

# Draft Environmental and Social Impact Assessment (Appendices)

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Project Number: 49360-001  
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## KAZ: BAKAD PPP Toll Road Project

Prepared by Environmental Resources Management (ERM) Eurasia.

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## Appendix 1: Air Quality Impact Assessment

## 2 ENVIRONMENTAL TOPICS

### 2.1 AIR QUALITY

#### 2.1.1 Summary of Baseline Findings and Sensitive Receptors

The geographical location of the Project area in the foothill of Ile Alatau (Trans-Ili Alatau) influences the climatic characteristics due to the existence of altitudinal zonation and mountain-and-valley air circulation.

According to the Köppen-Geiger climate classification, the climate within the Project area is defined as 'hot-summer humid continental climate'. The Project area lies in two boreal climate zones, Dfa and Dfb<sup>1</sup>.

The climate of the Project area is characterized by moderately cold winters, fast and humid mid-seasons, hot and dry long summers and relatively increased amount of average annual precipitation (compared to the surrounding area).

Mountain winds (with southern component), which bring cold air, are recorded shortly after sunset and continue until sunrise. During the day, the winds from the foothills towards the mountains (the Northern component) prevail.

According to the map of climatic zoning of SNiP 2.04-01-2001 (SNiP RK 2.04-01-2001 construction climatology) the subject area is situated in Climate Area III (Sub-area IIIB)<sup>2</sup>.

Air quality observations in the area of Almaty city are being conducted by national hydrometeorology service (Kazhydromet) on 11 monitoring stations, in 5 manual sampling points and in 4 points by mobile laboratories. All of them are located in the centre of the city and far from the BAKAD RoW. Air quality monitoring is carried out for the following parameters: particulate matter, sulphur dioxide, carbon monoxide, nitrogen dioxide, phenol and formaldehyde. The exceedances of the average daily MPC (MPC<sub>DA</sub>) and maximum permissible/allowable non-recurrent concentration (MPC<sub>MNR</sub>) were recorded during the measurements

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<sup>1</sup> Dfa = Hot-summer humid continental climate; coldest month averaging below  $-0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) (or  $-3^{\circ}\text{C}$  ( $27^{\circ}\text{F}$ )), at least one month's average temperature above  $22^{\circ}\text{C}$  ( $71.6^{\circ}\text{F}$ ), and at least four months averaging above  $10^{\circ}\text{C}$  ( $50^{\circ}\text{F}$ ). No significant precipitation difference between seasons (neither abovementioned set of conditions fulfilled).  
Dfb = Warm-summer humid continental climate; coldest month averaging below  $-0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) (or  $-3^{\circ}\text{C}$  ( $27^{\circ}\text{F}$ )), all months with average temperatures below  $22^{\circ}\text{C}$  ( $71.6^{\circ}\text{F}$ ), and at least four months averaging above  $10^{\circ}\text{C}$  ( $50^{\circ}\text{F}$ ). No significant precipitation difference between seasons (neither abovementioned set of conditions fulfilled).

<sup>2</sup> The moderate climate region. The average monthly air temperature in January varies from  $-5^{\circ}\text{C}$  to  $-14^{\circ}\text{C}$ ; the average monthly air temperature in July varies from  $+21^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$

In accordance with the information bulletin on the environmental conditions of the Republic of Kazakhstan (2017) (The RGP "Kazhydromet". Department of environmental monitoring) the level of air pollution in the area of Almaty is characterized as increased (API<sup>1</sup> - 6 units).

**Table 2.1-1** *Baseline concentrations of air pollutants based on State air quality monitoring network (Kazhydromet data)*

Pollutant (hazardous substance)	Air quality criteria <sup>2</sup> , mg/m <sup>3</sup>		Average baseline concentration, mg/m <sup>3</sup>	Average baseline concentration in MPC <sub>DA</sub>	Maximum single baseline concentration, mg/m <sup>3</sup>	Baseline concentration in MPC <sub>MNR</sub>
	MPC <sub>MNR</sub> <sup>3</sup>	MPC <sub>DA</sub> <sup>4</sup>				
Nitrogen oxide	0.4	0.06	0.04	0.7	0.70	1.8
Nitrogen dioxide	0.2	0.04	0.07	1.8	0.50	2.5
PM*	0.5	0.15	0.1708	1.1	0.7	1.4
PM-2.5	0.16	0.035	0.009	0.3	0.7	4.4
PM-10	0.3	0.06	0.03	0.5	1.0	3.3
Sulphur dioxide	0.5	0.05	0.056	1.1	1.738	3.5
Carbon monoxide	5.0	3.0	0.8	0.3	20	4.0
Phenol	0.01	0.003	0.0019	0.6	0.014	1.4
Formaldehyde	0.05	0.01	0.0123	1.2	0.049	0.98

Note: \* suspended matter - undifferentiated dust/aerosol;

<sup>1</sup> API is calculated using the following formula:  $I(n) = I(n) = \sum_{i=1}^n I_i = \sum_{i=1}^n (q_{av i} / MPC_{DA})^{C_i}$ , where  $q_{av i}$  is the annual average concentration of pollutant 'i'; MPC<sub>DA</sub> is the maximum permissible daily average concentration of this pollutant; C<sub>i</sub> is a dimensionless coefficient which enables to express the level of harmfulness of pollutant 'i' based on that of sulphur dioxide. The established C<sub>i</sub> values of 1.5, 1.3, 1.0 and 0.85 correspond to the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Hazard Class of a given pollutant in proportion to the sulphur dioxide level of harmfulness (Guideline RD 52.04.667-2005 [21])

<sup>2</sup> GN 2.1.6.3492-17 Maximum permissible/allowable concentrations of pollutants in the ambient air of urban and rural settlements (ГН 2.1.6.3492-17 "Предельно допустимые концентрации (ПДК) загрязняющих веществ в атмосферном воздухе городских и сельских поселений")

<sup>3</sup> Maximum permissible/allowable concentration, maximum non-recurrent (MPC<sub>MNR</sub>) is a concentration of a hazardous substance in the air of a residential locality which does not cause, when inhaled for 20-30 minutes, any reflex reactions in a human body

<sup>4</sup> Maximum permissible/allowable concentration, daily average (MPC<sub>DA</sub>) is a concentration of a hazardous substance (mg/m<sup>3</sup>) in the air of a residential locality which should not have any direct or indirect impact on a human being when inhaled continuously for an indefinitely long period

The assessment of atmospheric quality has been conducted in June 2018 as part of the baseline survey. The following parameters were sampled: concentration of nitrogen oxide (NO), nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO) and particulate matter in the air.

Atmospheric air sampling was carried out with portable gas analysers "GANK-4" produced by "NPO Pribor", LLC. The survey was performed on 14 points (1-time sampling (20 minutes average) and 4-time sampling (24-hour average) per point) in accordance with the national regulatory requirements<sup>1</sup>.

The location of the air sampling points is shown on the figure below (*Figure 2.1-1*).

Analysis of the air samples showed that the concentrations of carbon monoxide, nitrogen oxide, nitrogen dioxide, sulphur dioxide and particulate matter in most of the samples were below laboratory detection limit and significantly below the established standards (*Table 2.1-2*).

