160	160	67																					
Maintenance in local currency ('000 $)					317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317
Maintenance in foreign currency ('000 $)					62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
TOTAL ECONOMIC COSTS ('000 $)	**182**	**729**	**729**	**305**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**	**378**
Cost-benefit balance ('000 $)	**-40**	**-160**	**-160**	**-67**	**1892**	**1756**	**1792**	**1829**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**	**1839**
Cost-benefit balance at shadow prices																									
- balance of local payments ('000 $)	0	0	0	0	175	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
- balance of foreign payments ('000 $)	-40	-160	-160	-67	1717	1753	1789	1826	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836	1836
TOTAL BALANCE AT SHADOW PRICES	**-146**	**-583**	**-583**	**-244**	**6420**	**6378**	**6509,7**	**6644**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**	**6679**

IRR at market prices **116%** **NPV** **$1,01**

IRR at shadow price **114%** **NPV** **$3,02**

Annex 1

photographs, august 2001

Photo n°1: northern bank of the channel throat and sandy spit (the open sea is on the left hand side)
(very calm conditions: no waves, no current)

Photo n°2: southern bank of the channel throat (the open sea is on the right hand side)

Photo n°3: the Sagadam bucket dredger and its two barges, berthed in Turkmenbashi port

Photo n°4: same as photo 3, side viewed

Annex 2

maps and figures

European Union

Tacis

TRACECA

TRANSPORT CORRIDOR
EUROPE CAUCASUS ASIA

www.traceca.org

ST-PETERSBURG
VOLOGDA
KIROV
PERM
YEKATERINBURG
CHELYABINSK
OMSK
PETROPAVLOVSK
PAVLODAR
UST- KAMENOGORSK
SEMIPALATINSK
KOKCHETAV
ASTANA
KARAGANDA
NIZHNI NOVGOROD
KAZAN
MOSCOW
RUSSIAN FEDERATION
SMOLENSK
SAMARA
MINSK
BELARUSSIA
POLAND
BREST
GOMEL
KURSK
VORONEZ
Volga
Don
ARTYUBINSK
URALSK
KAZAKHSTAN
ALMATY
BISHKEK
KYRGHYZSTAN
TAJIKISTAN
VOLGOGRAD
ASTRAKHAN
Aral Sea
TASHKENT
UZBEKISTAN
SAMARKAND
DUSHANBE
BUKHARA
TURKMENISTAN
KABUL
AFGHANISTAN
PAKIST
KIEV
LVIV
UKRAINE
KHARKOV
POLTAVA
DNEPROPETROVSK
KRIVOJ ROG
DONETSK
LUGANSK
ZAPORUZJE
MARIUPOL
MELITOPOL
NIKOLAJEV
MOLDOVA
CHISINAU
ROSTOV ON DON
ROMANIA
ODESSA
SEVASTOPOL
KRASNODAR
NOVOROSSIJSK
GROZNY
MAKHACHKALA
AKTAU
TURKMENBASHI
ASHGABAT
BUCAREST
CONSTANTA
SOFIA
VARNA
BURGAS
BULGARIA
Black Sea
GEORGIA
TBILISI
AZERBAIJAN
BAKU
Caspian Sea
YEREVAN
ARMENIA
SAMSUN
ISTANBUL
TURKEY
THESSALONIKI
ANKARA
TEHRAN
IRAN
IRAQ
SYRIA
TEN CORRIDOR I
TEN CORRIDOR II
TEN CORRIDOR III
TEN CORRIDOR IV
TEN CORRIDOR IX

TRACECA INDEX

Section nbr.	Description
1	Port of ODESSA
2	ODESSA/POTI/BATUMI
3	Port of POTI
4	Port of BATUMI
5	POTI/BATUMI/TBILISI
6	TBILISI /YEREVAN
7	TBILISI/BAKU
8	YEREVAN/BAKU
9	Port of BAKU
10	Port of AKTAU
11	Port of TURKMENBASHI
12	TURKMENBASHI/CHARDZHOU
13	CHARDZHOU/BOKHARA/ SAMARKAND TASHKENT
14	SAMARKAND/TERMEZ/ DUSHANBE
15	KURGAN TUBA/ KUJAB (rail only)
16	AKTAU BEINEU/ CHU ALMATY/DRUZHBA
17	UGOVAYA/BISHKEK/

