6.2 Land Use Plan

6.2.1 General

A land use plan for the area surrounding an airport is important to secure the safe and efficient operations and to safeguard nearby communities by solving and or easing environmental problems caused by airport operations.

6.2.2 Current Land Use

The current land use for each airport is shown in **Figure 6.2.2.1 - Figure 6.2.2.6**. Urbanization has been expanding in the vicinity of the Almaty airport, while the other airports are mainly surrounded by rural areas.

The Kazakhstan government and provincial governments have been considering land use control of the surrounding areas of airports, but has not yet established any plans. However, for Almaty in particular it is necessary to immediately establish land use plans to protect surrounding the environment and safeguard neighbouring communities.

6.2.3 Land Use Plan

(1) For airport operations, there is an ICAO standard of obstacle limitation surfaces, and obstacle restriction and removal for aircraft operation. This gives height restriction for structures and buildings in land use around airports. The following figure, **Figure 6.2.3.1**, illustrates the Obstacle Limitation Surfaces specified by ICAO.

(2) There are also adverse environmental influences caused by airport operations, aircraft noise in particular. For noise countermeasures, it is necessary to introduce low noise level aircraft and engines to replace the existing ones. It is also necessary to restrict aircraft operations; it terms of numbers, of flights, time restrictions and to restrict flight patterns. In addition, effective land use control is necessary.

Table 6.2.3.1 is a typical example of compatible land use around airports presented by ICAO. which recommends that three zones should be established for the land use planning with regard to noise exposure level.

Zone A : where developments and land use need not to be restricted by noise exposure considerations.

Zone B : where moderate noise exposure levels may be encountered and there may be some need to restrict land use and developments.

Zone C : where high noise exposure levels may be encountered and as a consequence, most land use need to be restricted, and most developments not permitted.

Land use criteria was designed as per Table 6.2.3.1, referring to Japanese standard in terms of WECPNL.

Table 6.2.3.1 Land Use Compatibility

Aircraft noise level (WECPNL)	Compatible land use for zoning
less than 70	residential (housing, schools, hospitals)
less than 75	commercial (offices, shops)
more than 75	agriculture (farms, orchards), industrial (factories, warehouses), recreation (parks, sports facilities)
more than 95	green belt (buffer zone)

(3) Land use was planned by taking into account aircraft noise contours for 2020, land use compatibility, expandability, and for future airport development.

At all airports except Almaty, because the future influence of aircraft noise there is no need to change current land use except to set up the plans based on the noise contours.

At Almaty, aircraft noise gives influences current land use, particularly noise invasions of residential area. It is advisable to change the current land use plan **Figure 6.2.3.2** shows a proposed land use plan for the Almaty airport.

(4) As the area near Almaty airport has been significantly urbanized, it is urgent to prevent further urbanization in this area, by controlling land use. Furthermore, it is also necessary to abate the noise level affecting existing residential areas by countermeasures.

The proposed countermeasures are based on Japanese standards and appear in **Table 6.2.3.2**.

Table 6.2.3.2 Aircraft noise countermeasures

Aircraft noise level (WECPNL)	Countermeasure
area more than 70	sound proof schools and hospitals
area more than 75	sound proof housing
area more than 90	relocation of housing

The cost of sound proofing countermeasures is estimated at US$ 400 thousand.

Examples of compatible land uses or developments	ZONE A Unrestricted land uses and developments	ZONE B Some restrictions on land uses and developments	ZONE C Most land uses and developments not permitted
Agricultural - Crop farming			
Industrial - Machine shop			
Commercial - Warehouse and shipping - Office and banking			
Residential - low density housing			
Public Facilities - Schools			

Notes

1. The length of the bar indicates where the uses might be permitted without restriction in relation to aircraft noise exposure only and excluding other planning considerations. With respect to certain uses, e.g. housing, commercial, a development might be allowed in a zone of a higher restriction when other planning considerations indicate a need, and where suitable building techniques, sound insulation, etc., can reduce the aircraft noise exposure to an acceptable level.

2. In the special cases of activities dependent on speech communication, e.g. schools, or requiring more stringent standards, e.g. certain hospital activities, additional restrictions may be required to take account of absolute noise levels as well as total noise exposure, unless adequate noise reduction can be ensured in the building construction.

3. The zones will require to be defined against a noise exposure scale and in their application will need to take account of local and national needs.

Table 5-2. Some typical examples of compatible land uses around airports

The above table is typical zoning around airports compatible for aircraft noise exposure, prepared by ICAO.