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<sup>1</sup> These include:

- RD 52.04.186-89 Guidelines on atmospheric air pollution control (РД 52.04.186-89 Руководство по контролю загрязнения атмосферы) – adopted in Kazakhstan as well ([http://online.zakon.kz/Document/?doc\\_id=31239132#pos=0;0&sel\\_link=1006306417](http://online.zakon.kz/Document/?doc_id=31239132#pos=0;0&sel_link=1006306417))
- GOST 17.2.6.02-85 Nature protection. Atmosphere. Automatic gas analyzers for atmospheric air pollution control. General technical requirements (ГОСТ 17.2.6.02-85 Охрана природы. Атмосфера. Газоанализаторы автоматические для контроля загрязнения атмосферы. Общие технические требования);
- ST RK 2036-2010 Guidelines on atmospheric air pollution control (СТ РК 2036-2010 Руководство по контролю загрязнения атмосферы);
- ST RK 2.302-2014 Determination with gas analyzers of mass concentration of pollutants in ambient air, working zone air and industrial emissions (СТ РК 2.302-2014 Определение массовой концентрации вредных веществ в атмосферном воздухе, в воздухе рабочей зоны, в промышленных выбросах газоанализатором)



Figure 2.1-1 Location of the air quality sampling points

**Table 2.1-2 Baseline concentrations of air pollutants based on the analysis of samples undertaken in 2018**

Air quality survey points	Carbon monoxide		Sulphur dioxide		Nitrogen oxide		Nitrogen dioxide		PM*	
	DA	MNR	DA	MNR	DA	MNR	DA	MNR	DA	MNR
AP-1 Kyrgauyldy	<1.5**	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-2 Bulakty	<1.5	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-3 Soyuzpechat gardener' partnership	<1.5	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-4 Bereke shift camp	<1.5	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-5 Aksengir	<1.5	<1.5	<0.025	<0.025	<0.03	0.31	<0.02	<0.02	<0.075	0.13
AP-6 Nurbereke gardener' partnership (near Komsomol)	<1.5	<1.5	<0.025	0.04	<0.03	0.31	<0.02	<0.02	<0.075	<0.075
AP-7 Yntymak	<1.5	<1.5	<0.025	0.03	<0.03	<0.03	<0.02	<0.02	<0.075	0.01
AP-8 Pokrovka	<1.5	<1.5	<0.025	0.03	<0.03	<0.03	<0.02	<0.02	<0.075	0.2
AP-9 Kyzyl Tu-1	<1.5	<1.5	<0.025	0.05	<0.03	0.05	<0.02	<0.02	<0.075	<0.075
AP-10 Panfilovo shift camp	<1.5	<1.5	<0.025	0.03	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-11 Panfilovo	<1.5	<1.5	<0.025	0.04	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-12 Kyzylkairat	<1.5	<1.5	<0.025	0.04	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-13 Issyk gardener' partnership (Issyk quarry)	<1.5	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
AP-14 Kargaly (Fabrichny quarry)	<1.5	<1.5	<0.025	<0.025	<0.03	<0.03	<0.02	<0.02	<0.075	<0.075
<b>MPC (National)</b>	3	5	0.05	0.5	0.06	0.4	0.04	0.2	0.15	0.5
<b>IFC (WHO) Guideline value</b>	-	100	0.05	0.5	-	-	-	0.2	-	-

Note: \* - suspended matter - undifferentiated dust/aerosol; \*\* < - below laboratory detection limit

Based on the air survey data, the ambient concentrations of pollutants sampled during the baseline study were well below relevant standards at each location.

To calculate the impact on receptors located close to Project interchanges, current traffic intensity was considered and summarised with the expected construction activities and predicted traffic through BAKAD. The intensity of the current traffic was observed in the baseline survey that considered regular traffic conditions and peak traffic on working days and weekends. Traffic intensity was measured at all eight locations of Project interchanges.

### 2.1.2 *Sensitive receptors*

The sensitive receptors in the following locations have been included in the assessment:

- Kyrgauyldy – 106 m to the centre of the BAKAD junction;
- Bulakty – 927 m to the centre of the BAKAD junction;
- Soyuzpechat' dacha community - 149 m to the BAKAD RoW;
- Bereke construction camp – 620 m to the BAKAD RoW/ 580 m to the asphalt concrete mixing plant;
- Aksengir - 175 m to the centre of the BAKAD junction;
- Nurbereke gardeners' partnership - 770 m to the centre of the BAKAD junction;
- Yntymak - 992 m to the centre of the BAKAD junction / 35 m to the RMF site;
- Pokrovka – 182 m to the centre of the BAKAD junction;
- Kyzyl-Tu-1 – 1070 m to the BAKAD road line;
- Panfilovo construction camp – 550 m of workers bedrooms from the asphalt concrete mixing plant;
- Panfilovo village - 680 m to the centre of the BAKAD junction;
- Kyzylkairat village - 227 m to the centre of the BAKAD junction;
- Issyk gardener' partnership - 25-30 m to the boundary of the Issyk quarry;
- Kargaly village - 865 to the boundary of Fabrichny quarry.

No hospitals, schools, or care homes were identified within 200 m of the Project RoW. No sensitive environmental receptors within the BAKAD RoW were identified either.

Sensitivity of the identified receptors to short-term increase of concentrations was determined as medium for the permanent residents and low for construction workers in the shift camp.



**Table 2.1-3 Sensitivity of the Receptors**

Receptor location	Sensitivity
Abay	Medium
Aksengir	Medium
Alatau	Medium
Bereke (construction camp)	Low
Bereke (village)	Medium
Bulakty	Medium
Chimbulak	Medium
Dachas (21-22 km)	Medium
Dachas (7 km)	Medium
Eltay	Medium
Irgeli	Medium
Isayevo	Medium
Issyk gardener' partnership	Medium
Kargaly	Medium
Kemertogan	Medium
Kokzek	Medium
Koyankus	Medium
Kyrgauylly	Medium
Kyzylkairat	Medium
Kyzyl-Tu-1	Medium
Kyzyl-Tu-2	Medium
Mukhametzhan Tuymebaev	Medium
Nurbereke gardeners' partnership	Medium
Ogonek	Medium
Otegen Batyr	Medium
Panfilovo (construction camp)	Low
Panfilovo (village)	Medium
Pokrovka	Medium
Rayimek	Medium
Soyuzpechat' dacha community	Medium
Taldybulak	Medium
Yntymak	Medium
Zhalek Batyr	Medium
Zhana Kuat	Medium
Zhanadaur	Medium

### 2.1.3 Project activities and Related Impacts

Based on the results of the Scoping exercise, the following activities during the construction stage were subject to further impact assessment:

- earth moving and ground preparation;
- movement of vehicles over open ground, on unpaved roads and on the surrounding road network; and
- on-site concrete batching, handling of friable materials and stockpiling.

Since the air quality impacts are related to changes in concentration of pollutants in the ambient air, criteria for magnitude determination are based on the numerical values of pollutants' concentrations expressed as portions of MPCs (Table 2.1-4).

Table 2.1-4 Criteria for evaluation of the Magnitude of air quality impacts

Magnitude of impact	Criteria
Negligible	< 0.25 MPC <sub>MNR</sub>
Small	0.25-0.50 MPC <sub>MNR</sub>
Medium	0.50-1.00 MPC <sub>MNR</sub>
Large	>1.00 MPC <sub>MNR</sub>

### 2.1.4 Assessment of the air impact during the BAKAD Construction Stage

The construction of the road will be conducted within 34 months. The main emission sources will be the engines of vehicles and construction equipment, asphalt concrete and concrete plants (Table 2.1-5).