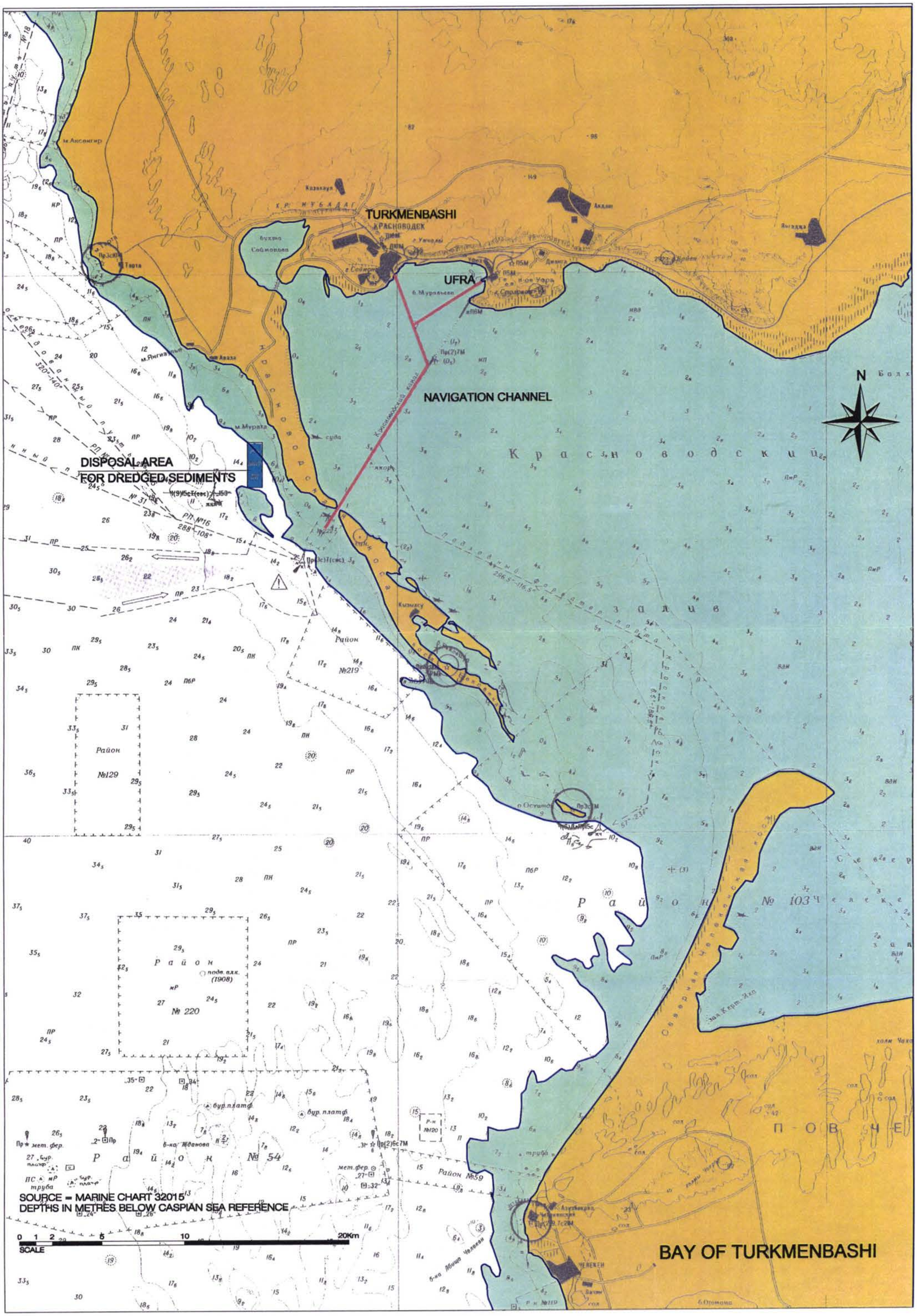
LEGEND

0 50 100 km

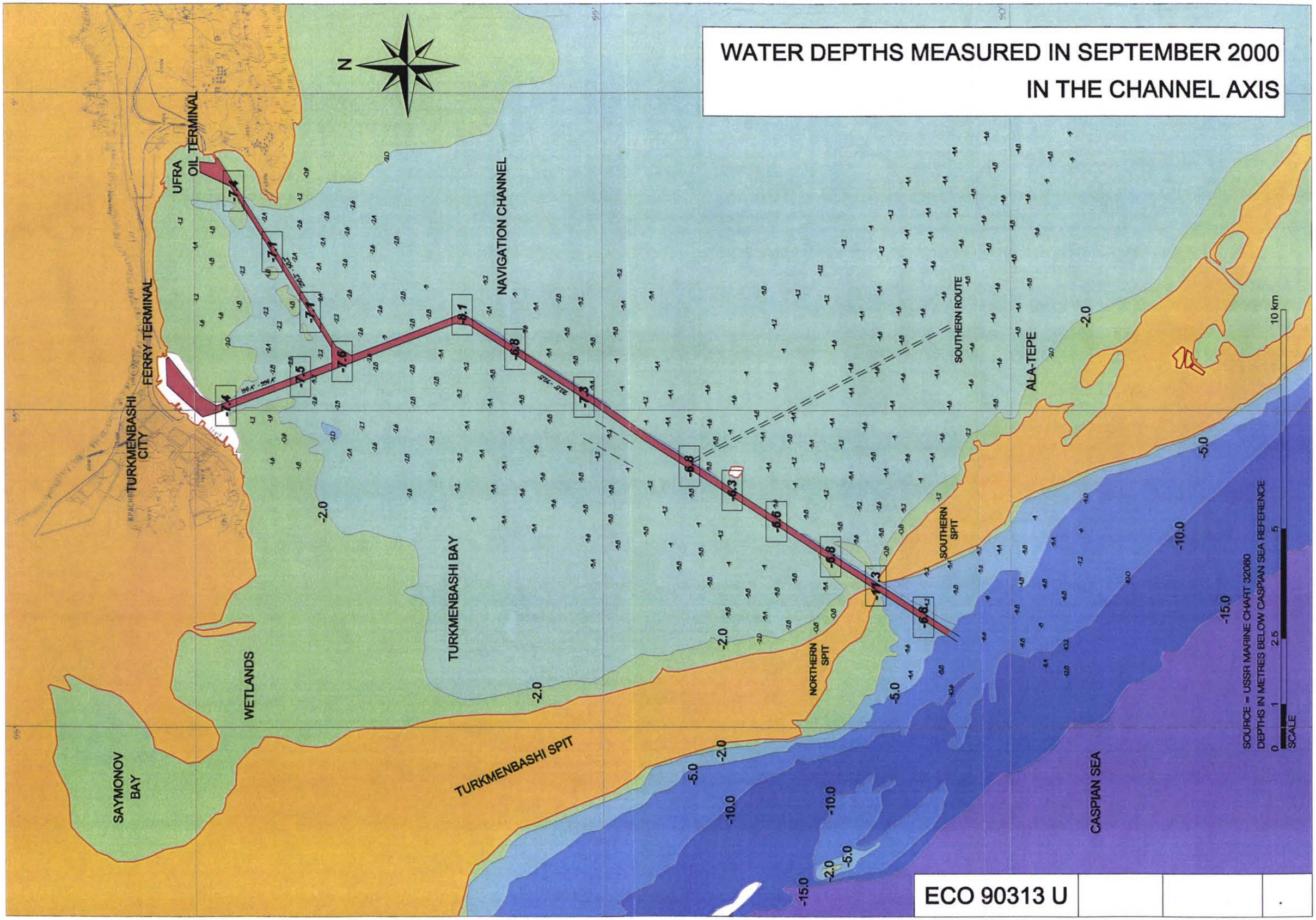
- Highway
- Main road
- Other road
- Railway
- Major city
- City up to 500.000 inhabitants
- City up to 50.000 inhabitants

TRACECA LEGEND

- Ports
- Maritime route
- Rail Corridor
- Road Corridor

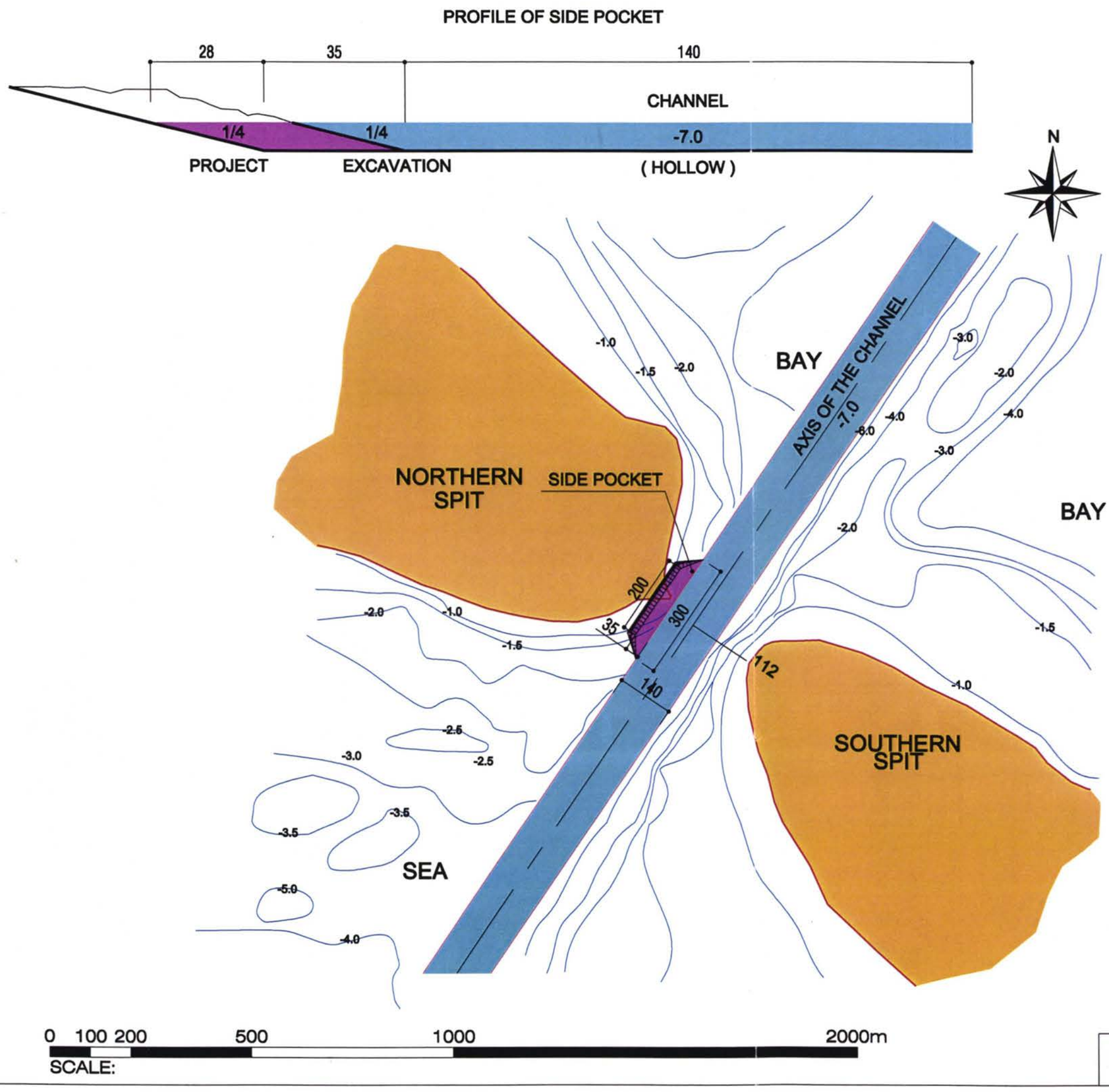

TURKMENBASHI
UFRA
NAVIGATION CHANNEL
DISPOSAL AREA
FOR DREDGED SEDIMENTS
N
SOURCE = MARINE CHART 32015
DEPTHS IN METRES BELOW CASPIAN SEA REFERENCE
0 1 2 5 10 20Km
SCALE
BAY OF TURKMENBASHI