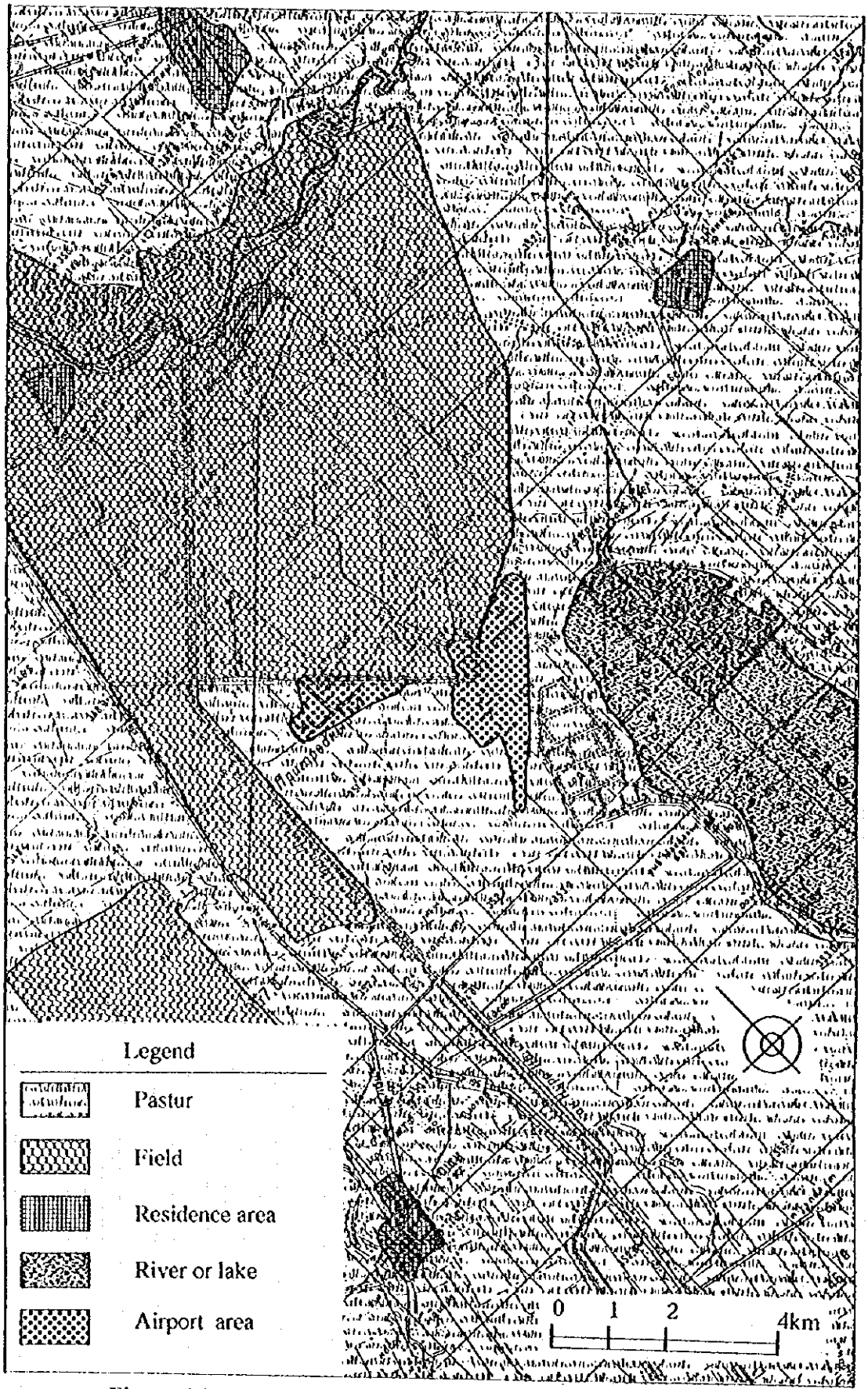


Figure 6.2.2.1 Current Land Use at Akmola Airport and its Surrounding Area

Figure 6.2.2.2 Current Land Use at Almaty Airport and its Surrounding Area

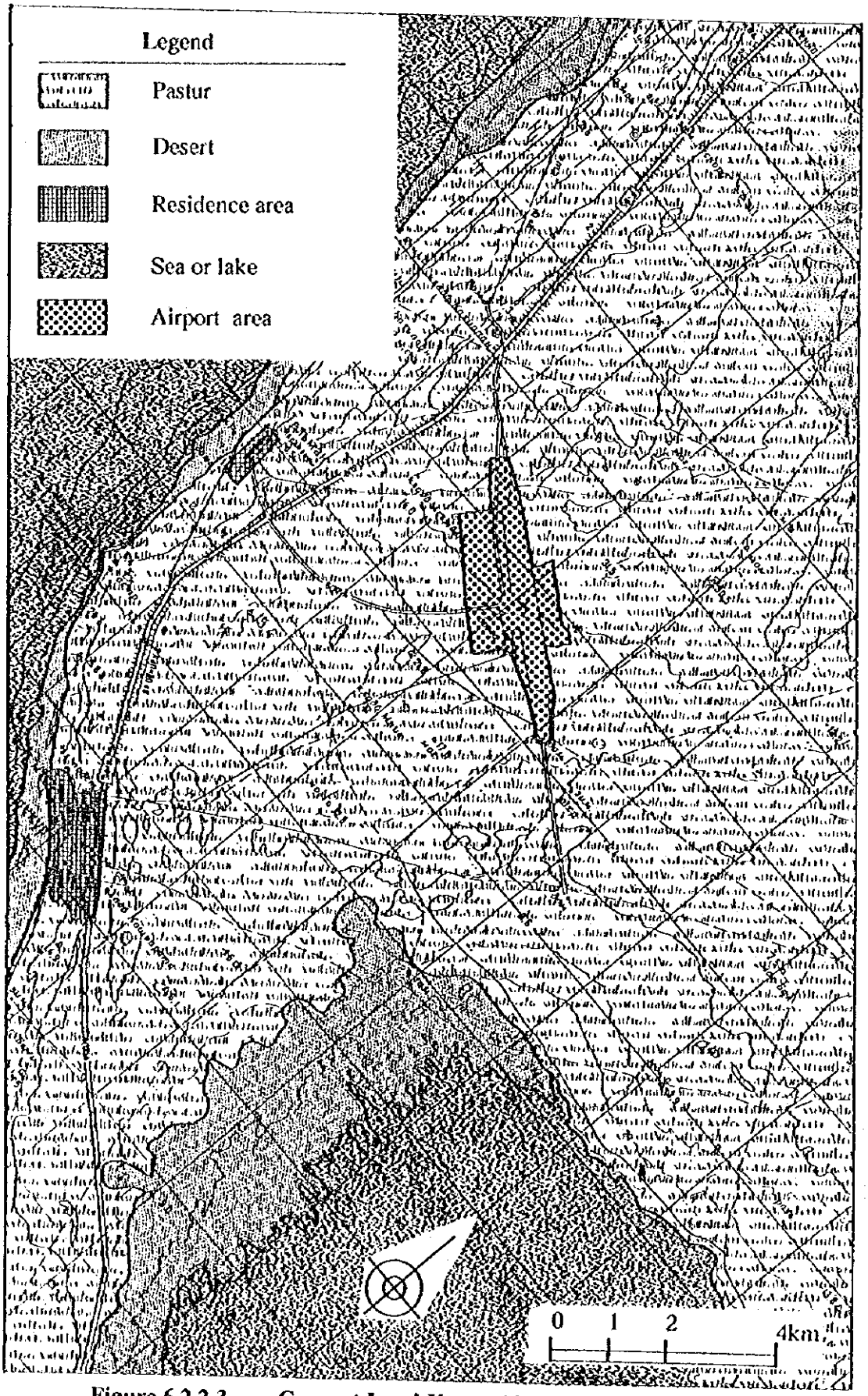


Figure 6.2.2.3 Current Land Use at Aktau Airport and its Surrounding Area

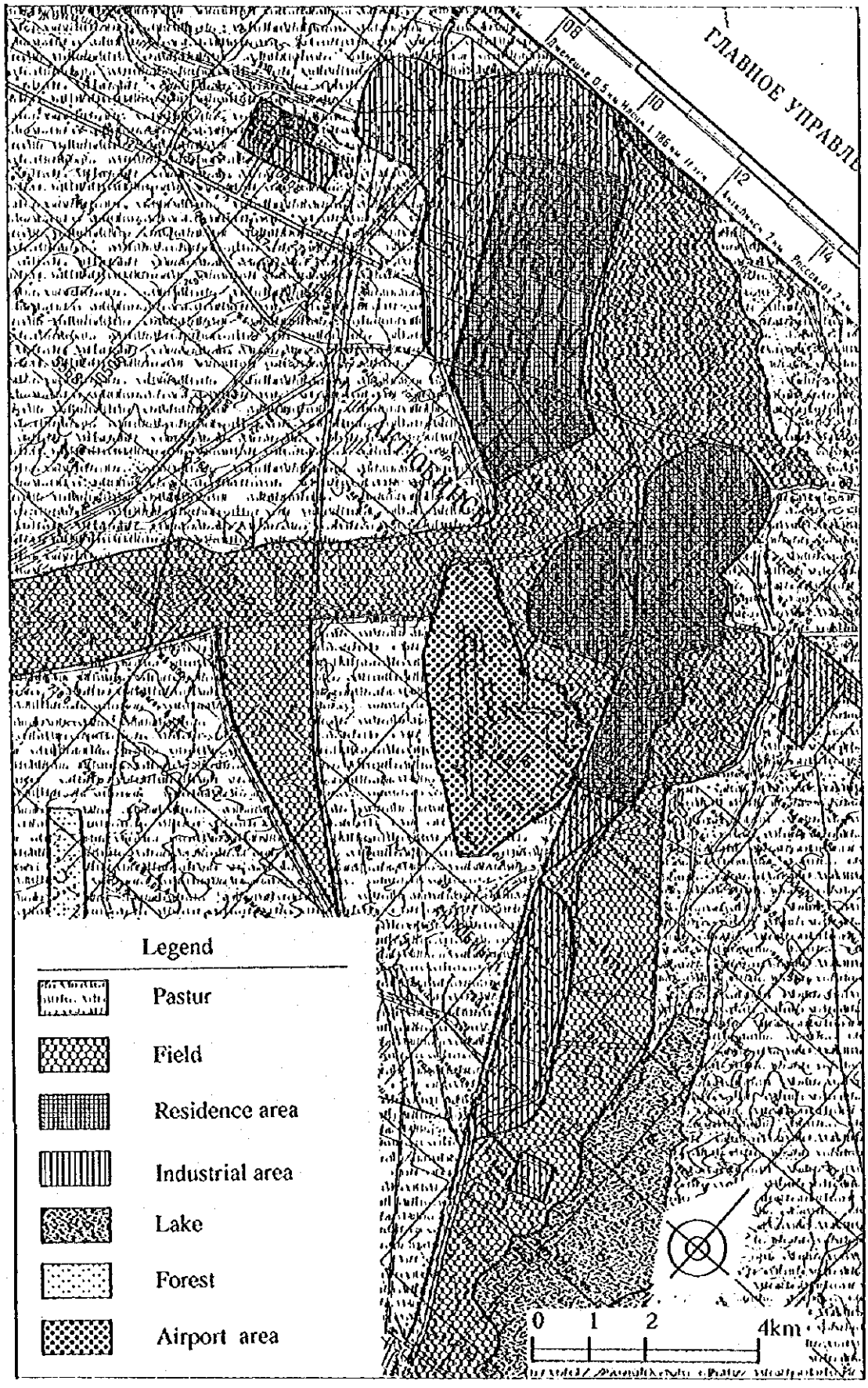


Figure 6.2.2.4 Current Land Use at Aktyubinsk Airport and its Surrounding Area

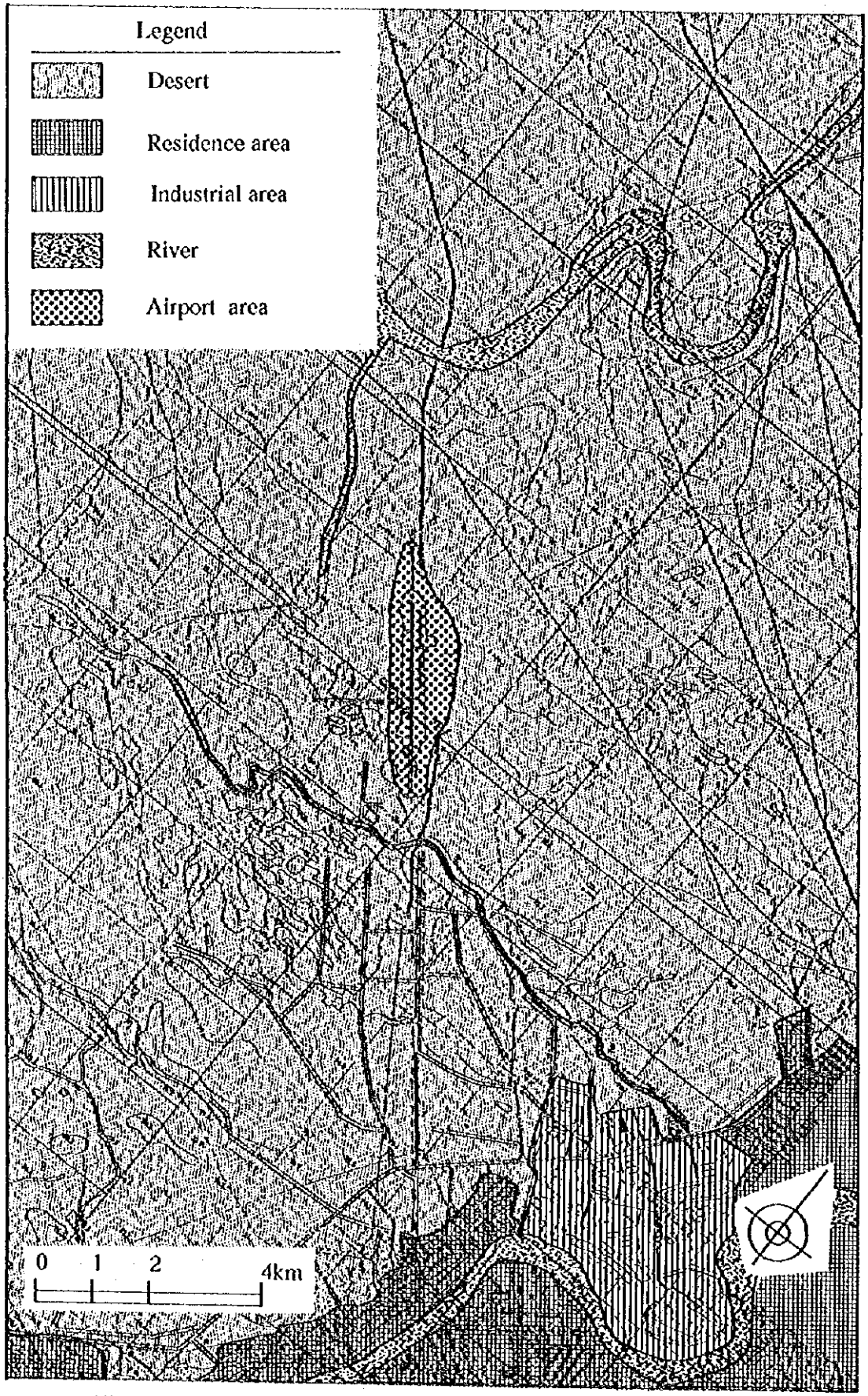


Figure 6.2.2.5 Current Land Use at Atyrau Airport and its Surrounding Area