Table 2.1-5 Sources of pollutants emissions at the BAKAD construction stage

Site/production facility	Source number	Sources of emissions
<b>Bereke construction camp</b>		
Asphalt concrete plant	01	Pipe-mixing and reactor plant, drying drum, treatment plant
	6001	Unloading, storage and transportation of mineral materials (warehouses, dispensers, conveyors), bitumen tanks and storage hopper of finished asphalt
Concrete plants	6002 - 6004	Concrete mix conveyors, mixing plants
Concrete mixture plant	6005	Unloading, storage and transportation of mineral materials (sand, crushed stone, mineral powder), dispensers, unloading of cement trucks
Access roads	6006-6008	Dump trucks, cement trucks, concrete mixers, bituminous road surfacing finisher, asphalt carriers
<b>Panfilovo construction camp</b>		
Asphalt concrete plant	02	Pipe-mixing and reactor plant, drying drum, treatment plant
	6009	Unloading, storage and transportation of mineral materials (warehouses, dispensers, conveyors), bitumen tanks and storage hopper of finished asphalt
Concrete plants	6010, 6011	Concrete mix conveyors, mixing plants
Concrete mixture plant	6012	Unloading, storage and transportation of mineral materials (sand, crushed stone, mineral powder), dispensers, unloading of cement trucks
Access roads	6013-6015	Dump trucks, cement trucks, concrete mixers, bituminous road surfacing finisher, asphalt carriers
<b>Fabrichny quarry</b>		
Extraction site	6016	Hydraulic hammer, excavators, bulldozers, loaders, dump trucks
Crushing and sorting site	6017	Crushing plants, screens, conveyors
Storage, loading and transportation	6018	Outdoor storage warehouse, loaders, dump trucks
<b>Issyk quarry</b>		
Extraction site	6019	Hydraulic hammer, excavators, bulldozers, loaders, dump trucks
Crushing and sorting site	6020	Crushing plants, screens, conveyors
Storage, loading and transportation	6021	Outdoor storage warehouse, loaders, dump trucks
<b>Linear section of the route 200 m long (km 37 of the route<sup>1</sup>)</b>		
Stage of construction of earth embankment	6022	Dump trucks, bulldozers, graders, water trucks, rollers
Stage of the road pavement		Dump trucks, bulldozers, graders, rollers, tars, pavers

<sup>1</sup> The site has been chosen as an exemplary one for the purpose of the impact assessment during the construction

Site/production facility	Source number	Sources of emissions
Stage of road arrangements (guardrails, lighting, markings of the roadway)		Welding and painting works, loaders, cranes, trucks
<b>Construction of the transport interchange at km 21 of the route</b>		
Stage of construction of foundations for the supports of the overpass on a plot of 400 m length	6023	Excavators, drilling machines, cranes, concrete pumps, concrete mixers, dump trucks, vibration loaders

The total number of emission sources during the construction will be 25. Two of them will be stationary emission sources, and 23 will be fugitive sources.

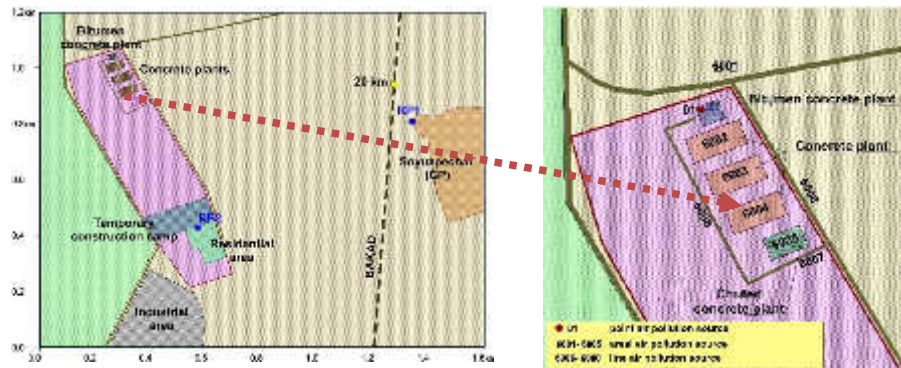
In addition, the following impact of auxiliary construction facilities was considered:

- two (2) asphalt concrete plants and 5 concrete plants located at Bereke and Panfilovo construction camps;
- two (2) crushed stone quarries located in the vicinity of Kargaly village “Fabrichny” quarry, and in the vicinity of Bolek village - “Issyk” quarry.

At the Bereke construction camp the following installations will be in operation:

- asphalt plant with a capacity of 240 t/h,
- concrete plant with a capacity of 115 m<sup>3</sup>/h,
- concrete plants with a capacity of 105 m<sup>3</sup>/ h,
- plants for the production of concrete mix with a capacity of 400 t/h each,
- dump trucks, cement trucks, concrete and asphalt – 100 vehicles/hour.

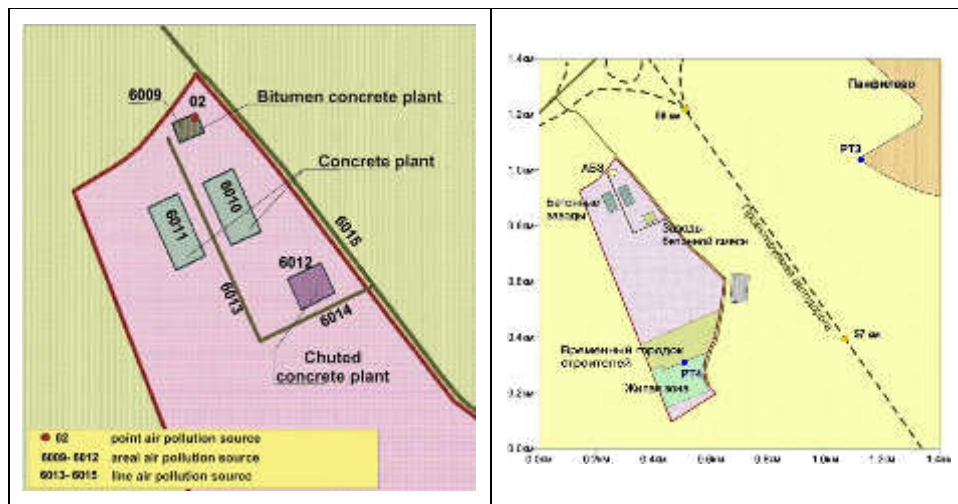
Figure 2.1-2 Location of asphalt and concrete plants at the Bereke construction camp



At the Panfilovo construction camp, the following installations will be in operation:

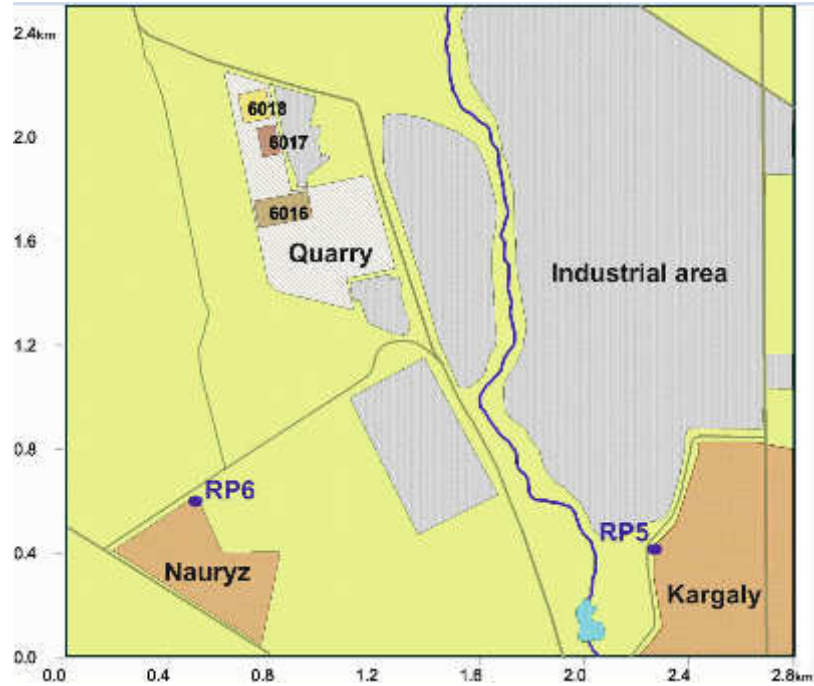
- asphalt plant with a capacity of 170 t/ h,
- 2 concrete plants with a capacity of 115 and 105 m<sup>3</sup>/ h,
- 2 plants for the production of concrete mix with a capacity of 400 t/ h each,
- dump trucks, cement trucks, concrete-and asphalt – 75 vehicles/hour.