WATER DEPTHS MEASURED IN SEPTEMBER 2000 IN THE CHANNEL AXIS



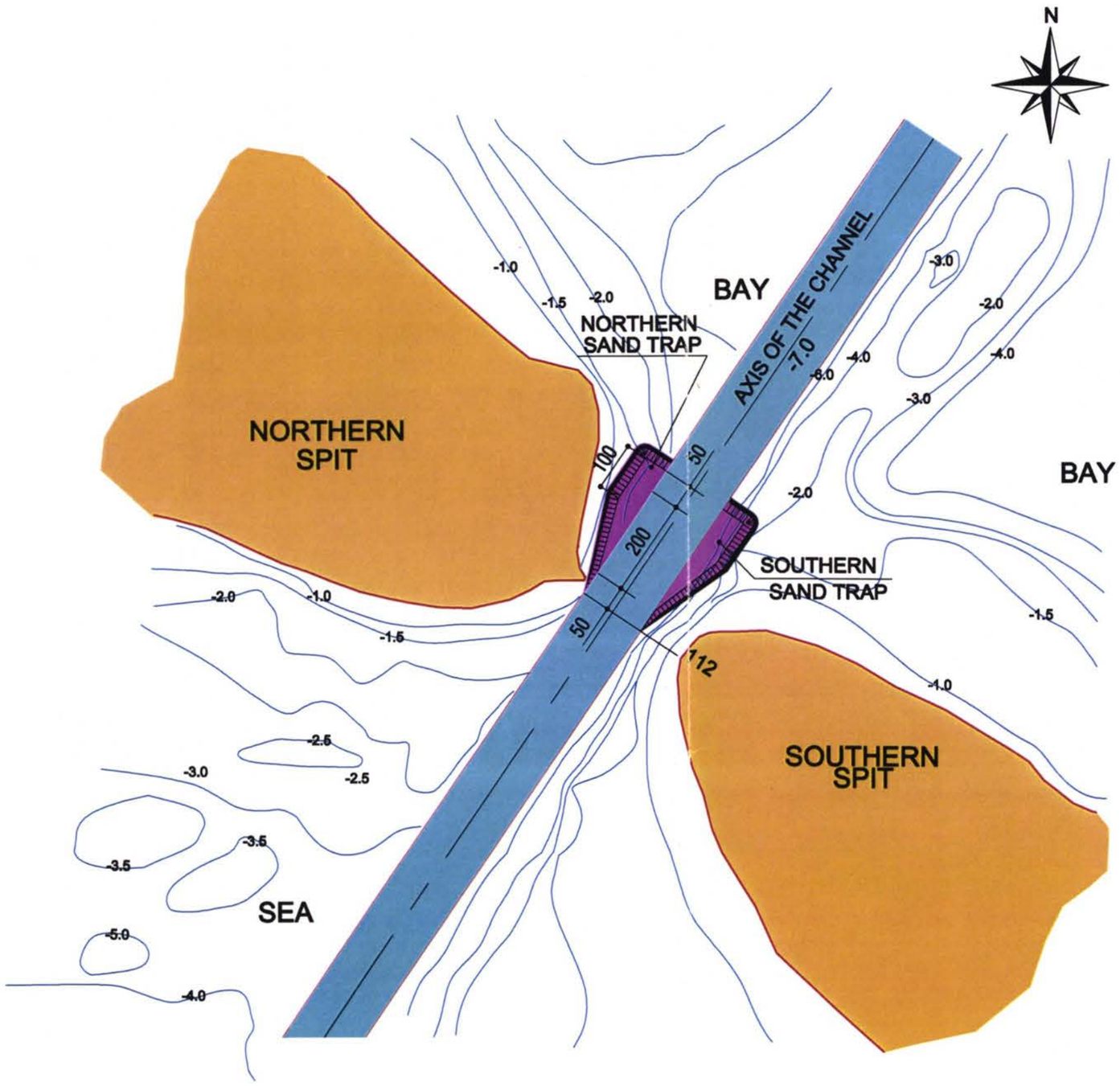
ECO 90313 U			.

FIGURE 1
SIDE POCKET



ECO 90313 U	FIG	001	A

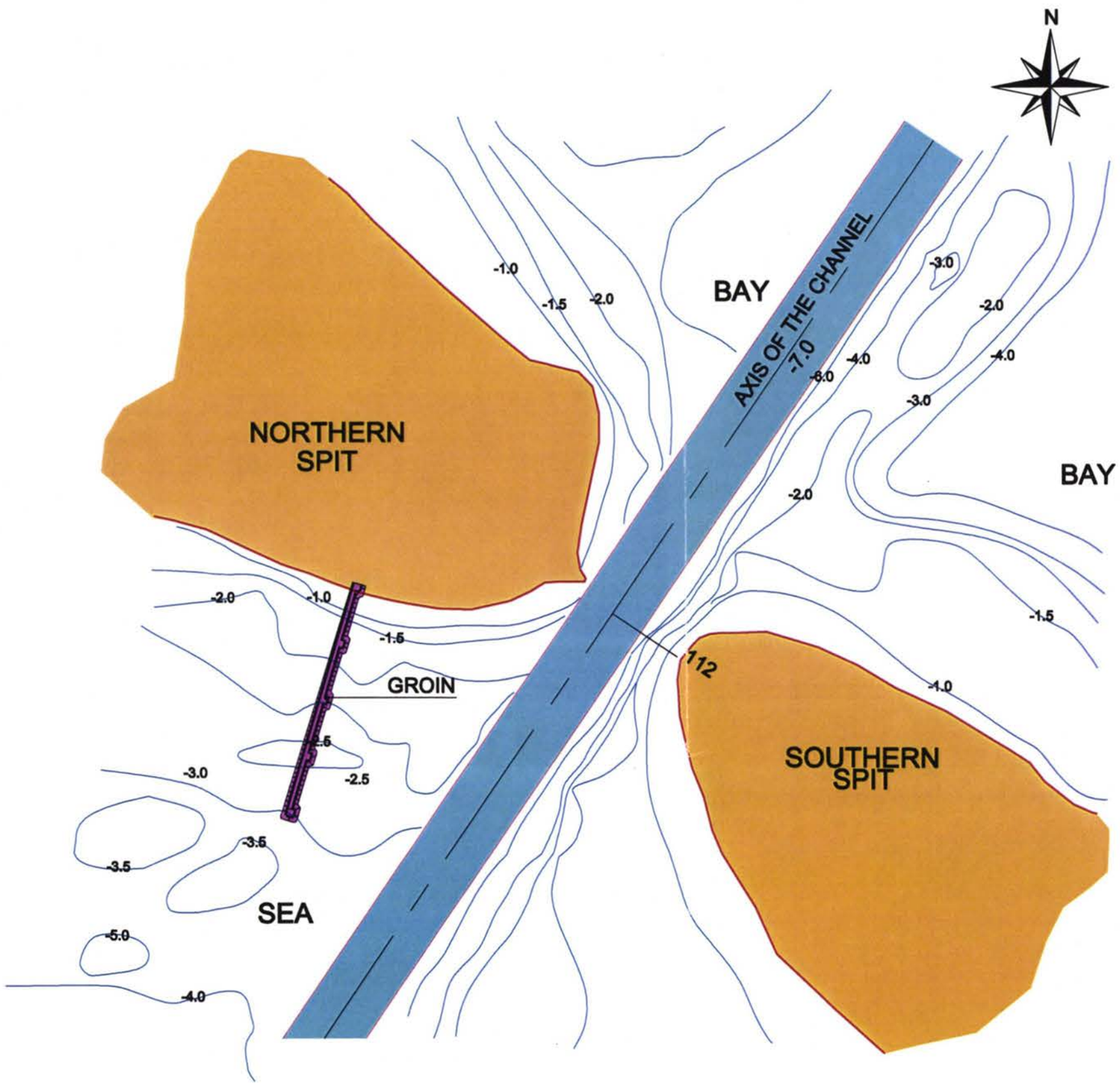
FIGURE 2
SAND TRAPS



0 100 200 500 1000 2000m
SCALE:

ECO 90313 U	FIG	002	A

FIGURE 3
OPEN SEA GROIN



0 100 200 500 1000 2000m

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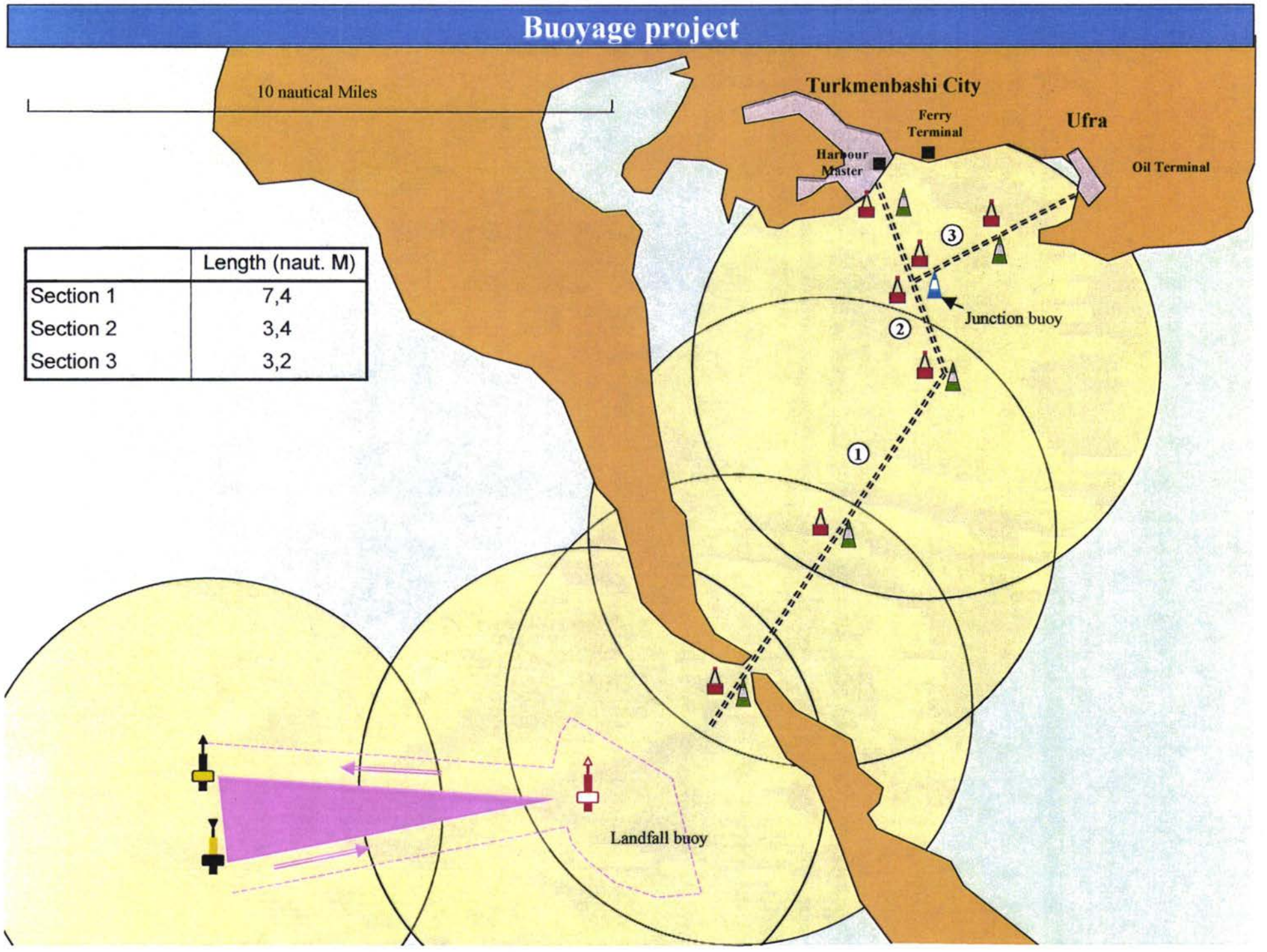
ECO 90313 U	FIG	003	A

Buoyage project



	Length (naut. M)
Section 1	7,4
Section 2	3,4
Section 3	3,2

TAIL TUBE TYPE LIGHTBUOY

This tail-tube lightbuoy, 2400 mm in diameter, volume 5m³, of modular design and augmented stability is intended for moderate open sea.

Buoy GBM 2400 - 5 Q

The float is made-up of four half shells built in rotomoulded high density polyethylene, filled with a closed cells polyurethane foam so as to keep the buoy afloat even in case of damage.

The float is assembled on a steel structure receiving the ballast at its lower end.

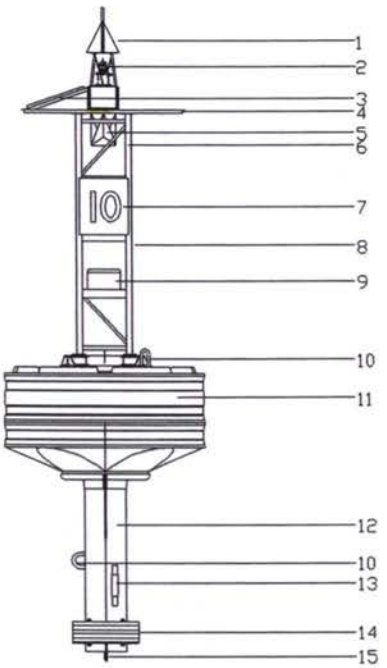
The steel ballast is adjustable so as to adapt the buoy stability to the site sea conditions.

The buoy superstructure is a painted aluminium alloy lattice tower bearing the light equipment, a top-mark and a radar reflector.

The light equipment includes:

- a GRL 110/ 155 lantern,
- a flasher,
- 3 or 4 photovoltaïc 12V. 20W. panels,
- a charge regulator,
- a 12V sealed lead-calcium battery.

A synchroflash system may be provided, as well as a remote monitoring outstation.



DESIGNATION	
1	Top mark
2	GRL 110/155 lantern
3	Solar modules 20W
4	Guard rail
5	Radar reflector
6	Tower
7	Identification plates
8	Ladder
9	Battery chest
10	Lifting eyes
11	Float
12	Tail tube
13	Ballast
14	Mooring eye

PARTS SPECIFICATION			
Float : Four half shells made of high density rotomoulded polyethylene filled with closed cells polyurethane foam	*Diameter =* *Height =* *Volume =* *Mass =*	***2400*** ***1300*** ***5*** ***400***	*mm* *mm* *m³* *kg*
Structure : One painted steel piece including the body main shaft bearing the ballast and the float shells blocking system	*Height =* *Mass =*	***3650*** ***850***	*mm* *kg*
Ballast :	*Mass =*	***520***	*kg*
Tower : Painted aluminium lattice bearing the electrical light equipment, the radar reflector and the top mark	*Height =* *Mass =*	***3350*** ***250***	*mm* *kg*

BUOY MAIN DATA			
Total mass (without mooring line)	*M =*	***2020***	*kg*
Volume	*V =*	***5***	*m³*
Reserve buoyancy	*Eb =*	***3***	*m³*
Total height	*H =*	***8150***	*mm*
Focal plane height	*Fph =*	***4490***	*mm*
Draught	*D =*	***2300***	*mm*
Righting moment	*Rm =*	***2074***	*daN.m*
Roll period	*Rp =*	***3.5***	*sec.*
Heave period	*Hp =*	***1.4***	*sec.*

PROXIMITY BUOY

This compact lightbuoy, 1800 mm in diameter, volume 1.7 m^3, is intended for moderate open sea and shallow waters.

Buoy GBP 1800 - 1.7 L

The keel, the float and the spar are made up of a unique rotomoulded high density polyethylene piece.

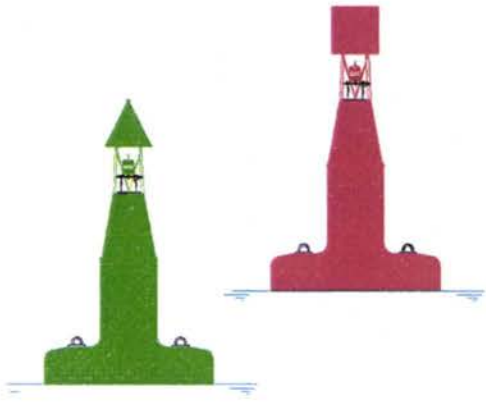
The float section is filled with a closed cells polyurethane foam so as to keep the buoy afloat even in case of damage.