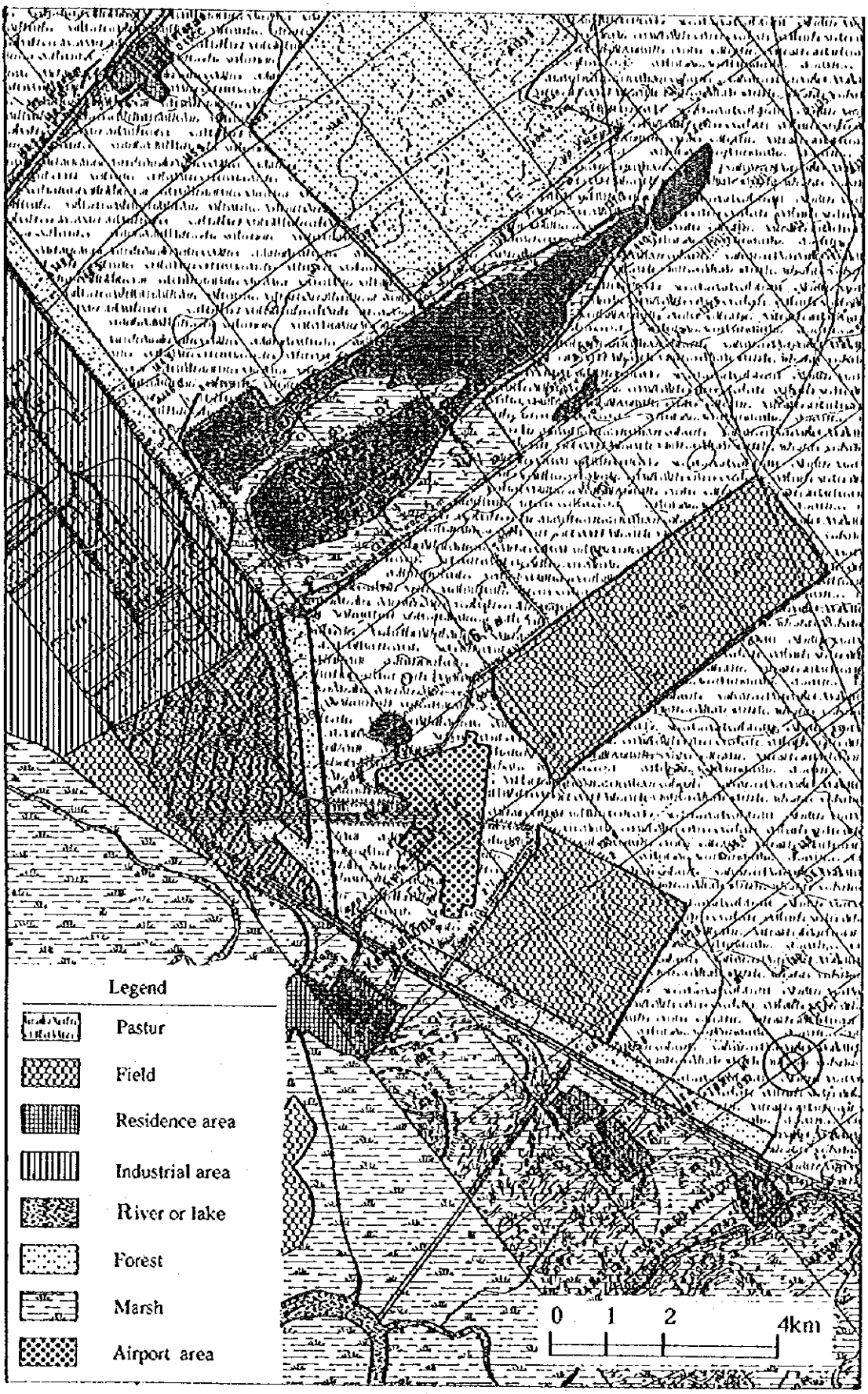
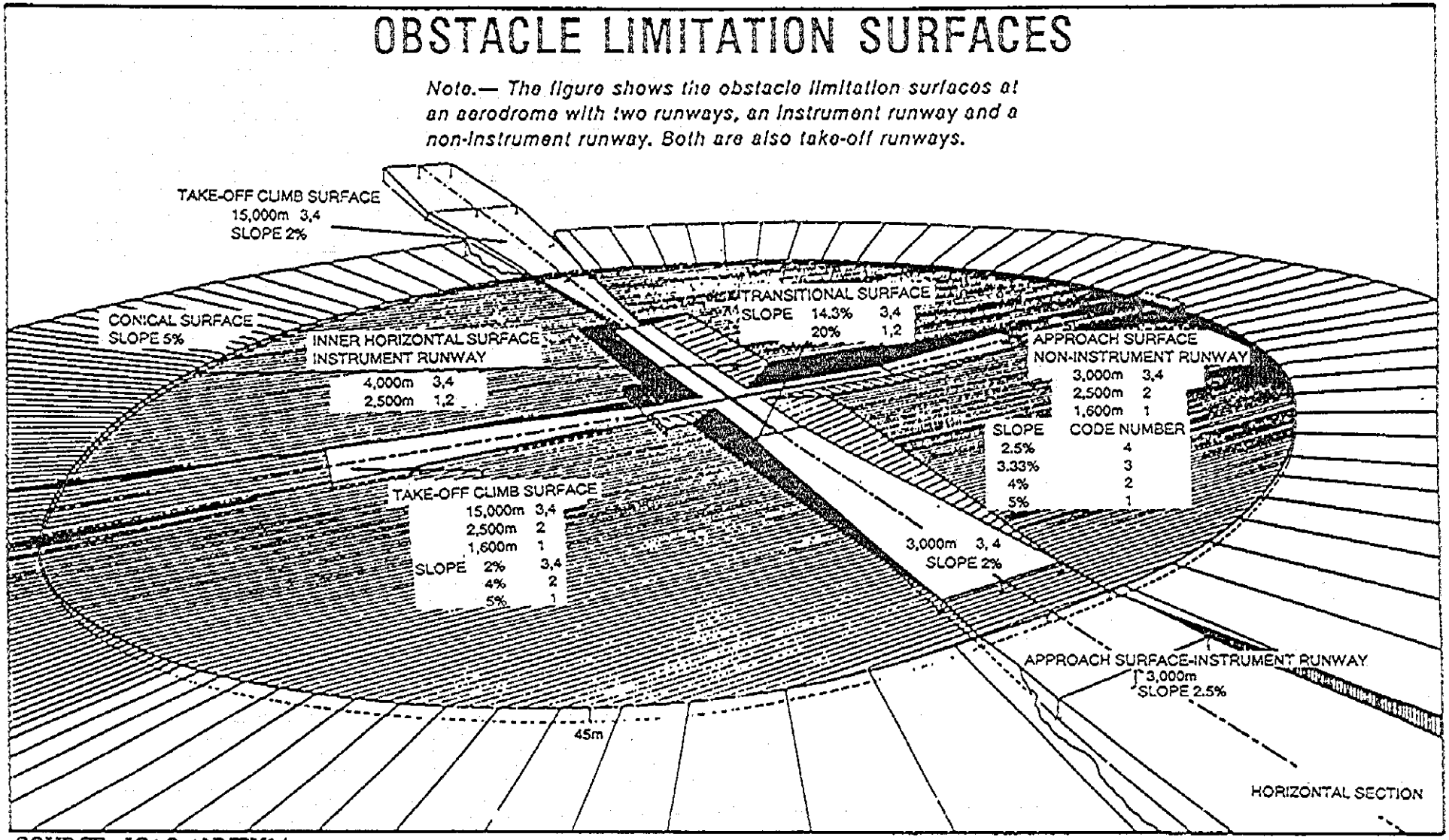
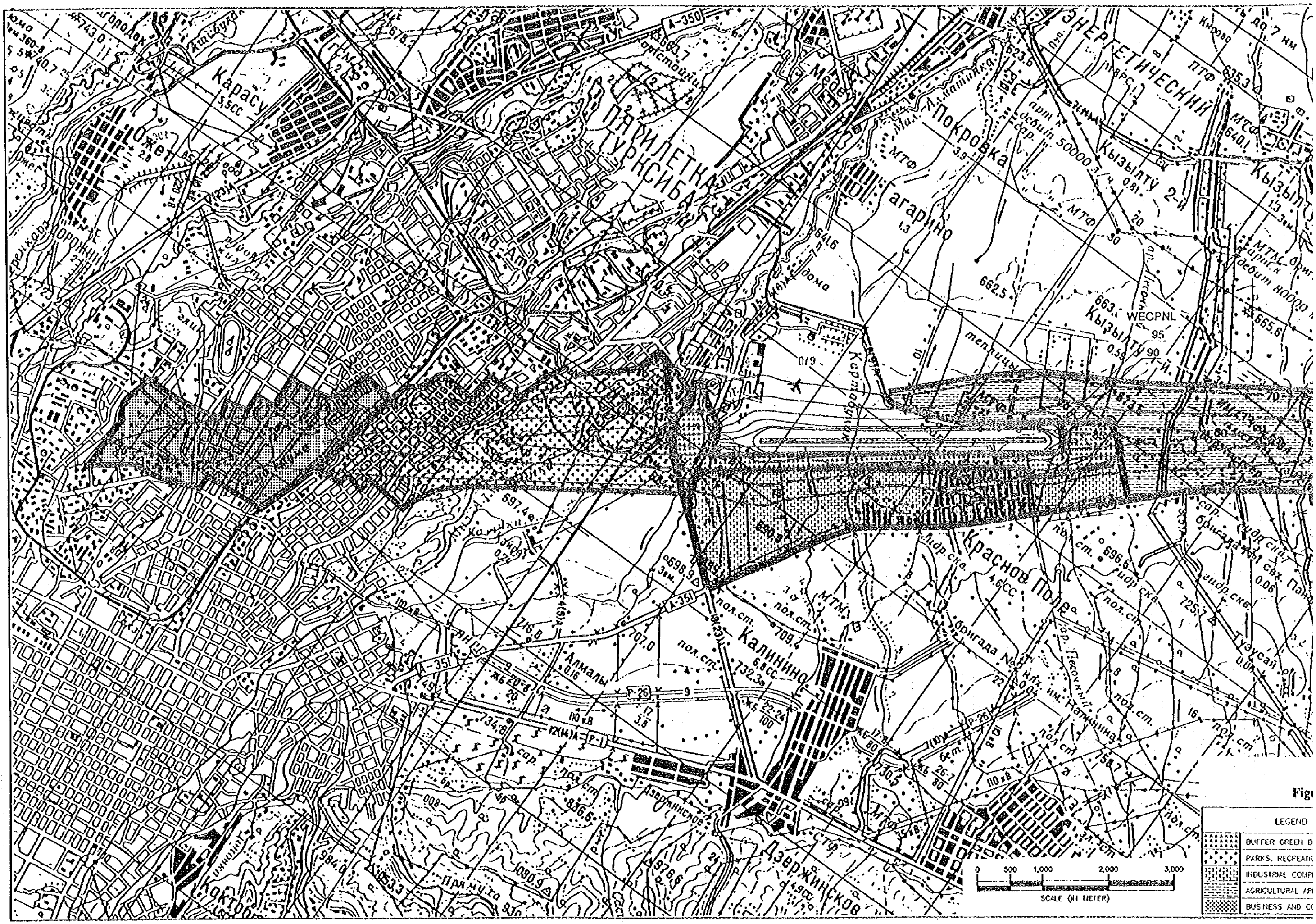


Figure 6.2.2.6 Current Land Use at Pavlodar Airport and its Surrounding Area

Figure 6.2.3.1 Obstacle Limitation Surfaces of ICAO



SOURCE : ICAO ANNEX14



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Гагарино
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Энергетический
WECPNL
Картабулак
Красное Поле
Калинино
Алмалы
А-351
Р-26
Дзержинское

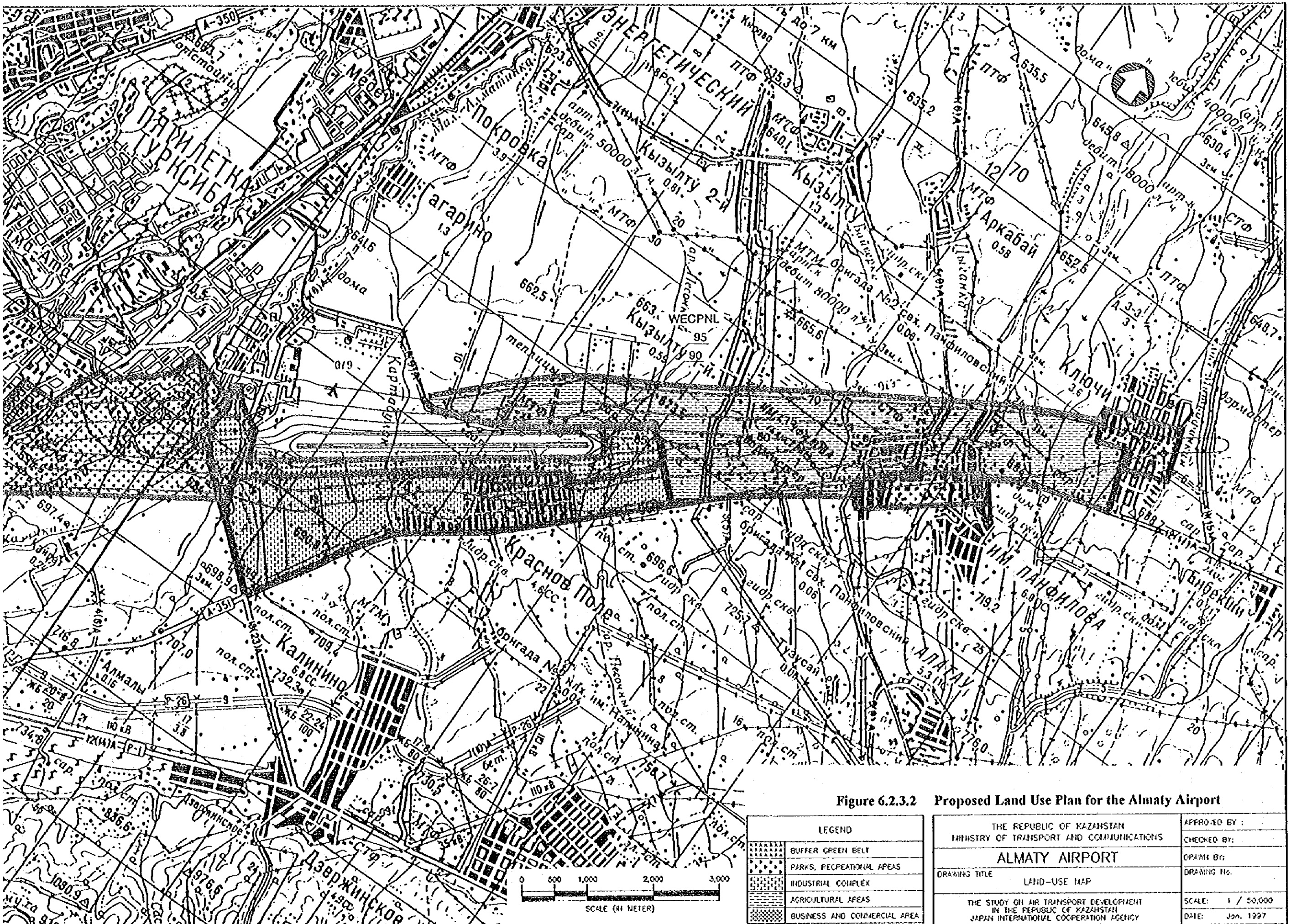
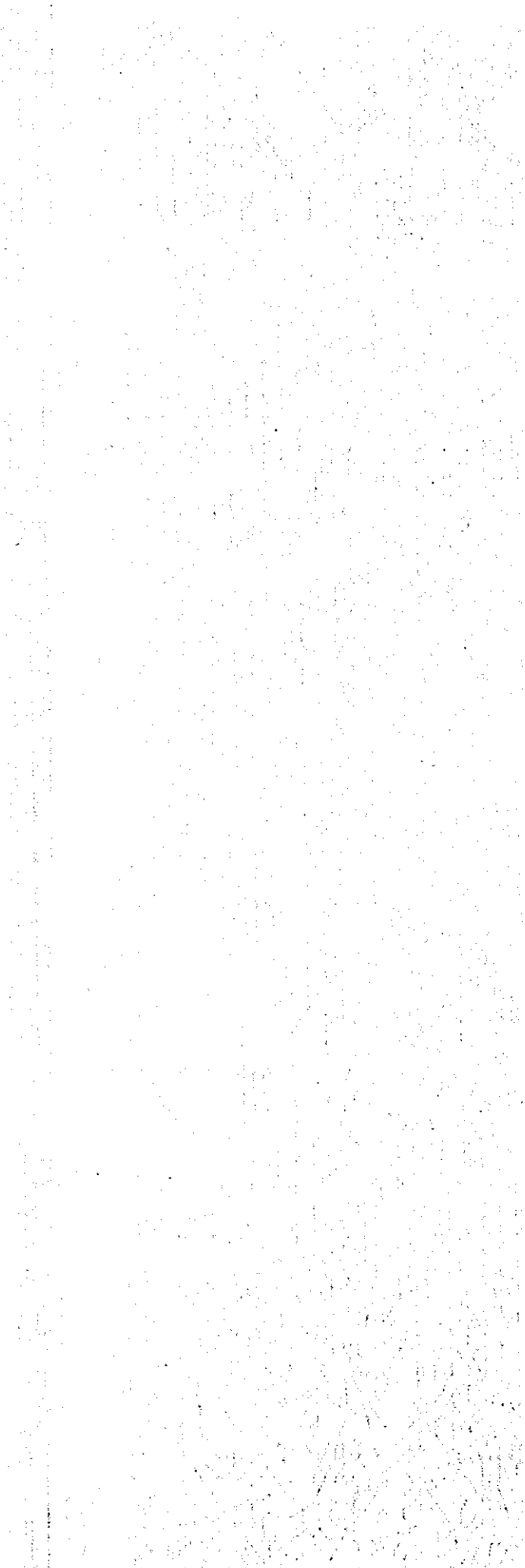