Figure 2.1-3 Location of asphalt and concrete plants at the Panfilovo construction camp



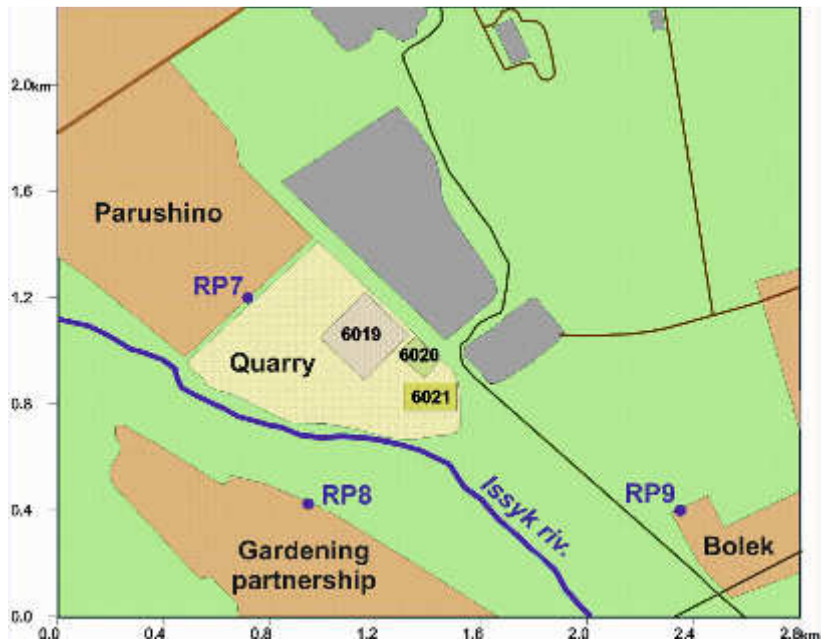
Fabrichny quarry will produce 400 t/h of crusher and 500 t/h of sieve plate. Five excavators, 8 dump trucks units, 3 bulldozers, 6 loaders, crushing and sorting plant will be simultaneously working there.

Figure 2.1-4 Location of Fabrichny quarry near Kargaly settlement



Up to 400 t/h of crusher and 500 t/h of sieve plate will be produced in the Issyk quarry. The quarry equipment includes 3 excavators, 6 dump trucks, 2 bulldozers, 4 loaders, crushing and sorting installation.

Figure 2.1-5 Location of the Issyk quarry near Bolek settlement



Construction of the main BAKAD route will include the following main stages:

- I. Preparatory stage:
  - Relocation of utilities,
  - Organization of construction camps and temporary access roads,
  - Site levelling, demolition of buildings and other obstacles in the exclusion zone, construction of asphalt plant, concrete plants, and commissioning of the quarry.
- II. Construction of the roadbed:
  - construction of embankment or excavation;
  - compaction of the spilled soil;
  - arrangement of the roadbed and strengthening of slopes.
- III. Road pavement:
  - filling and compaction of crushed stone layer;
  - grouting;
  - asphalt work.
- IV. Installation of road barriers, lighting, road marking, welding and painting of metal structures.
- V. Landscaping works.

Stages of construction of transport crossings (junctions, bridges, overpasses):

- I. Preparatory works:
  - organization of construction sites and temporary roads;
  - levelling.
- II. Construction of bridge or overpass abutments:
  - construction of bored piles;
  - construction of sheet pile fencing;
  - pit excavation;
  - concreting of foundations;
  - concreting of abutments.
- III. Finalization of a bridge or the overpass:
  - Road pavement,
  - Improvement of the roadsides.

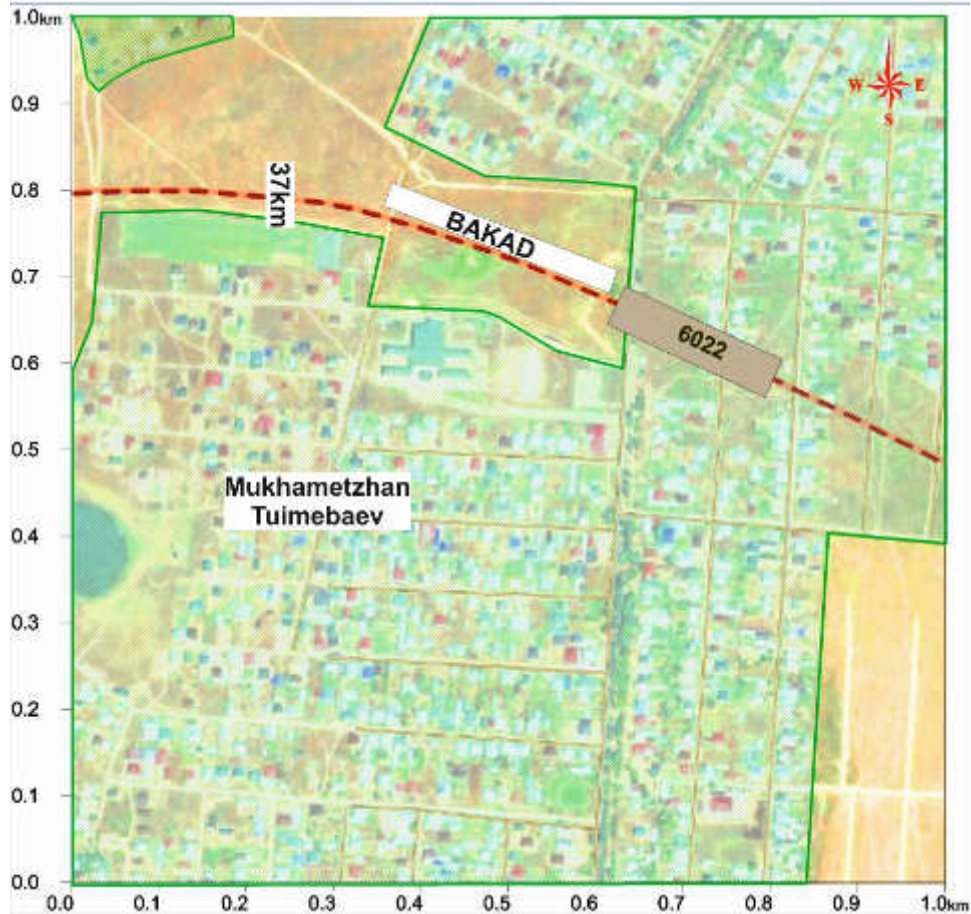
The bigger impact on the ambient air is expected during the most intensive stages of construction, therefore these were considered for the assessment of air pollution. According to the construction schedule, the largest number (more than 30 units) of simultaneously operating road construction equipment on small construction sites is expected during the excavation and concrete works - filling and compaction of the embankment of the highway and concreting the foundations of the supports of overpasses and bridges.