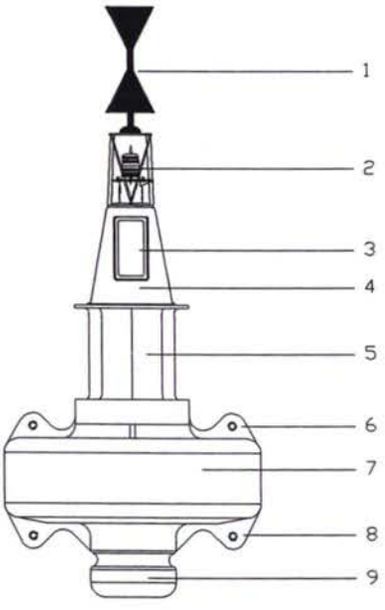
The colour pigment and the polyethylene are selected to fit the long service life of the buoy.

Lifting and mooring eyes are fixed to two watertight pipes crossing the float.

A reinforced concrete ballast provides stability.

These buoys are equipped with a compact solar beacon which includes:
- a GRL 110 lantern,
- a flasher,
- Photovoltaïc 12V. 10W. panels,
- a charge regulator,
- a sealed lead calcium battery
- a radar reflector,
- a top-mark.



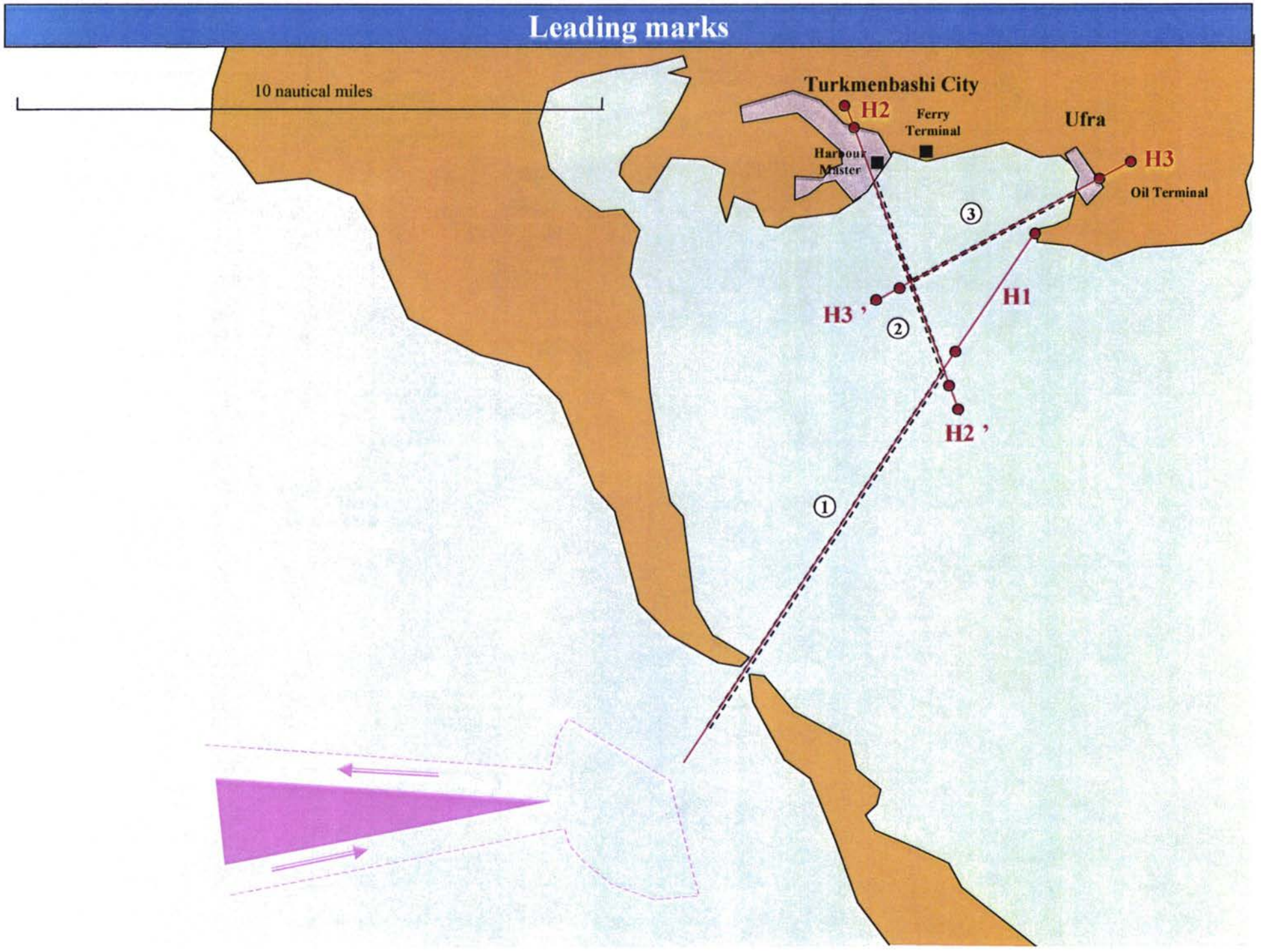


DESIGNATION	
1	Top-mark
2	Lantern (GRL 110 or 155)
3	Solar module 10W
4	Compact solar beacon
5	Spar
6	Lifting eyes
7	Float
8	Mooring eyes
9	Ballast

PARTS SPECIFICATIONS			
Keel :	*Diameter =*	***600***	*mm*
Polyethylene filled with reinforced concrete	*Height =*	***520***	*mm*
	Volume =	***0.15***	*m^3*
	Mass =	***370***	*kg*
Float :	*Diameter =*	***1800***	*mm*
Polyethylene filled with closed cells foam	*Height =*	***600***	*mm*
	Volume =	***1.7***	*m^3*
	Mass =	***150***	*kg*
Spar :	*Length =*	***950***	*mm*
Polyethylene filled with closed cells foam	*Diameter =*	***600***	*mm*
	Mass =	***15***	*kg*
Equipment :	*Height =*	***1820***	*mm*
GRP compact solar beacon bearing electrical equipment and top-mark	*Section =*	***600 x 600***	*mm*
	Mass =	***70***	*kg*

BUOY MAIN DATA			
Total mass (without mooring)	*M =*	***605***	*kg*
Body volume	*V =*	***1.7***	*m^3*
Reserve buoyancy	*Eb =*	***1.10***	*m^3*
Overall height	*H =*	***3890***	*mm*
Draught	*D =*	***720***	*mm*
Focal plane height	*Fch*	***2330***	*mm*

Leading marks

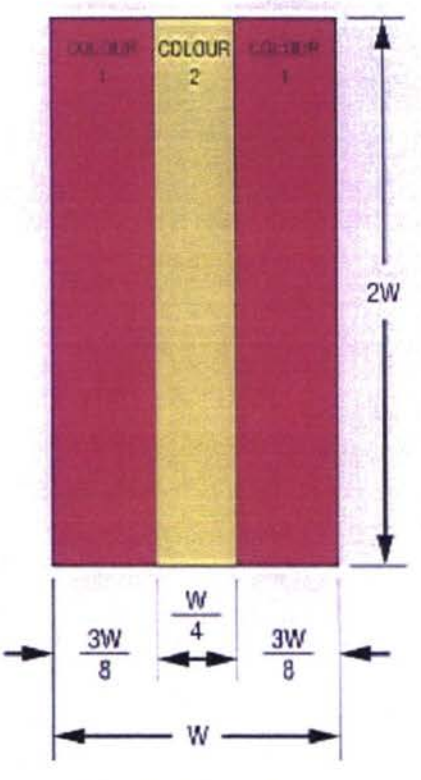


H1 daymarks should be designed for 5 mile observation distance
H2 daymarks for 4 miles
H3 daymarks for 3 miles