Figure 6.2.3.2 Proposed Land Use Plan for the Almaty Airport

LEGEND
BUFFER GREEN BELT
PARKS, RECREATIONAL AREAS
INDUSTRIAL COMPLEX
AGRICULTURAL AREAS
BUSINESS AND COMMERCIAL AREA

THE REPUBLIC OF KAZAHSTAN MINISTRY OF TRANSPORT AND COMMUNICATIONS	APPROVED BY :
ALMATY AIRPORT	CHECKED BY:
DRAWING TITLE LAND-USE MAP	DRAWN BY: DRAWING No.
THE STUDY ON AIR TRANSPORT DEVELOPMENT IN THE REPUBLIC OF KAZAHSTAN JAPAN INTERNATIONAL COOPERATION AGENCY	SCALE: 1 / 50,000 DATE: Jan. 1997



6.3 Construction Plan

The followings major considerations have been taken when planning airport development.

(1) Safety considerations are paramount. Work shall be scheduled to minimize the risk of accidents and not to impair the movement of aircraft.
(2) The time available for outdoor work will be limited by long winter seasons. Work and resource scheduling should take this into account.
(3) Certain items of equipment, some materials and some skilled labor will need to be imported. This requirements should be well planned in advance.
(4) A suitable quarry site capable of providing 200,000 cu.m of good quality aggregate should be secured.
(5) Asphalt concrete will be used for pavements because it can be used by aircraft soon after it has been laid.
(6) Mobilization will start during the winter season so that earthwork can be started as soon as the season ends.
(7) Prefabrication of major facilities components will be used wherever possible.

Construction schedule is shown in **Table 6.3.1**

Table 6.3.1 Construction Program

Work Items	Year	1	2	3
1	Civil Works	=========	=========	=========
1.1	Airside Facilities (Runway, Taxiway, Apron and Other Civil Works)	=========	=========	=========
1.2	Landside Facilities (Access Road, Terminal Road, Car Park and Other Civil Works)	=========		=========
2	Architectural Works	====	=========	=========
2.1	Passenger terminal Building	====	=========	=========
2.2	Administration building	====	=========	=======
2.3	Control Tower and navigation building		=========	=======
2.4	Other buildings	====	=========	=========
3	Airport Utilities		=========	=========
3.1	Air Navigation Systems	=========	=========	=========
3.2	Power supply	=========	=========	
3.3	Air-conditioning and heating facility		=========	=========
3.4	Sanitary works			=========
4	Test Operation and Flight Check etc.			= =

6.4 Cost Estimation

6.4.1 Premise

It was difficult to accurately estimate construction costs because very little infrastructure work has taken place in recent years and there is no developed market for construction materials.

Costs were estimated based on available information from the following sources.

(1) Airport staff and construction companies working in Kazakhstan.
(2) The JICA Road Study for Kazakhstan
(3) Computing reasonable equipment rental fees based on equipment prices and comparing these with actual rental fees being charged.
(4) Current salaries and wages of construction labor.
(5) Transportation costs of the various construction resources form point of origin.

The estimated costs for each designated airport are summarized in **Table 6.4.1** following tables.

Table 6.4.1 Cost Estimates for Designated Airports (2005)

US$ / KZT = 70.3

Cost Item \ Airport	Akmola (US$ 1,000)	Almaty (US$ 1,000)	Aktau (US$ 1,000)	Aktyubinsk (US$ 1,000)	Atyrau (US$ 1,000)	Pavlodar (US$ 1,000)
A. Compensation	8,748	400	0	0	0	0
B. Preliminary General Cost	25,779	32,144	13,198	13,488	18,473	18,591
C. Construction / Installation	151,577	155,408	74,146	64,464	77,440	75,265
1 Civil Works	26,453	34,031	3,713	10,869	9,666	11,148
2 Architectural Works	48,760	56,870	19,120	14,623	19,627	16,272
3 Air Navigation Systems	26,103	32,658	20,998	22,230	20,715	20,998
4 Supporting Facilities	28,982	3,363	16,772	3,957	13,498	12,516
5 Special Equipment	7,499	14,358	6,802	6,926	6,895	7,489
6 Contingencies	13,780	14,128	6,741	5,860	7,040	6,842
D. Construction Cost	186,104	187,953	87,344	77,952	95,913	93,856
E. Consulting Cost	15,158	15,541	7,415	6,446	7,744	7,526
Project Cost	**201,262**	**203,493**	**94,758**	**84,398**	**103,657**	**101,383**

Detailed cost estimates for each airport appears in **Tables 6.4.2 to 6.4.7.** and further break-down costs are shown in Volume III of the report.

Table 6.4.2 Cost Estimates for Akmola Airport (2005)

US$ / KZT = 70

Work Items			Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A	Compensation		0	615,000	8,748	615,000	Land acquisition
B	Preliminary and General		16,425	657,542	25,779	1,812,244	
C	Construction / Installation		87,376	3,544,659	137,798	9,687,172	
	1	Civil Works	13,237	929,130	26,453	1,859,678	
		i Airside	12,468	737,596	22,960	1,614,098	
		ii Landside	769	191,534	3,493	245,580	
	2	Architectural Works	26,818	1,542,523	48,760	3,427,828	
	3	Air Navigation Systems	20,492	394,427	26,103	1,835,017	
	4	Supporting Facilities	20,080	625,861	28,982	2,037,454	
		i Power Supply	2,804	21,899	3,115	218,988	
		ii Outdoor Lighting	119	933	133	9,332	
		iii Sanitary Works	220	55,150	1,004	70,596	
		iv Communication syster	13	3	13	884	
		v Air-conditioning & hea	11,615	544,336	19,358	1,360,840	
		vi Fuel Supply System	5,310	3,540	5,360	376,814	
	5	Special Equipment	6,749	52,719	7,499	527,195	
D	Total of (B + C)		103,801	4,202,202	163,576	11,499,416	
E	Contingencies		8,738	354,466	13,780	968,717	10% of C
F	Total of (D+ F)		112,539	4,556,668	177,356	12,468,133	
G	Consulting Cost		9,611	389,913	15,158	1,065,589	10% of (C+E)
H	Grand Total		122,150	5,561,580	201,262	14,148,722	A+F+G

Table 6.4.3 Cost Estimates for Almaty International Airport (2005)

US$ / KZT= 70

Work Items			Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A	Compensation		0	28,120	400	28,120	For noise pollution
B	Preliminary and General		19,028	922,065	32,144	2,259,734	
C	Construction / Installation		91,697	3,479,074	141,280	9,932,009	
	1	CivilWorks	19,420	1,027,161	34,031	2,392,377	
		i Airside	18,319	860,271	30,556	2,148,089	
		ii Landside	1,101	166,890	3,475	244,288	
	2	Architectural Works	31,279	1,799,082	56,870	3,997,961	
	3	Air Navigation Systems	25,146	528,109	32,658	2,295,886	
	4	Supporting Facilities	3,015	24,449	3,363	236,407	
		i Power Supply	2,804	21,899	3,115	218,988	
		ii Outdoor Lighting	119	933	133	9,332	
		iii Sanitary Works	92	1,618	115	8,088	
		iv Communication syster	0	0	0	0	
		v Airconditioning & hea	0	0	0	0	
		vi Fuel Supply System	0	0	0	0	
	5	Special Equipment	12,837	100,272	14,358	1,009,377	
D	Total of (B + C)		110,725	4,401,139	173,425	12,191,743	
E	Contingencies		9,170	347,907	14,128	993,201	10% of C
F	Total of (D + E)		119,894	4,749,046	187,553	13,184,944	
G	Consulting Cost		10,087	382,698	15,541	1,092,521	10% of (C + E)
H	Grand Total Amount		129,981	5,159,865	203,4930	14,305,585	A+F+G

Table 6.4.4 Cost Estimates for Aktau Airport, 2005 year

US$/KZT = 70.3

Work Items	Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A Compensation					
B Preliminary and General	8,406	336,857	13,198	927,790	
C Construction / Installation	49,689	1,010,041	67,406	4,738,619	
1 Civil Works	1,955	123,560	3,713	261,025	
i Airside	1,735	73,163	2,776	195,138	
ii Landside	220	50,397	937	65,887	
2 Architectural Works	10,516	604,861	19,120	1,344,136	
3 Air Navigation Systems	16,919	51,363	20,998	1,476,176	
4 Supporting Facilities	14,177	182,438	16,772	1,179,090	
i Power Supply	1,816	14,184	2,018	141,844	
ii Outdoor Lighting	398	3,111	442	31,106	
iii Sanitary Works	92	1,618	115	8,088	
iv Communication system	13	3	13	884	
v Air-conditioning & heating system	9,204	161,752	11,504	808,761	
vi Fuel Supply System	2,655	1,770	2,680	188,407	
5 Special Equipment	6,122	47,819	6,802	478,193	
D Total of (B + C)	58,095	1,346,897	80,603	5,666,410	
E Contingencies	4,969	101,004	6,741	473,862	10% of C
F Total of (D + E)	63,064	1,447,901	87,344	6,140,272	
G Consulting Cost	5,466	111,104	7,415	521,248	10% of (C + E)
H Grand Total	68,530	1,559,006	94,758	6,661,520	