The rate of construction of the earth embankment at the average will be 200 m per day (2 working shifts). At the linear site at the same time will work 7 bulldozers, 6 graders, 6 watering machines and 8 rollers. The soil will be delivered to the site by up to 50 trucks per day (20 tons capacity).



For the so-called worst-case scenario the construction of an embankment at the km 37 of the BAKAD was selected, where the route runs directly through residential areas. At the same site, the impact on air quality will be caused by other types of work – construction of roadway, installation of road barriers and lighting, road marking, welding and painting of metal structures.

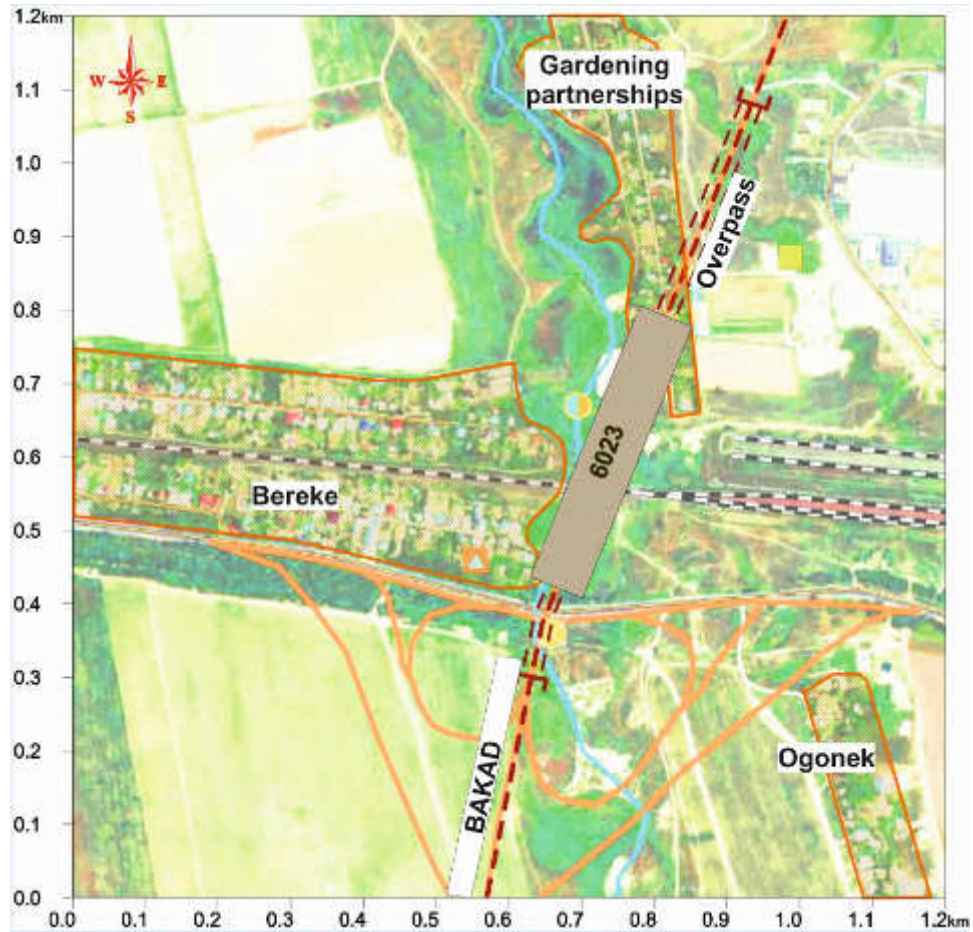
Figure 2.1-6 Linear construction site within the residential area



The impact on the air quality caused by concrete works was assessed using the example of the construction of the longest (more than 800 m) Project overpass in the area of Bereke (km 21 of the BAKAD route). During this part of construction works 8 dump trucks, 2 drilling machines, 2 crawler cranes, 4 excavators, 2 concrete pumps, 2 concrete mixers and 10 vibro-hammers will operate simultaneously at the construction site.



Figure 2.1-7 Construction site of the overpass in the vicinity of Bereke



To define changes of pollutants' concentrations in the ambient air, a dispersion modelling was performed with the use of AERMOD model.

Maximum one-time concentrations of these pollutants (pollutants of concern) in atmospheric air are presented in the figures below.

Figure 2.1-8 Maximum one-time concentration of nitrogen dioxide (in parts MPC<sub>MNR</sub>) in the ambient air in the area of Bereke. Operation of the asphalt and concrete plants

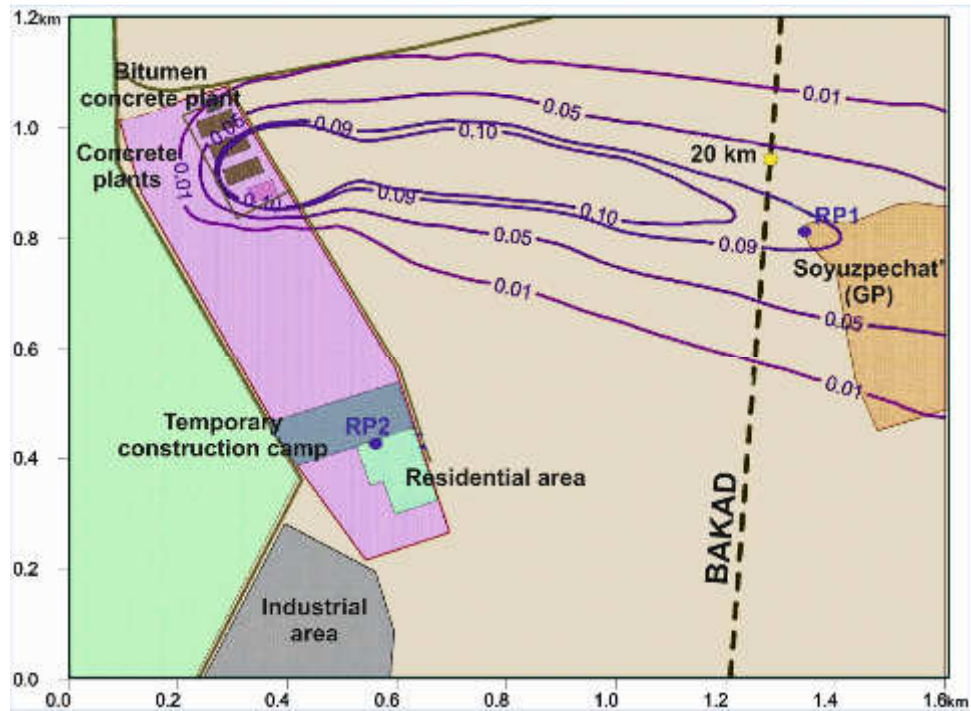


Figure 2.1-9 Maximum one-time concentration of particle matter (in parts MPC<sub>MNR</sub>) in ambient air in the area of Bereke (RP 1). Operation of the asphalt and concrete plants