DAYMARKS

Minimum Width of a Standard Rectangular Dayboard versus Distance

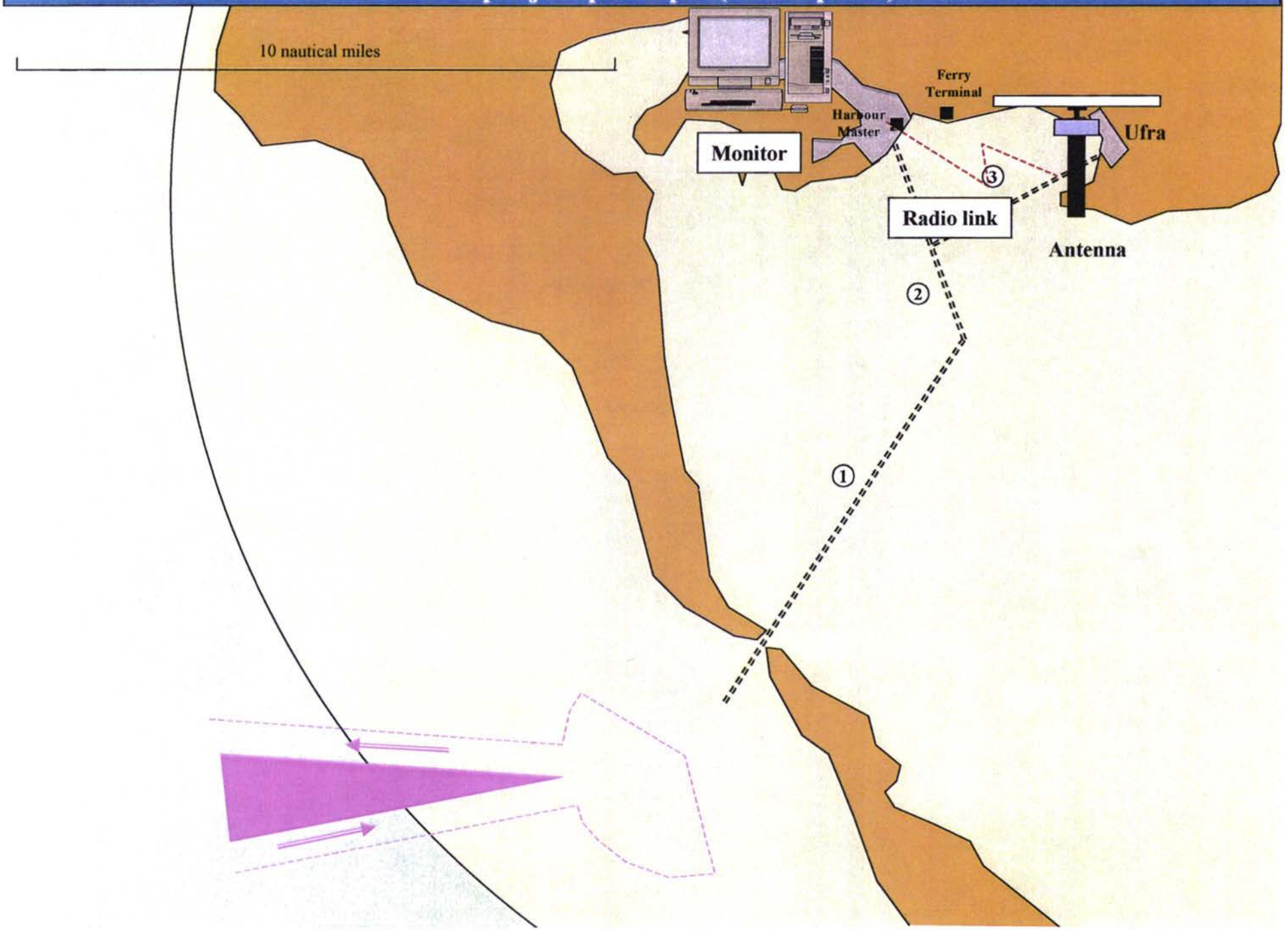
Observation Distance (sea miles)	Minimum Width (metres)	(feet)
0.25	0.2	0.6
0.5	0.4	1.2
0.75	0.6	1.8
1	0.8	2.4
2	1.5	4.8
3	2.3	7.2
4	2.9	9.6
5	3.7	12



Standard sizing for a rectangular dayboard.

Ref.: International Association of Lighthouses Authorities (IALA)

Radar project principle (Ufra option)



Annex 3

financial tables (8)

Turkmenbashi navigation channel - Investment costs (in euro)

Item n°	Item description	Unit	Quantity	Unit price	Total price
	A. Navigation aids				
A1	*Supply of cardinal tail-tube buoys*	*lump sum*	*2*	*15 300*	*30 600*
A2	*Supply of a landfall tail-tube buoy fitted with Racon system*	*lump sum*	*1*	*55 300*	*55 300*
A3	Installation of tail-tube buoys	lump sum	3	3 000	9 000
A4	*Supply of channel gate buoys*	*lump sum*	*13*	*6 400*	*83 200*
A5	Supply of radio synchronisation systems for channel buoys	lump sum	6	1 800	10 800
A6	Installation of channel buoys	lump sum	13	2 000	26 000
A7	Rehabilitation of leading mark H1 (two beacons)	lump sum	1	1 500	1 500
A8	Rehabilitation of leading marks H2 & H3 (two beacons each)	lump sum	2	1 100	2 200
A9	Construction of radar antenna support	lump sum	1	9 000	9 000
A10	*Supply and installation of an Arpa radar with antenna*	*lump sum*	*1*	*110 000*	*110 000*
A11	*Supply and installation of a GMDSS receiver*	*lump sum*	*1*	*18 000*	*18 000*
A12	*Supply of VHF and MW radio receiver and transmitter*	*lump sum*	*1*	*5 000*	*5 000*
A13	*Supply of VHF hand radio sets*	*lump sum*	*3*	*900*	*2 700*
A14	*Supply and installation of equipment for wind measurement*	*lump sum*	*1*	*500*	*500*
A15	*Supply of barometer, thermometer, watch and binoculars*	*lump sum*	*1*	*1 300*	*1 300*
A16	*Supply of a tool set for maintenance and repair (shore-based)*	*lump sum*	*1*	*7 500*	*7 500*
A17	*Supply of a tool set for maintenance and repair (vessel-based)*	*lump sum*	*1*	*3 000*	*3 000*
A18	*Supply of spare parts*	*lump sum*	*1*	*20 000*	*20 000*
A19	*Supply and installation of computer equipment for the harbour master's office*	*lump sum*	*1*	*4 000*	*4 000*
A20	*Supply and installation of a GPS for the buoy tender*	*lump sum*	*1*	*600*	*600*
A21	Initial training of port staff for electronic navigation aids	lump sum	1	18 000	18 000
A22	Initial training of port staff for other navigation aids	lump sum	1	6 000	6 000
	Total A				**424 200**
	B. Survey equipment and survey works				
B1	Supply and installation of a GPS for the Ulker launch	lump sum	1	600	600
B2	Supply and installation of vessel-based hydrographic surveying equipment	lump sum	1	8 000	8 000
B3	Training of port staff for hydrographic surveys	lump sum	1	2 000	2 000
B4	Environmental investigations (sampling and chemical analyses)	lump sum	1	5 300	5 300
B5	Surveying the channel hydrography	day	22	150	3 300
	Total B				**19 200**
	C. Dredging equipment				
C1	Tugging the Sagadam dredger to Baku by CSC tug (and return)	lump sum	1	2 000	2 000
C2	Dry-docking the Sagadam dredger in Baku (CSC dry-dock)	lump sum	1	55 000	55 000
C3	Underwater inspection / overhaul of the barges	lump sum	2	7 000	14 000
C4	Replacement of electrical panels onboard the Sagadam dredger	lump sum	1	5 000	5 000
C5	Supply and installation of a GPS for the Sagadam dredger	lump sum	1	600	600
C6	Overhaul of the anchor boat	lump sum	1	6 000	6 000
C12	Inspection & technical assistance for the dredger	lump sum	1	15 000	15 000
	Total C				**97 600**
	D. Capital dredging works				
D1	Dredging of 1 750 000 m3 of sand in the spit area	month	14	33 000	462 000
D2	Dredging of 4 000 000 m3 of mud inside the bay	month	32	36 200	1 158 400
	Total D				**1 620 000**
	Traceca funding				341 700
	Other funding				1 819 300
	Total all works				2 161 000

Notes:

Italicized items are covered by a Traceca grant

Group D unit price covers annual amortization of dredging equipment as well as costs of personnel and of consumables

Turkmenbashi navigation channel - Annual maintenance and operating costs (in euro)