Table 6.4.5 Cost Estimates for Aktyubinsk Airport

US$/KZT= 70.3

Work Items	Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A Compensation					
B Preliminary and General	8,996	315,764	13,488	948,173	
C Construction / Installation	42,033	1,164,944	58,604	4,119,841	
1 CivilWorks	6,281	322,553	10,869	764,082	
i Airside	6,066	286,966	10,148	713,402	
ii Landside	215	35,587	721	50,680	
2 Architectural Works	8,042	462,583	14,623	1,027,962	
3 Air Navigation Systems	17,849	307,976	22,230	1,562,775	
4 Supporting Facilities	3,627	23,145	3,957	278,149	
i Power Supply	1,816	14,184	2,018	141,844	
ii Outdoor Lighting	119	933	133	9,332	
iii Sanitary Works	439	7,714	549	38,572	
iv Communication system	1,253	313	1,257	88,402	
v Airconditioning & heating system	0	0	0	0	
vi Fuel Supply System	0	0	0	0	
5 Special Equipment	6,233	48,687	6,926	486,873	
D Total of (B + C)	51,029	1,480,708	72,091	5,068,014	
E Contingencies	4,203	116,494	5,860	411,984	10% of C
F Total of (D + E)	55,232	1,597,202	77,952	5,479,998	
G Consulting Cost	4,624	128,144	6,446	453,183	10% of (C+E)
H Grand Total	59,855	1,725,346	84,398	5,933,181	A+F+G

Table 6.4.6 Cost Estimates for Atyrau Airport

KZT / US$ = 70.3

	Work Items	Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A	Compensation	0	0	0	615,000	
B	Preliminary and General	12,675	407,574	18,473	1,298,624	
C	Construction / Installation	52,835	1,234,872	70,400	4,949,126	
	1 Civil Works	5,931	262,568	9,666	679,497	
	i Airside	5,715	207,357	8,664	609,100	
	ii Landside	216	55,211	1,001	70,397	
	2 Architectural Works	10,795	620,884	19,627	1,379,743	
	3 Air Navigation Systems	16,721	280,802	20,715	1,456,268	
	4 Supporting Facilities	13,183	22,145	13,498	948,923	
	i Power Supply	1,816	14,184	2,018	141,844	
	ii Outdoor Lighting	119	933	133	9,332	
	iii Sanitary Works	558	4,355	619	43,549	
	iv Communication system	1,416	354	1,421	99,894	
	v Air-conditioning & heating system	9,274	2,319	9,307	1,360,840	
	vi Fuel Supply System	0	0	0	376,814	
	5 Special Equipment	6,206	48,473	6,895	484,696	
C	Total of (B + C)	65,510	1,642,446	88,873	6,247,750	
D	Contingencies	5,283	123,487	7,040	494,913	10% of C
E	Total of (D + E)	70,793	1,765,933	95,913	6,742,663	
F	Consulting Cost	5,812	135,836	7,744	544,404	10% of (C + E)
G	Grand Total	**76,605**	**1,901,769**	**103,657**	**7,902,067**	A+F+G

Table 6.4.7 Cost Estimates for Pavlodar Airport

US$ / KZT = 70.3

	Work Items	Foreign Total (US$ 1,000)	Local Total (KZT 1,000)	Combined Total (US$ 1,000)	Combined Total (KZT 1,000)	Remarks
A	Compensation	0	0	0	0	
B	Preliminary and General	12,542	425,257	18,591	1,306,980	
C	Construction / Installation	50,080	1,290,133	68,422	4,810,101	
	1 Civil Works	6,512	325,868	11,148	783,687	
	i Airside	6,145	253,220	9,747	685,182	
	ii Landside	368	72,648	1,401	98,505	
	2 Architectural Works	8,949	514,749	16,272	1,143,886	
	3 Air Navigation Systems	16,919	286,774	20,998	1,476,176	
	4 Supporting Facilities	10,951	110,023	12,516	879,849	
	i Power Supply	2,804	21,899	3,115	218,988	
	ii Outdoor Lighting	119	933	133	9,332	
	iii Sanitary Works	900	7,030	1,000	70,300	
	iv Communication system	13	3	13	884	
	v Air-conditioning & heating system	4,460	78,388	5,575	1,360,840	
	vi Fuel Supply System	2,655	1,770	2,680	376,814	
	5 Special Equipment	6,749	52,719	7,489	526,504	
D	Total of (B + C)	62,623	1,715,391	87,014	6,117,081	
E	Contingencies	5,008	129,013	6,842	481,010	10% of C
F	Total of (C+ E)	67,631	1,844,404	93,856	6,598,091	
G	Consulting Cost	5,509	141,915	7,526	529,111	10% of (C+ E)
H	Grand Total	**73,140**	**1,986,319**	**101,383**	**7,127,202**	A+F+G

6.5 Environmental Impact Analysis

6.5.1 Akmola

As a result of the Initial Environmental Evaluation, the following items were examined in the Environmental Impact Analysis: hazards (risk of aircraft accidents), flora and fauna (migratory birds), air pollution, water pollution (treatment of airport surface water), noise (aircraft noise levels), land subsidence, and environmental impact during the construction phase (muddy water discharge).

(1) Hazards

a) Aircraft Accidents

According to ICAO data (Annual Report of the Council, 1995), the rate of fatal aircraft accidents in 1995 was approximately 1.3 per 1,000,000 aircraft landings. In Japan, from 1975 through 1994, large aircraft takeoff accidents comprised 5.2% of the total number of aircraft accidents and landing accidents made up 25.3% of the total (large aircraft total-30.5%). Small aircraft takeoff accidents comprised 7.9% of the total number of aircraft accidents and landing accidents made up 35.9% of the total (small aircraft total-43.8%). Statistically, most accidents occur during the few minutes of takeoff and landing. Therefore, it is reasonable to think that, in the event of an aircraft accident, the chances of the areas around the ends of the runway suffering damage are high.

Forecast: Around Akmola airport, there are presently few dwellings near the ends of the runway. As shown in the Present Land Use Plan (**Figure 6.2.2.1**), with the movement of the capital in the future, and alternative land use, dwellings will not be permitted in those areas and disasters will be kept to a minimum.

b) Collision with birds

In the provinces of the former U.S.S.R., every year 30-50 cases of engine damage were caused by some 1500 collisions with birds. Of these collisions, 61% occurred at altitudes under 100m, while 25% occurred in the range of 100-600m (Yakoby, 1974). 41 families, 19 genera, 74 species, and 105 sub-species of birds have been reported as residing in the vicinity of Akmola airport. Of these, 56% are waterfowl which live in wetlands, 31% are sparrow-type birds, and 8% are predatory birds. There are many wetlands near the airport, for example Maibalyk Lake (250 sq. km.), and numerous grey geese, riverine ducks, coots, and mallards are sighted. There are a small number of seagulls, sandpipers, and flamingos. In addition, magpies, sparrows, marsh harriers, rock doves, quail, grey crows, rooks, larks, and wheatears have been reported.

According to information from the Aeronavigation Service, birds from Maibalyk Lake can be found in the areas in which aircraft fly year-round, excluding winter. In rare cases, geese, occasionally diving ducks, and often silverish and lake gulls are seen. The number of birds increase during the migratory season and decrease in the winter, leaving only doves, magpies, and sparrows. Occasionally in the spring large flocks of seagulls land on the runway and are run off with firecrackers. The carcass

of a seagull which collided with an airplane was found on the runway on just one occasion. In spite of large numbers of rock doves in the area, there have been no reported collisions with them.

Forecast: The number of flights using the airport will increase dramatically. As number of flights using the airport will increase dramatically, it is believed that the number of birds living in the airport area will diminish. However, while there have been no reported collisions with large birds, in the future continuous vigilance is necessary. If the need arises, it will be necessary to consider taking countermeasures to the birds.

(2) Fauna and Flora (Migratory Birds)

There are many migratory birds in the vicinity of the airport in spring and fall with few in summer and winter. In March, swans and gray geese are seen. In April, migration increases and wild ducks, garganeys, widgeons, ruddy shelducks and pochards are seen. At this time, sandpipers migrate in. In May, the movement of migrating birds temporarily stops and local birds start actively moving. In July, northern sandpipers migrate in. This means that in May as well as July and August, the flight of birds and aircraft are in conflict. At the end of September and in October, migration slows and local birds become active. In the winter, there are few birds in the area. This period is one of intensive migration for most riverine and diving ducks as well as gray geese and barnacles. During the winter, there are few birds in the vicinity of the airport. During the spring, the main direction of the migrating birds is north or northeast, while in the autumn the reverse, south or southwest, is true. The majority of the wetland species migrate at heights of 80-300m.

Forecast: The airport vicinity is part of the migration route. In the future, the number of flights using the airport will increase markedly. If the migrating birds find the airport environment not to their liking, it is possible that they will select another route with a more suitable environment. At any rate, it is advisable to pay attention to whether or not there are changes in the migration routes.

(3) Air Pollution

There are no air pollution measurement sites near the airport. The closest measurement site is about 15km from the airport in Akmola city. Average annual values are shown below. Akmola city is located in a range from 14 - 22km from the airport.

Measurement site: Meteoroligical bureau site in an "Economy Chemistry" factory (Dzhambyl str.).

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.003	0.023	2.1
1994	0.002	0.013	0.3
1995	0.003	0.022	1.0

Measurement site: Municipal hospital

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.002	0.021	1.9
1994	0.001	0.023	0.4
1995	0.002	0.022	1.5

The environmental standards for air pollution are daily averages and are: 0.05 mg/m3 for SO2, 0.04 mg/m3 for NO2, and 3.0 mg/m3 for CO; converting to yearly averages gives: 0.027 mg/m3 for SO2, 0.020 mg/m3 for NO2, and 1.26 mg/m3 for CO. Therefore, the data from these measurement sites show that while SO2 levels are below the maximum permitted levels, most NO2 levels exceed the standards and some CO levels also go over the standards.

Forecast: In Akmola, in the year 2005, it is forecast that the demand for passenger service and cargo volume will be 8-9 times present levels, with 8-9 times the current number of flights and arrivals. It is thought that SO2 levels will not exceed the environmental standards, while levels of both NO2 and CO will. In addition to investigating how much exhaust gas from aircraft contributes to air pollution, it is advisable to consider the use of fuel-efficient aircraft engines.

(4) Water Pollution (Treatment of airport surface water)

In order to check the level of pollution of the surface water at the airport, and because this water flows into Maibalyk Lake, an analysis of the water quality at Maibalyk Lake was done. The measurement points are shown in **Figure 6.5.1.1**, and the measurement results are shown below.

Measurement dates: October 9-10, 1996.

Point	Distance fr. Shore	Water Depth	Water Temp.	pH	O2	BOD	COD	Phenol	Oil
	(m)	(m)	(_C)		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
No.1	250	0.5	7.0	7.3	6.85	2.14	38.5	0.001	0.05
No.2	250	0.5	8.7	7.9	8.75	2.16	45.4	0.002	0.03
M.P.V		-	-	-	over 4	3.0	-	0.001	0.05

M.P.V.: Maximum permitted values in Kazakhstan.

From the above data, the water quality of Maibalyk Lake, altered by the surface water from the airport which flows into the lake during periods of rain, is near the maximum permitted values.

Forecast: Since the amount of equipment utilized at the airport will also increase in the future, airport waste water should be continuously monitored and, if necessary, treated chemically.

(5) Noise (Aircraft Noise Levels)

Forecast: **Figure 6.5.1.2** shows aircraft noise contour forecast for the year of 2020 with the weighted equivalent continuous perceived noise level (WECPNL), which was proposed by ICAO as an evaluation unit for aircraft noise. In this forecast, all the aircraft were assumed to be converted to low-noise type by 2020. It is expected that influence by the the aircraft noise would be small enough because of comparatively low traffic. However it is desirable to make alternative land use plan based on the magnitude of aircraft noise in the vicinity and to regulate dwellings there to avoid problems in the future.