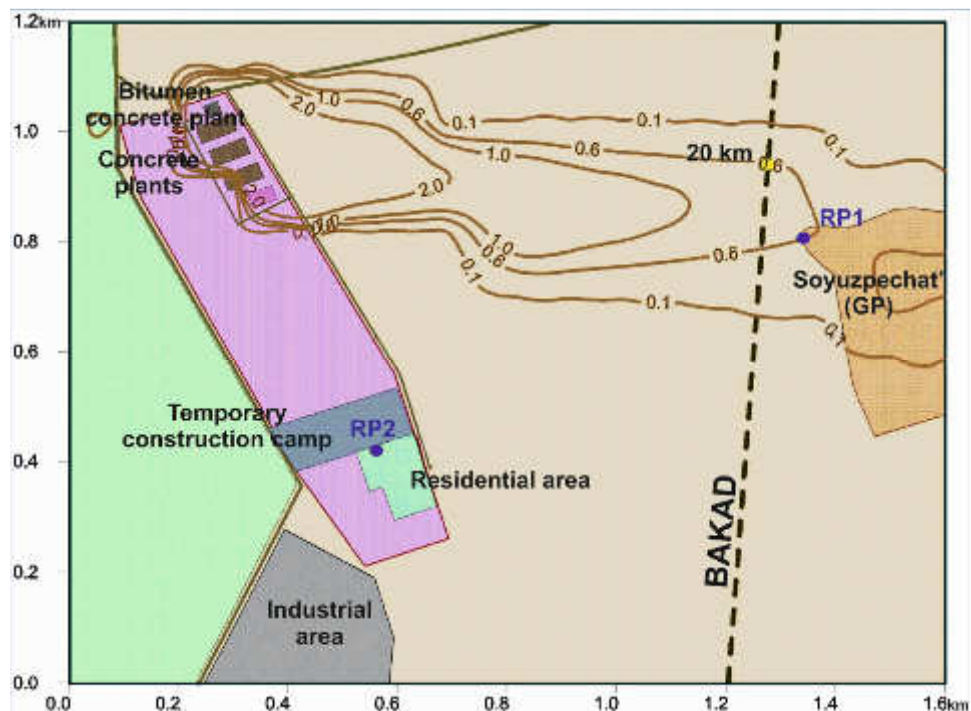


Figure 2.1-10 Maximum one-time concentration of particle matter (parts of  $MPC_{MNR}$ ) in ambient air in the area of Bereke (RP-2). Operation of the asphalt and concrete plants

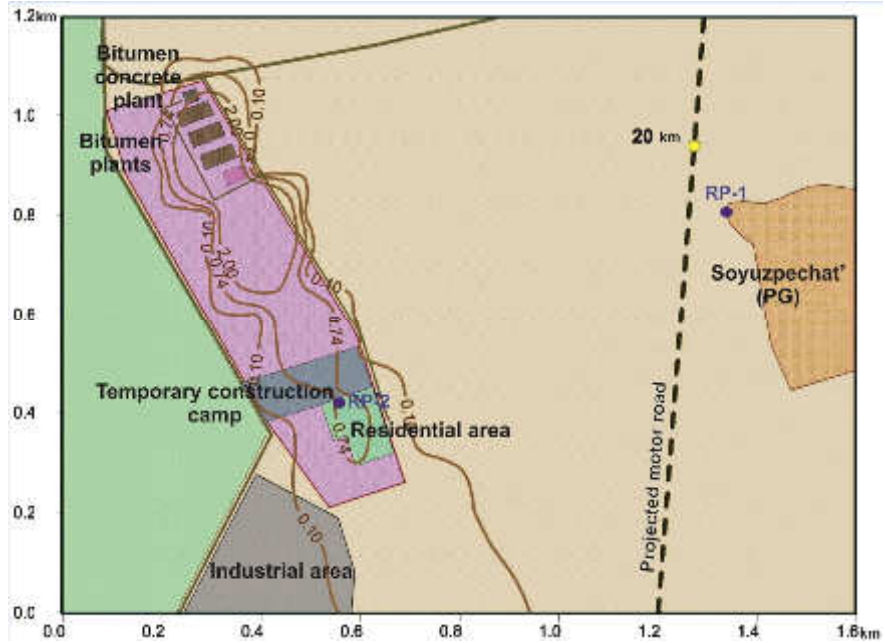


Figure 2.1-11 Maximum one-time  $NO_2$  concentrations (in fractions of  $MPC_{MNR}$ ) in the ambient air of the Panfilovo settlement. Operation of asphalt-concrete and concrete plants

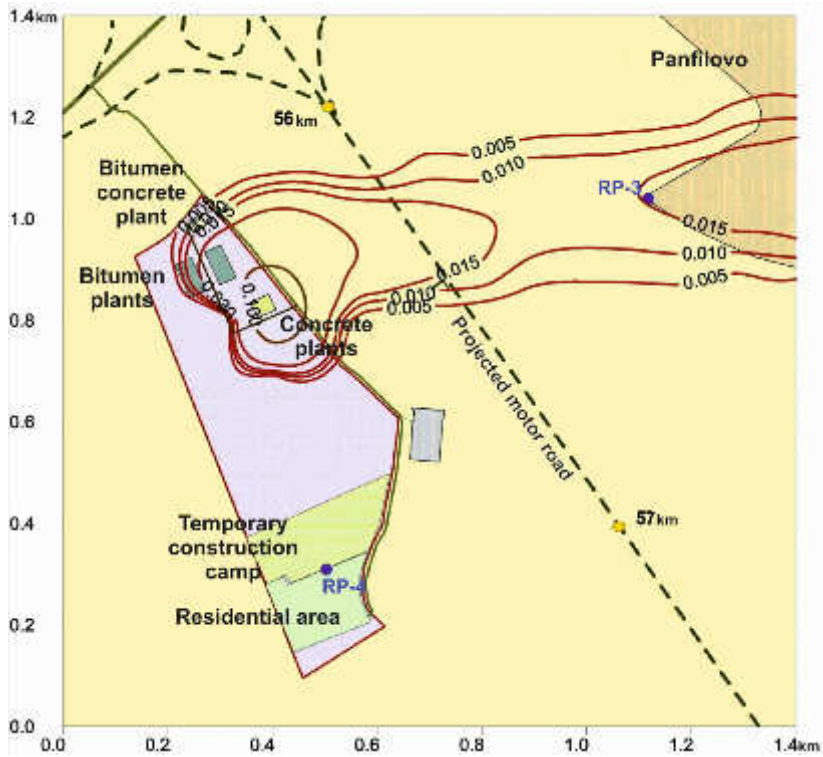


Figure 2.1-12 Maximum one-time particle matter concentrations (in fractions of  $MPC_{MNR}$ ) in the ambient air of the Panfilovo settlement. Operation of asphalt-concrete and concrete plants

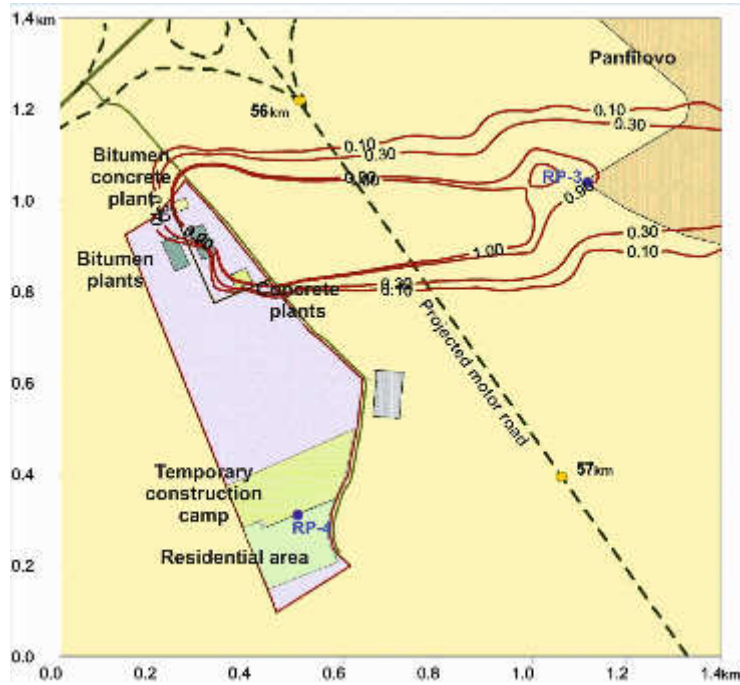


Figure 2.1-13 Maximum one-time particle matter concentrations (in fractions of  $MPC_{MNR}$ ) in the ambient air of the Panfilovo camp. Operation of asphalt-concrete and concrete plants