Item n°	Item description	Unit	Quantity	Unit price	Total price
	A. Navigation aids				
A1	Maintenance of tail-tube buoys (big units)	lump sum	3	1 000	3 000
A2	Maintenance of channel gate buoys (small units)	lump sum	13	500	6 500
A3	Maintenance of Racon system	lump sum	1	300	300
A4	Maintenance of leading beacons	lump sum	6	200	1 200
A5	Radar maintenance	lump sum	1	2 000	2 000
A6	Supply of miscellaneous spare parts	lump sum	1	1 500	1 500
A7	Maintenance of computer equipment	lump sum	1	1 200	1 200
	Total A				**15 700**
	B. Survey equipment and survey works				
B1	Regular hydrographic surveys in the channel	lump sum	4	6 600	26 400
B2	Maintenance of hydrographic equipment	lump sum	1	600	600
	Total B				**27 000**
	C. Dredging equipment				
C1	Dry-docking the Sagadam dredger (each 4 years)	lump sum	0,25	57 000	14 250
C2	Other maintenance onbard the Sagadam dredger	lump sum	1	3 000	3 000
C3	Dry-docking the two barges (each 4 years)	lump sum	0,5	10 000	5 000
C4	Other maintenance onbard the barges	lump sum	2	1 000	2 000
C5	Maintenance of anchor boat	lump sum	1	1 500	1 500
	Total C				**25 750**
	D. Maintenance dredging works				
D1	Dredging of 30 000 m3 of sand in the spit area	month	1	88 000	88 000
D2	Dredging of 10 000 m3 of mud inside the bay	month	3	88 000	264 000
	Total D				**352 000**
	Total all works				420 450

TURKMENBASHI **EXPECTED INCOME STATEMENT FROM CHANNEL/BUOYS DUES** **Traffic scenario: pessimistic**

Unit due in USD per m3	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**
Of which: maintenance of the channel	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027
Of which: maintenance of buoys	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014
FERRY TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	400	458	465	472	479	486	491	496	501	507	512
Number of ship movements	800	916	930	944	958	972	982	992	1002	1014	1024
Typical size of ship in m3	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095
Channel/buoys dues from ferries	312 382	357 677	363 144	368 611	374 077	379 544	383 449	387 354	391 258	395 944	399 849
GENERAL CARGO TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	135	151	154	157	161	164	167	170	173	176	180
Number of ship movements	270	302	308	314	322	328	334	340	346	352	360
Typical size of ship in m3	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166
Channel/buoys dues from GC ships	50 733	56 746	57 873	59 000	60 504	61 631	62 758	63 886	65 013	66 141	67 644
OIL TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of ships (crude oil)	42	42	150	152	153	155	156	158	159	161	162
Number of ships (oil products)	670	675	675	682	689	695	702	709	717	724	731
Number of ship movements	1 424	1 434	1 650	1 668	1 684	1 700	1 716	1 734	1 752	1 770	1 786
Typ. size of c.o. tankers in m3	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128
Typ. size of o.p. tankers in m3	22 130	22 131	22 132	22 133	22 134	22 135	22 136	22 137	22 138	22 139	22 140
Channel/buoys dues from c.o. tankers	44 993	44 993	160 690	162 833	163 904	166 046	167 118	169 260	170 332	172 474	173 545
Channel/buoys dues from o.p. tankers	607 911	612 475	612 503	618 883	625 263	630 737	637 118	643 500	650 791	657 174	663 558
Total dues from tankers	652 904	657 469	773 193	781 716	789 167	796 783	804 236	812 761	821 122	829 648	837 103
TOTAL CHANNEL/BUOYS DUES	**1 016 019**	**1 071 892**	**1 194 210**	**1 209 327**	**1 223 748**	**1 237 958**	**1 250 443**	**1 264 000**	**1 277 394**	**1 291 733**	**1 304 596**

TURKMENBASHI

EXPECTED INCOME STATEMENT
FROM CHANNEL/BUOYS DUES **Traffic scenario: optimistic**

Unit due in USD per m3	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**
Of which: maintenance of the channel	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027
Of which: maintenance of buoys	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014
FERRY TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	400	467	484	502	521	825	855	885	915	938	963
Number of ship movements	800	934	968	1004	1042	1650	1710	1770	1830	1876	1926
Typical size of ship in m3	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095
Channel/buoys dues from ferries	312 382	364 706	377 982	392 039	406 877	644 288	667 716	691 145	714 574	732 535	752 059
GENERAL CARGO TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	135	154	160	166	173	194	203	213	223	234	246
Number of ship movements	270	308	320	332	346	388	406	426	446	468	492
Typical size of ship in m3	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166
Channel/buoys dues from GC ships	50 733	57 873	60 128	62 383	65 013	72 905	76 287	80 045	83 803	87 937	92 447
OIL TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of ships (crude oil)	42	42	150	155	159	164	169	174	179	184	190
Number of ships (oil products)	670	675	675	695	716	738	760	783	806	830	855
Number of ship movements	1 424	1 434	1 650	1 700	1 750	1 804	1 858	1 914	1 970	2 028	2 090
Typ. size of c.o. tankers in m3	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128
Typ. size of o.p. tankers in m3	22 130	22 131	22 132	22 133	22 134	22 135	22 136	22 137	22 138	22 139	22 140
Channel/buoys dues from c.o. tankers	44 993	44 993	160 690	166 046	170 332	175 688	181 044	186 401	191 757	197 113	203 541
Channel/buoys dues from o.p. tankers	607 911	612 475	612 503	630 680	649 766	669 761	689 758	710 664	731 572	753 390	776 118
Total dues from tankers	652 904	657 469	773 193	796 726	820 097	845 449	870 802	897 065	923 329	950 503	979 659
TOTAL CHANNEL/BUOYS DUES	**1 016 019**	**1 080 048**	**1 211 303**	**1 251 148**	**1 291 988**	**1 562 641**	**1 614 806**	**1 668 255**	**1 721 706**	**1 770 976**	**1 824 165**

TURKMENBASHI **EXPECTED INCOME STATEMENT**
FROM CHANNEL/BUOYS DUES **Traffic scenario: medium**

Unit due in USD per m3	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**	**0,041**
Of which: maintenance of the channel	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027
Of which: maintenance of buoys	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014
FERRY TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	400	466	476	484	491	771	783	796	809	822	835
Number of ship movements	800	932	952	968	982	1542	1566	1592	1618	1644	1670
Typical size of ship in m3	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095	38 095
Channel/buoys dues from ferries	312 382	363 925	371 734	377 982	383 449	602 116	611 488	621 640	631 792	641 945	652 097
GENERAL CARGO TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of calls	135	153	159	164	170	188	195	202	209	216	224
Number of ship movements	270	306	318	328	340	376	390	404	418	432	448
Typical size of ship in m3	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166	9 166
Channel/buoys dues from GC ships	50 733	57 497	59 752	61 631	63 886	70 650	73 281	75 911	78 542	81 173	84 179
OIL TERMINAL	**2 000**	**2 001**	**2 002**	**2 003**	**2 004**	**2 005**	**2 006**	**2 007**	**2 008**	**2 009**	**2 010**
Number of ships (crude oil)	42	42	150	153	156	159	162	166	169	172	176
Number of ships (oil products)	670	675	675	689	702	716	731	745	760	775	791
Number of ship movements	1 424	1 434	1 650	1 684	1 716	1 750	1 786	1 822	1 858	1 894	1 934
Typ. size of c.o. tankers in m3	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128	26 128
Typ. size of o.p. tankers in m3	22 130	22 131	22 132	22 133	22 134	22 135	22 136	22 137	22 138	22 139	22 140
Channel/buoys dues from c.o. tankers	44 993	44 993	160 690	163 904	167 118	170 332	173 545	177 830	181 044	184 258	188 543
Channel/buoys dues from o.p. tankers	607 911	612 475	612 503	625 235	637 061	649 795	663 438	676 175	689 820	703 467	718 022
Total dues from tankers	652 904	657 469	773 193	789 139	804 179	820 127	836 983	854 005	870 864	887 725	906 565
TOTAL CHANNEL/BUOYS DUES	**1 016 019**	**1 078 891**	**1 204 680**	**1 228 752**	**1 251 513**	**1 492 893**	**1 521 752**	**1 551 556**	**1 581 199**	**1 610 842**	**1 642 842**