(6) Land Subsidence

As there is neither subsidence-causing peat nor plans for new wells, subsidence should not occur.

(7) Environmental Impact During Construction Phase (muddy water discharge)

The construction work is primarily renovation of the existing airport and seemingly will have little environmental impact. However, it is necessary to plan so that there is no negative impact from the construction on the surrounding environment and follow through with that plan.

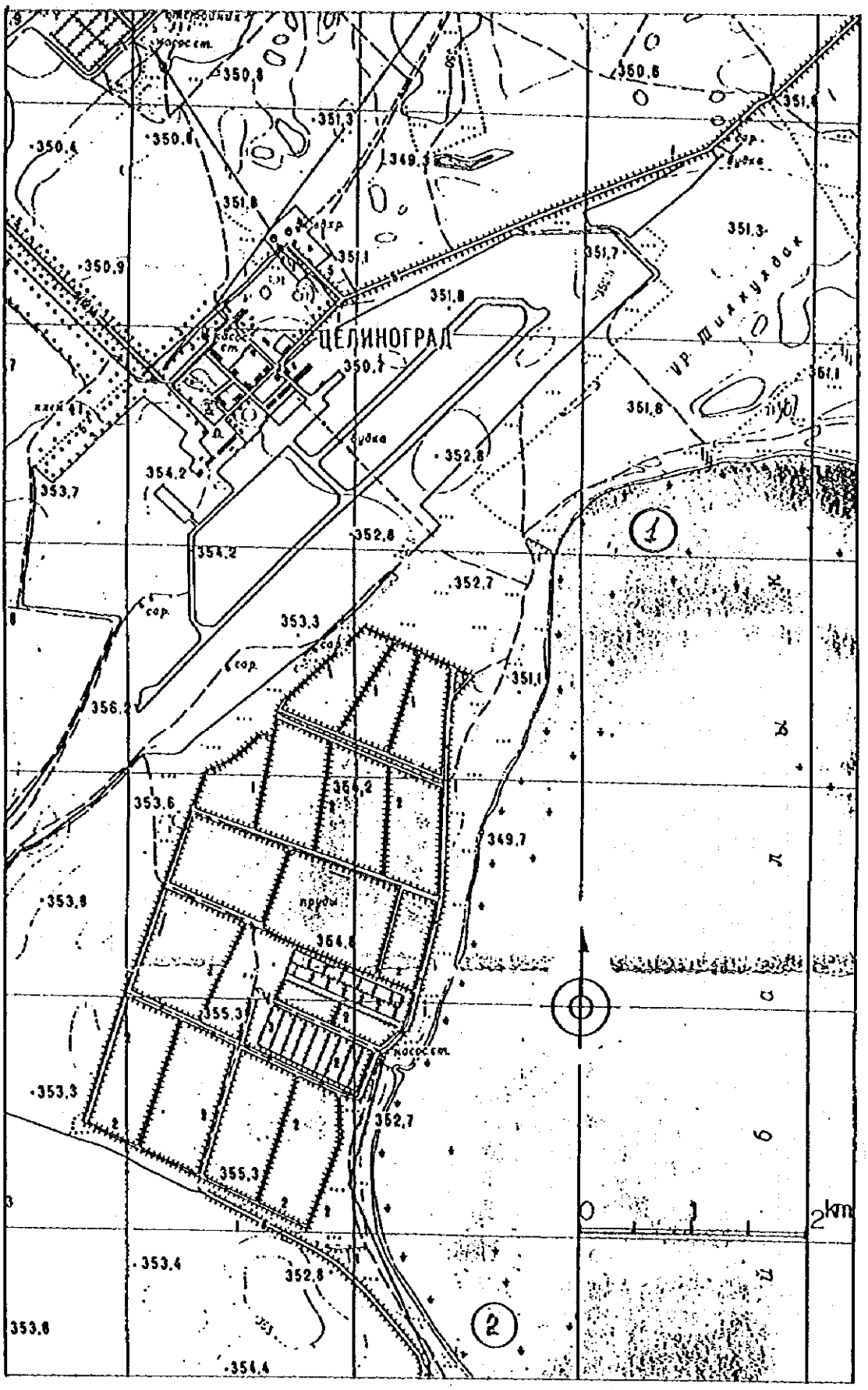


Figure 6.5.1.1 Water Quality Survey Points (Akmola)

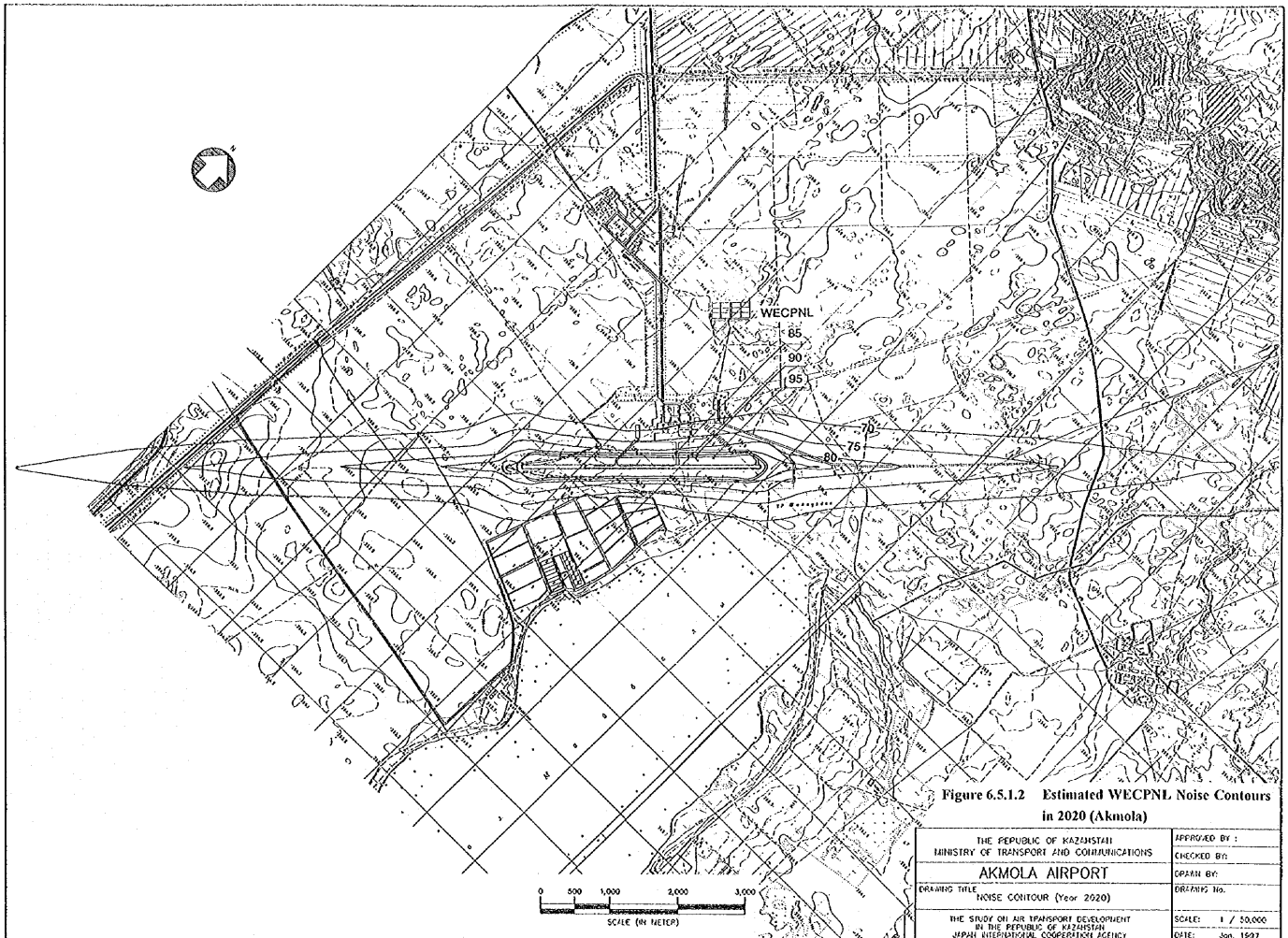


Figure 6.5.1.2 Estimated WECPNL Noise Contours in 2020 (Akmola)

THE REPUBLIC OF KAZAKHSTAN MINISTRY OF TRANSPORT AND COMMUNICATIONS	APPROVED BY :
	CHECKED BY:
AKMOLA AIRPORT	DRAWN BY:
DRAWING TITLE NOISE CONTOUR (Year 2020)	DRAWING No.
THE STUDY ON AIR TRANSPORT DEVELOPMENT IN THE REPUBLIC OF KAZAKHSTAN JAPAN INTERNATIONAL COOPERATION AGENCY	SCALE: 1 / 50,000 DATE: Jan. 1997

6.5.2 Aktyubinsk

As a result of the Initial Environmental Evaluation, the following items were examined in the Environmental Impact Analysis: hazards (risk of aircraft accidents), groundwater, air pollution, noise (aircraft noise levels), and environmental impact during the construction phase (muddy water discharge).

(1) Hazards (Risk of Aircraft Accidents)

Like Akmola, in the event of an aircraft accident at Aktybinsk, the areas around the ends of the runways have a significant chance of suffering damage. Consequently, it is advisable that settlement of the area be prevented by means of alternative land use and regulation.

(2) Groundwater

At present, 2 wells (4-19m deep) are being used to supply drinking water. It is expected that the usage of the airport in the year 2005 will not reach the levels in 1990, the year of maximum airport use.

Therefore, it is thought that water demand in the year 2005 will be less than that in 1990 and that the wells will neither run dry nor become polluted.

(3) Air Pollution

The closest air pollution measurement site is the one at the airport terminal and the next closest site is in Aktybinsk city, 9km to the west. Average annual values are shown below.

Measurement site: Airport

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.028	0.041	0.6
1994	0.024	0.041	1.3
1995	0.026	0.040	1.2

Measurement site: Pobeda str.,2

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.030	0.054	1.4
1994	0.026	0.046	2.6
1995	0.031	0.050	2.7

When compared against the same standards as used at Akmola, the SO2 values measured at the airport did not exceed the standards, while the values of NO2 and CO exceeded the standards at both the airport and the city measurement sites.

Forecast: It is forecast that in Aktybinsk in the year 2005, both passenger traffic and cargo volume will be approximately twice current levels. As it is believed that the number of both arriving and departing flights will also double, it is presumed that the levels of SO2, NO2, and CO will exceed the standards. In addition to determining the degree to which aircraft exhaust contributes to air pollution, it is recommended that the use of

fuel-efficient aircraft engines be considered.

(4) Noise (Aircraft Noise Levels)

Forecast: **Figure 6.5.2.1** shows aircraft noise contour forecast for the year of 2020 with the weighted equivalent continuous perceived noise level (WECPNL), which was proposed by ICAO as an evaluation unit for aircraft noise. In this forecast, all the aircraft were assumed to be converted to low-noise type by 2020. It is expected that influence by the the aircraft noise would be small enough because of comparatively low traffic. However it is desirable to make alternative land use plan based on the magnitude of aircraft noise in the vicinity and to regulate dwellings there to avoid problems in the future.

(5) Environmental Impact during Construction Phase (Muddy Water Discharge)

The construction work is primarily renovation of the existing airport and seemingly will have little environmental impact. However, it is necessary to plan so that there is no negative impact from the construction on the surrounding environment and to follow through with that plan.