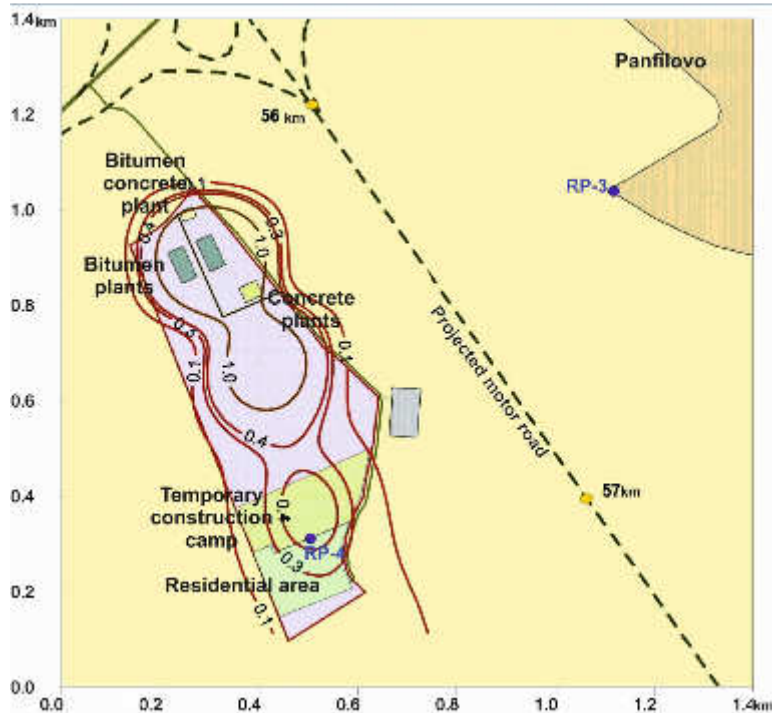




Figure 2.1-14 Maximum one-time particle matter concentrations (in fractions of MPC<sub>MNR</sub>) in the ambient air of the Mukhametzhan Tuimebaev during construction

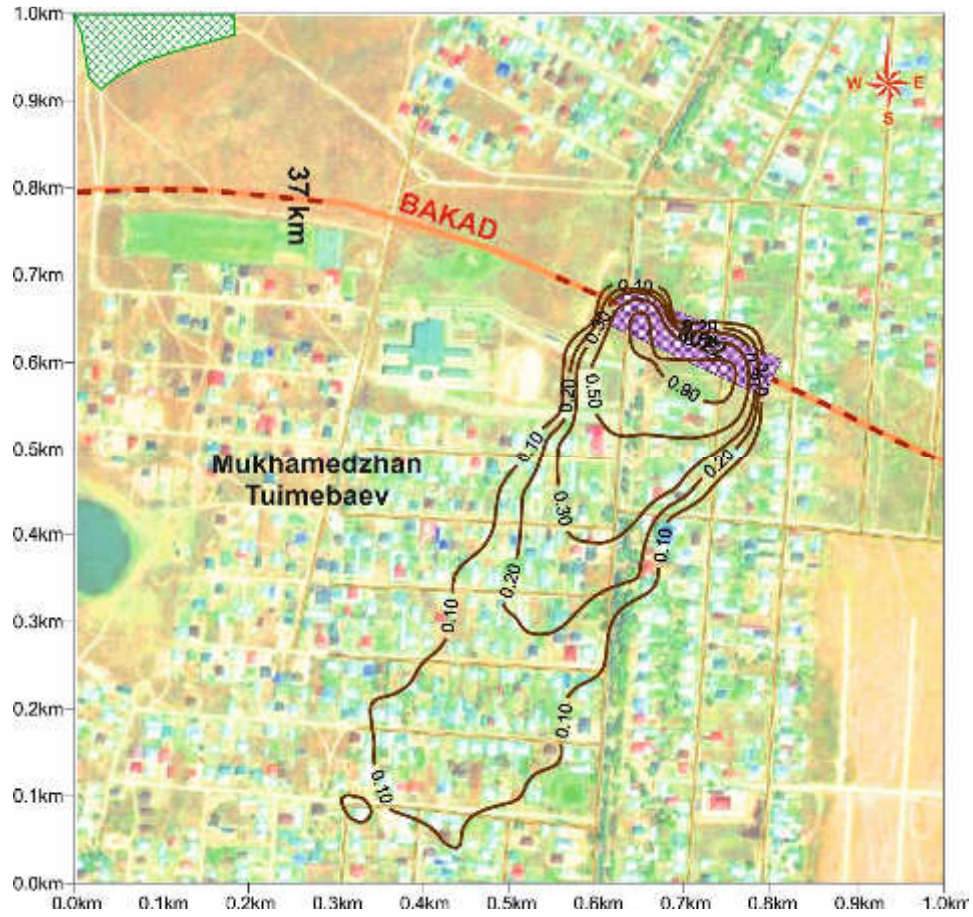
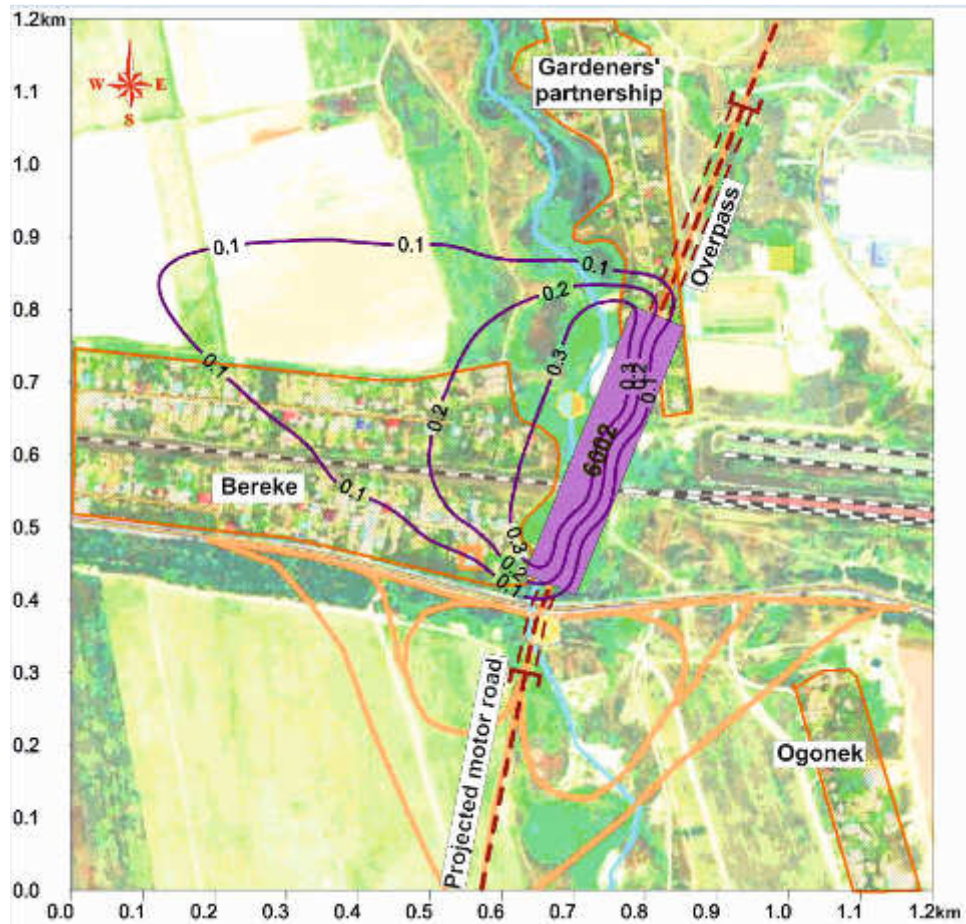


Figure 2.1-15 Maximum one-time NO<sub>2</sub> concentrations (in fractions of MPC<sub>MNR</sub>) in the atmospheric air for the installation of concrete foundations of trestle supports



Concentrations of pollutants in the ambient air resulting from the Project construction are presented in the table below (Table 2.1-6).