TURKMENBASHI **EXPECTED CASH FLOW** **Traffic scenario: pessimistic**

	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010
OPERATING REVENUES IN USD	**1 016 019**	**1 071 892**	**1 194 210**	**1 209 327**	**1 223 748**	**1 237 958**	**1 250 443**	**1 264 000**	**1 277 394**	**1 291 733**	**1 304 596**
OPERATING EXPENSES											
Maintenance of navigation aids	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130
Channel surveys	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300
Maintenance of dredging equipment	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175
Yearly dredging works (deprec. exclud.)	38 800	38 801	38 802	38 803	38 804	38 805	38 806	38 807	38 808	38 809	38 810
Overheads (10 % of TML overheads)	125 000	128 750	132 613	136 591	140 689	144 909	149 257	153 734	158 346	163 097	167 990
Depreciation of dredging equipment	0	0	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000
Depreciation of navigation aids	0	0	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080
Depreciation of capital dredg.works	0	0	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900
Interest charges	0	0	0	0	0	0	0	0	0	0	0
TOTAL OPERATING EXPENSES	**225 405**	**229 156**	**600 000**	**603 979**	**608 078**	**612 299**	**616 648**	**621 126**	**625 739**	**630 491**	**635 385**
TOTAL OPER. PROFIT BEF. TAXES	**790 614**	**842 736**	**594 211**	**605 348**	**615 671**	**625 659**	**633 796**	**642 874**	**651 655**	**661 242**	**669 211**
Taxes (50%)	395 307	421 368	297 105	302 674	307 835	312 830	316 898	321 437	325 827	330 621	334 606
OPERATING PROFIT AFTER TAXES	**395 307**	**421 368**	**297 105**	**302 674**	**307 835**	**312 830**	**316 898**	**321 437**	**325 827**	**330 621**	**334 606**
GROSS POTENTIAL CASH FLOW	**395 307**	**421 368**	**664 085**	**669 654**	**674 815**	**679 810**	**683 878**	**688 417**	**692 807**	**697 601**	**701 586**
Local expenses for the project		**327 474**	**654 948**	**654 948**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bank loan refunding	-	-	-	-	-	-	-	-	-	-	-
NET POTENTIAL CASH FLOW	**395 307**	**93 894**	**9 137**	**14 706**	**674 815**	**679 810**	**683 878**	**688 417**	**692 807**	**697 601**	**701 586**
Cumulative cash flow		93 894	103 031	117 737	792 552	1 472 362	2 156 240	2 844 657	3 537 464	4 235 065	4 936 651

TURKMENBASHI **EXPECTED CASH FLOW** **Traffic scenario: optimistic**

	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010
OPERATING REVENUES IN USD	**1 016 019**	**1 080 048**	**1 211 303**	**1 251 148**	**1 291 988**	**1 562 641**	**1 614 806**	**1 668 255**	**1 721 706**	**1 770 976**	**1 824 165**
OPERATING EXPENSES											
Maintenance of navigation aids	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130
Channel surveys	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300
Maintenance of dredging equipment	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175
Yearly dredging works (deprec. exclud.)	38 800	38 801	38 802	38 803	38 804	38 805	38 806	38 807	38 808	38 809	38 810
Overheads (10 % of TML overheads)	125 000	128 750	132 613	136 591	140 689	144 909	149 257	153 734	158 346	163 097	167 990
Depreciation of dredging equipment	0	0	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000
Depreciation of navigation aids	0	0	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080
Depreciation of capital dredg.works	0	0	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900
Interest charges	0	0	0	0	0	0	0	0	0	0	0
TOTAL OPERATING EXPENSES	**225 405**	**229 156**	**600 000**	**603 979**	**608 078**	**612 299**	**616 648**	**621 126**	**625 739**	**630 491**	**635 385**
TOTAL OPER. PROFIT BEF. TAXES	**790 614**	**850 892**	**611 304**	**647 169**	**683 910**	**950 342**	**998 158**	**1 047 129**	**1 095 967**	**1 140 485**	**1 188 780**
Taxes (50%)	395 307	425 446	305 652	323 585	341 955	475 171	499 079	523 564	547 983	570 243	594 390
OPERATING PROFIT AFTER TAXES	**395 307**	**425 446**	**305 652**	**323 585**	**341 955**	**475 171**	**499 079**	**523 564**	**547 983**	**570 243**	**594 390**
GROSS POTENTIAL CASH FLOW	**395 307**	**425 446**	**672 632**	**690 565**	**708 935**	**842 151**	**866 059**	**890 544**	**914 963**	**937 223**	**961 370**
Local expenses for the project		**327 474**	**654 948**	**654 948**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bank loan refunding	-	-	-	-	-	-	-	-	-	-	-
NET POTENTIAL CASH FLOW	**395 307**	**97 972**	**17 684**	**35 617**	**708 935**	**842 151**	**866 059**	**890 544**	**914 963**	**937 223**	**961 370**
Cumulative cash flow		97 972	115 656	151 272	860 208	1 702 359	2 568 418	3 458 962	4 373 925	5 311 148	6 272 518

TURKMENBASHI **EXPECTED CASH FLOW** **Traffic scenario: medium**

	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010
OPERATING REVENUES IN USD	**1 016 019**	**1 078 891**	**1 204 680**	**1 228 752**	**1 251 513**	**1 492 893**	**1 521 752**	**1 551 556**	**1 581 199**	**1 610 842**	**1 642 842**
OPERATING EXPENSES											
Maintenance of navigation aids	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130	14 130
Channel surveys	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300	24 300
Maintenance of dredging equipment	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175	23 175
Yearly dredging works (deprec. exclud.)	38 800	38 801	38 802	38 803	38 804	38 805	38 806	38 807	38 808	38 809	38 810
Overheads (10 % of TML overheads)	125 000	128 750	132 613	136 591	140 689	144 909	149 257	153 734	158 346	163 097	167 990
Depreciation of dredging equipment	0	0	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000	275 000
Depreciation of navigation aids	0	0	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080	19 080
Depreciation of capital dredg.works	0	0	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900	72 900
Interest charges	0	0	0	0	0	0	0	0	0	0	0
TOTAL OPERATING EXPENSES	**225 405**	**229 156**	**600 000**	**603 979**	**608 078**	**612 299**	**616 648**	**621 126**	**625 739**	**630 491**	**635 385**
TOTAL OPER. PROFIT BEF. TAXES	**790 614**	**849 735**	**604 680**	**624 773**	**643 436**	**880 594**	**905 104**	**930 430**	**955 459**	**980 352**	**1 007 457**
Taxes (50%)	395 307	424 867	302 340	312 387	321 718	440 297	452 552	465 215	477 730	490 176	503 729
OPERATING PROFIT AFTER TAXES	**395 307**	**424 867**	**302 340**	**312 387**	**321 718**	**440 297**	**452 552**	**465 215**	**477 730**	**490 176**	**503 729**
GROSS POTENTIAL CASH FLOW	**395 307**	**424 867**	**669 320**	**679 367**	**688 698**	**807 277**	**819 532**	**832 195**	**844 710**	**857 156**	**870 709**
Local expenses for the project		**327 474**	**654 948**	**654 948**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bank loan refunding	-	-	-	-	-	-	-	-	-	-	-
NET POTENTIAL CASH FLOW	**395 307**	**97 393**	**14 372**	**24 419**	**688 698**	**807 277**	**819 532**	**832 195**	**844 710**	**857 156**	**870 709**
Cumulative cash flow		97 393	111 766	136 184	824 882	1 632 159	2 451 691	3 283 886	4 128 596	4 985 752	5 856 460

Annex 4

abbreviations & acronyms, references, staff list

ABBREVIATIONS & ACRONYMS

AIS	Automated Identification System
BSL	Baltic Sea Level
cm	centimetre
CSC	Caspian Shipping Company
CSL	Caspian Sea Level
dm	decimetre
dwt	dead weight tonnage
EA	Environmental Assessment
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EPS	Electronic Positioning System
g	gram
GMDSS	Global Maritime Distress Safety System
GNP	Gross National Product
GPS	Global Positioning System
IALA	International Association of Lighthouses Authorities
IMDG	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
kg	kilogram
km	kilometre
Krasnovodsk	former name of Turkmenbashi
l	litre
m	metre
m2	square metre
m3	cubic metre
MARPOL	International Convention for Prevention of Marine Pollution
Mt	Million tonnes
NM	Nautical mile
TML	Turkmen Maritime Lines
Traceca	Transport Corridor Europe-Caucasus-Asia
TSA	Turkmen Sea Administration
TSS	Traffic Separation Scheme
USD	United States dollar
VHF	Very High Frequency (radio system for short range communications)
VTS	Vessel Traffic Service

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