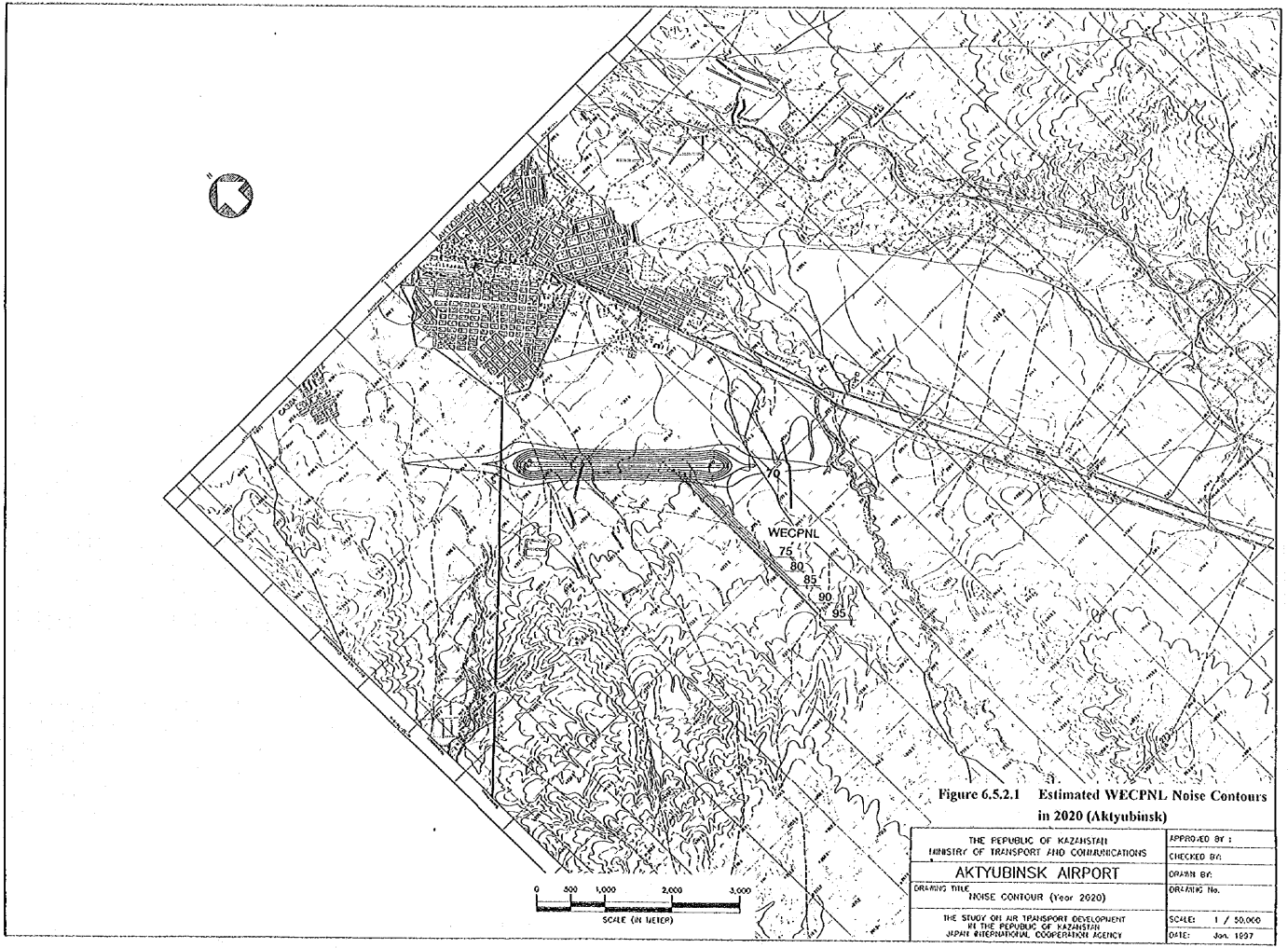


Figure 6.5.2.1 Estimated WECPNL Noise Contours in 2020 (Aktyubinsk)

6.5.3 Almaty

As a result of the Initial Environmental Evaluation, the following items were examined in the Environmental Impact Analysis: motor vehicle noise levels, hazards (risk of aircraft accidents), air pollution, water pollution, noise (aircraft noise levels), and the environmental impact during the construction phase (muddy water discharge).

(1) Motor Vehicle Noise Levels

In order to determine the traffic noise levels on the access roads to the airport, a survey was performed. The details and results of the survey are shown below.

Survey date: Oct. 22, 1996 (Tues.), 8:39 a.m.- 8:47 p.m.

Survey location: In Almaty city, about 1km from the airport terminal, at the edge of the road.

Survey road: Width, about 15m; 4 lanes; with a center strip.

Traffic volume: In the near lane, 71 vehicles (toward the airport); in the far lane, 77 vehicles (away from the airport).

Survey results: Noise level (average power), 78dB(A)

According to Kazakhstan standards, noise for which there are no specific regulations, like traffic noise, are regulated by assessing a value 5dB(A) below the actually measured value. Therefore, our survey results would yield an assessed value of 73dB(A), which surpasses the highest noise limits in Kazakhstan (60dB(A), for gymnasiums, airports, and inside train stations) by about 10dB(A).

Forecast: It is expected that the noise levels on the access roads to the airport will increase in the future due to the increase in traffic volume resulting from both the increasing utilization of the airport and the increasing usage of automobiles. On the other hand, the increasing usage of automobiles may be tempered by the construction of a subway system, thereby reducing traffic noise levels. In addition to continuous monitoring of the situation, it may be necessary to take measures such as constructing soundproof walls and prohibiting residential areas near the roads.

(2) Hazards (Risk of Aircraft Accidents)

The situation here is similar to that at Akmola. The areas around the ends of the runway are particularly susceptible to damage in the event of an aircraft accident and, as such, dwellings should be discouraged from the area by regulatory action and alternative land use plan.

(3) Air Pollution

The measurement sites nearest the airport are located 9km to the west and 9km to the southwest of the airport. The average yearly values from these sites are shown below.

Measurement site: Ainubulak microregion (9km west)

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.021	0.081	2.4
1994	0.020	0.063	2.4
1995	0.020	0.090	2.4

Measurement site: Kopernic str. (Malaya stanitsa) (9km southwest)

Year	SO2(mg/m3)	NO2(mg/m3)	CO(mg/m3)
1993	0.019	0.082	2.8
1994	0.014	0.052	2.7
1995	0.020	0.070	2.6

When compared with the same standards that were used for Akmola, SO2 values did not exceed the standards at any measurement site, while values for NO2 and CO exceeded the standards at all sites.

Forecast: It is forecast that, in the year 2005, both passenger and cargo volume at Almaty airport will be three times the present levels, with departing and arriving flights also tripling. Whether SO2 will exceed the standards in the future is unclear, while it is presumed that NO2 and CO will exceed the standards. In addition to determining to what degree aircraft exhaust contributes to air pollution, it would be advisable to consider the use of fuel-efficient aircraft engines.

(4) Water Pollution (Treatment of the Surface Water at the Airport)

In order to check the level of pollution of the surface water at the airport, the water quality of the rivers into which water from the airport drains was analyzed. The measurement points are shown in **Figure 6.5.3.1** and the analysis results are shown below.

Measurement dates: Oct. 9-10, 1996.

Point	Water Temp.	Water Speed	pH	O2	BOD	COD	Phenol	Oil
	(°C)	(m/s)		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
No.1(upstream)	14.4	0.013	7.57	8.94	1.07	13.3	0.006	0.09
No.2(downstream)	14.2	0.96	7.57	8.95	1.08	9.99	0.002	0.08
No.3(upstream)	9.3	0.27	7.85	10.9	1.08	14.5	0.005	0.09
No.4(downstream)	13.0	0.23	7.67	9.58	1.07	21.1	0.004	0.15
M.P.V.	-	-	-	over 4	3.0	-	0.001	0.05

M.P.V.: Maximum Permitted Values in Kazakhstan.

Comparing the upstream point (point No.1) and the downstream point (point No. 2) of one river, which are located on opposite sides of the airport, it appears that the surface water from the airport does not pollute this river. However, when comparing the upstream point (point No.3) and the downstream point (point No.4) of another river, two times the amount of oil was found at the downstream point compared with the upstream point. It is possible that local factories and automobile

transport are the source of this oil, but it is also possible that it is coming from water polluted with oil from the airport terminal.

Forecast: It is believed that usage of the airport will increase by the year 2005. Accordingly, in addition to performing a detailed study to determine the source of the pollution, it would be advisable to consider countermeasures such as treatment equipment and facilities.

(5) Noise (Aircraft Noise Levels)

In order to check the present level of noise at Almaty airport, a survey of aircraft noise levels was carried out. However, during the time period in which the survey was done, Oct.10 - Oct.16, departing and arriving flights were cancelled due to runway repair work. The survey points are shown in **Figure 6.5.3.2**. The survey results are as shown below.

Survey Site Dist. from runway	No. of flights	Max. Value dB(A)	Ave. Power all data dB(A)	Ave. Power 7:00-23:00 dB(A)	Ave. Power 23:00-7:00 dB(A)	WECP NL	No. of flights over 95dB(A)	No. of flights over 85dB(A)
1 6.0km	151	96	81	82	76	79	1	12
2 4.0km	144	105	90	91	80	87	5	39
3 0.5km east	154	100	89	89	83	88	10	46
4 2.0km	125	108	92	91	94	88	7	34
5 5.0km	124	106	89	84	91	84	3	23
6 6.5km	125	98	84	81	85	79	1	21

In Kazakhstan, the environmental standards relating to aircraft noise levels state that during the daytime (7 a.m.- 11 p.m.), a maximum level of 85dB(A) shall not be exceeded, and that during the night (11 p.m.-7 a.m.), a maximum level of 75dB(A) shall not be exceeded. In addition, at main airports like those at Almaty and Akmola, in the daytime, as long as the noise levels do not exceed 95dB(A), 10 instances of levels above 85dB(A) per day are permitted. When appraising the current noise levels, it is clear that they are not within the standards, regardless of where the survey was performed. On examining the difference in noise levels coming from various types of aircraft measured at sites 1 and 2, which are directly below the flight path, the following observations can be made. During takeoff, when compared with an A310, the Tu154, Il76, and Il86 are 8-14, 23-25, and 10-20dB(A) louder, respectively. During landing, the Tu154 and Il76 are 1-7 and 11-19dB(A) louder, respectively. In addition, the Tu134 has similar noise levels to the A310 during both takeoff and landing. It is apparent that the aircraft causing the

greatest amount of noise are the Tu154, Il76, Il86, which are aircraft from the former Soviet Union.

Forecast: It was confirmed based on measurements of aircraft noise that the noise level has already exceeded the maximum permissible level in the environmental standard of Kazakhstan. Taking it granted that the aircraft traffic will increase according to improvement and recovery in economic situation, it is desirable to consider countermeasures to control the aircraft noise. It is obvious by the actual measurement that major noise-source is the former-USSR-made aircraft. Therefore it is primarily recommended on the noise-source to convert or renovate those engines or aircraft themselves to those with low noise. Taking into consideration the fact that urbanization in the vicinity of the airport is in progress, it is recommended to make alternative land use plan, regulate dwellings against further urbanization and implement countermeasures to the traffic noise in order to improve the present situation.

Figure 6.5.3.3 shows aircraft noise contour forecast for the year of 2020 with the WECPNL.

(6) Environmental Impact During Construction Phase (Muddy Water Discharge)

The construction work is primarily renovation of the existing airport and seemingly will have little environmental impact. However, it is necessary to plan so that there is no negative impact from the construction on the surrounding environment and follow through with that plan.

Figure 6.5.3.1 Water Quality Survey Points (Almaty)

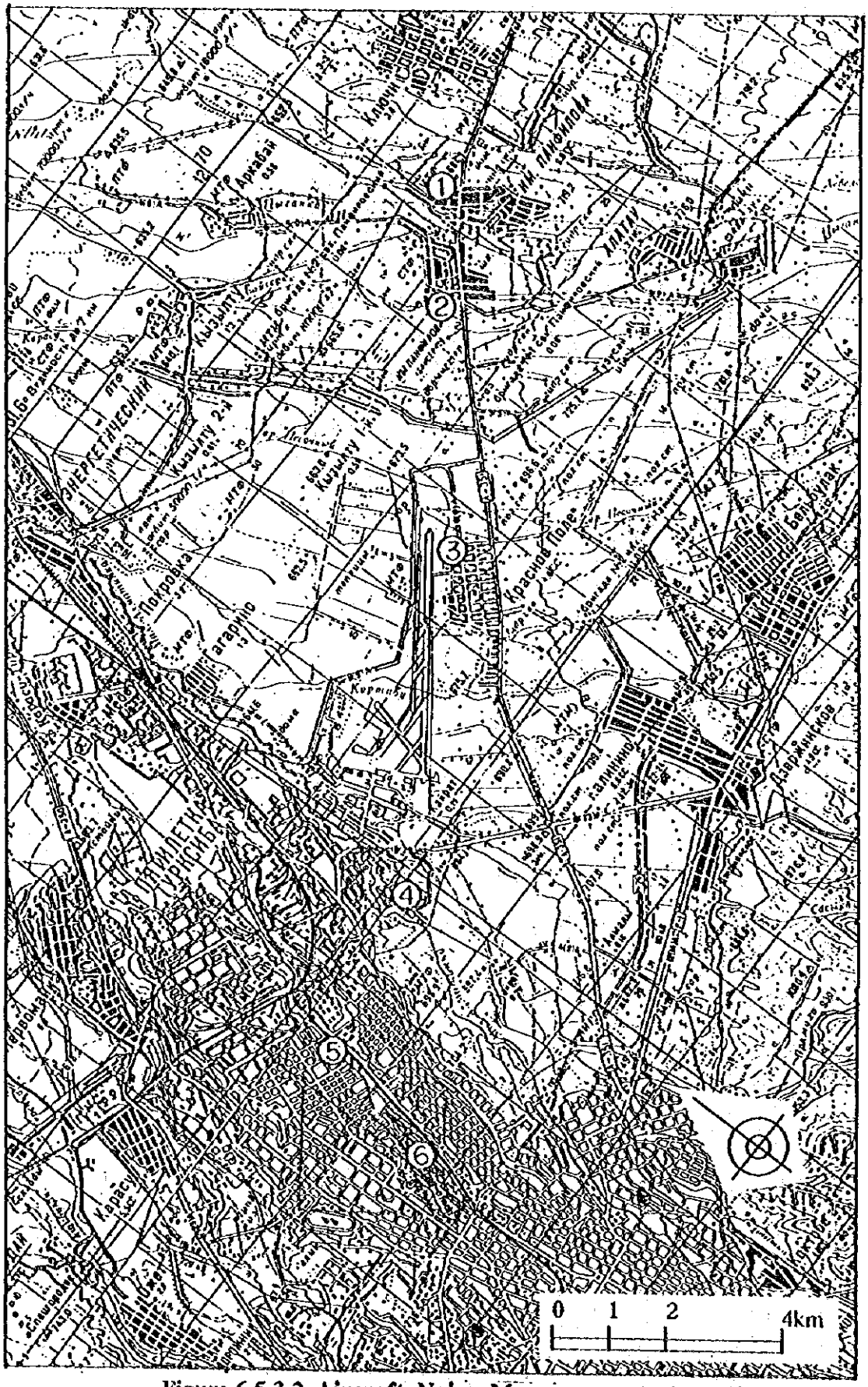
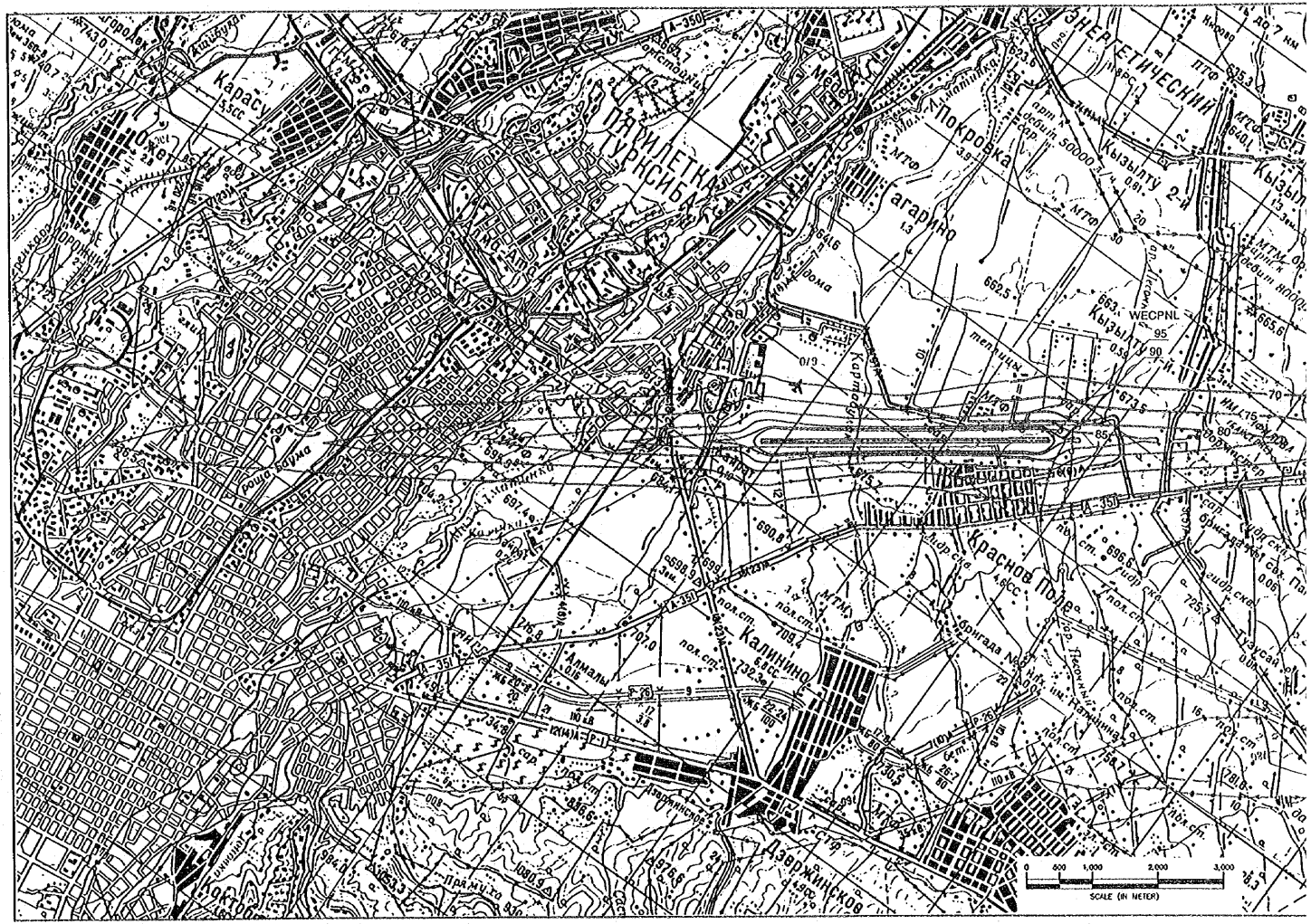


Figure 6.5.3.2 Aircraft Noise Measurment Points (Almaty)


Пятилетка
Покровка
Гагарино
Энергетический
Кызылту 2-й
Кызылту
Карасу
Окт
Красное Поле
Калинино
Дзержинское
WECPNL
95
90
SCALE (IN METER)
0
500
1,000
2,000
3,000

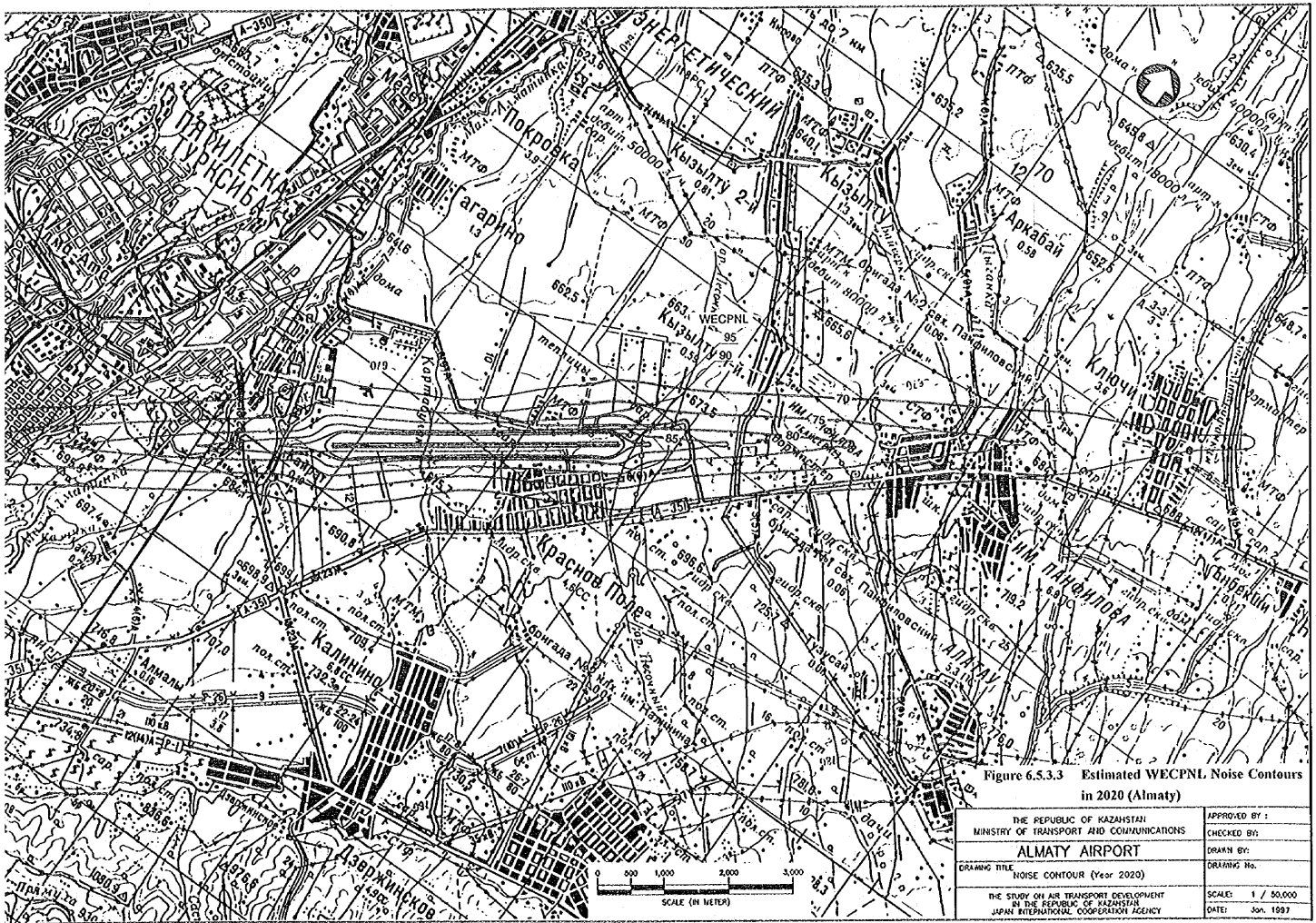


Figure 6.5.3.3 Estimated WECPNL Noise Contours in 2020 (Almaty)

THE REPUBLIC OF KAZAKHSTAN MINISTRY OF TRANSPORT AND COMMUNICATIONS	APPROVED BY :
	CHECKED BY:
ALMATY AIRPORT	DRAWN BY:
DRAWING TITLE NOISE CONTOUR (Year 2020)	DRAWING No.
THE STUDY ON AIR TRANSPORT DEVELOPMENT IN THE REPUBLIC OF KAZAKHSTAN JAPAN INTERNATIONAL COOPERATION AGENCY	SCALE: 1 / 50,000 DATE: Jan. 1997