Modelling results showed that most intense construction activities will not result in the extremely elevated concentrations of a number of pollutants, including sulphur dioxide and carbon monoxide. However, nitrogen dioxide and dust (particulate matter) concentrations in the ambient air will be in some cases close to or even exceed the national threshold levels at sensitive receptors.

Most of the predicted concentration values are below 10% of the relevant air quality standards, therefore the corresponding impact magnitude will be negligible. At some receptors, NO<sub>2</sub> and PM concentrations will be significantly higher than that of the other pollutants, and relevant magnitude will vary from small to medium (Table 2.1-7)

Table 2.1-7 The significance of the air quality impact was determined based on the impact magnitude and sensitivity of receptors (*Table 2.1-8*).

**Table 2.1-6 Concentrations of pollutants in the ambient air resulting from the Project construction activities**

Receptor location	Pollutant concentration as proportion of MPC <sub>MNR</sub>					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Rayimek	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Abay	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bulakty	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Irgeli	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Kemertogan	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dachas (7 km)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Soyuzpechat' dacha community	0.01-0.10	<0.10	<0.10	<0.10	<0.10	0.10-0.60
Bereke (construction camp)	<0.10	<0.10	<0.10	<0.10	<0.10	0.10-0.80
Bereke (village)	0.10-0.30	<0.10	<0.10	<0.10	<0.10	<0.10
Ogonek	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Kokzek	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Eltay	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dachas (21-22 km)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Isayevo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aksengir	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zhalek Batyr	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mukhametzhan Tuymebaev	<0.10	<0.10	<0.10	<0.10	<0.10	0.03-0.90
Yntymak	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zhanadaur	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Koyankus	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10



Receptor location	Pollutant concentration as proportion of MPC <sub>MNR</sub>					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Pokrovka	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zhana Kuat	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Otegen Batyr	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Kyzyl-Tu-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Kyzyl-Tu-2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Panfilovo (village)	<0.10	<0.10	<0.10	<0.10	<0.10	0.10-0.90
Panfilovo (construction camp)	<0.10	<0.10	<0.10	<0.10	<0.10	0.10-0.40
Kyzylkairat	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Taldybulak	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chimbulak	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Alatau	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

\* non-methane hydrocarbons

**Table 2.1-7 Magnitude of air quality impacts during construction stage**

Receptor location	Impact magnitude					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Rayimek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Abay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bulakty	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Irgeli	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kemertogan	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (7 km)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Soyuzpechat' dacha community	Negligible	Negligible	Negligible	Negligible	Negligible	Medium
Bereke (construction camp)	Negligible	Negligible	Negligible	Negligible	Negligible	Medium
Bereke (village)	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Ogonek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kokzek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Eltay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (21-22 km)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Isayevo	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Aksengir	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Zhalek Batyr	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Mukhametzhan Tuymebaev	Negligible	Negligible	Negligible	Negligible	Negligible	Medium
Yntymak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Zhanadaur	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Koyankus	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Pokrovka	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Receptor location	Impact magnitude					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Zhana Kuat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Otegen Batyr	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-2	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Panfilovo (village)	Negligible	Negligible	Negligible	Negligible	Negligible	Medium
Panfilovo (construction camp)	Negligible	Negligible	Negligible	Negligible	Negligible	Small
Kyzylkairat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Taldybulak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Chimbulak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Alatau	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

\* non-methane hydrocarbons

**Table 2.1-8 Significance of air quality impacts during construction stage**

Receptor location	Impact significance					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Rayimek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Abay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bulakty	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Irgeli	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kemertogan	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (7 km)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Soyuzpechat' dacha community	Negligible	Negligible	Negligible	Negligible	Negligible	Moderate
Bereke (construction camp)	Negligible	Negligible	Negligible	Negligible	Negligible	Minor
Bereke (village)	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Ogonek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kokzek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Eltay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (21-22 km)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Isayevo	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Aksengir	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Zhalek Batyr	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Mukhametzhan Tuymebaev	Negligible	Negligible	Negligible	Negligible	Negligible	Moderate
Yntymak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Zhanadaur	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Koyankus	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Pokrovka	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Receptor location	Impact significance					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Zhana Kuat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Otegen Batyr	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-2	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Panfilovo (village)	Negligible	Negligible	Negligible	Negligible	Negligible	Moderate
Panfilovo (construction camp)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzylkairat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Taldybulak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Chimbulak	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Alatau	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

\* non-methane hydrocarbons

## 2.1.5 Assessment of the air impact during the BAKAD Operational phase

### Identification of the “worst case” scenario

When choosing the scenario for impact assessment the traffic in the start-up period (2021) and peak period (2045) have been compared.

BAKAD Section 3 was taken as a sample road section (the one with a most intensive traffic flow) to calculate the volume of emissions caused by the traffic flow.

The table (Table 2.1-9) below provides the breakdown of freight vehicles based on their capacity (as per methodology adopted by EMEP/CORINAIR).

**Table 2.1-9 Traffic structure and intensity at Section 3 of the BAKAD Road (PK 440-PK 470)**

Year of operation	Traffic intensity (vehicles per day)	Traffic structure, %				
		Passenger cars	Freight vehicles			
			<3.5 t	3.5 – 7.5 t	7.5 – 16 t	>16 t – 32 t
2021	30,142	81	10.5	1.0	5.0	2.5
2045	92,863	81	10.5	1.0	5.0	2.5

Table 2.1-10 below provides the estimated breakdown of passenger vehicles as in 2021 (in %) based on the characteristics of engines (EURO 0 to EURO5).

Since such estimations for Almaty city are not available the average for a city of similar size in the former Soviet Union was adopted.

**Table 2.1-10 Traffic structure in 2021 based on environmental performance of engines**

Environmental standard	EURO 0	EURO I	EURO II	EURO III	EURO IV	EURO V
V, I	Passenger vehicles (%)					
<1.4	0	5	20	35	30	10
1.4-2	0	5	25	30	30	10
>2	0	8	22	30	30	10
Diesel (<2)	0	6	20	30	30	14
Diesel (>2)	0	5	24	30	30	11
Type	Freight vehicles with capacity up to 3,5 t (%)					
Gasoline	0	5	20	40	25	10
LNG	0	5	20	40	25	10
Diesel	0	5	20	40	25	10

Environmental standard	EURO 0	EURO I	EURO II	EURO III	EURO IV	EURO V
Type	Freight vehicles with larger capacities (%)					
<7.5	0	5	25	40	20	10
7.5-16	0	5	25	40	20	10
16-32	0	5	25	40	20	10

By 2045, there will be a complete renewal of the vehicle fleet and it was assumed that the engines of all cars will have an environmental class not lower than EURO 5. The basis for such assumption are:

- Currently the oldest cars in Kazakhstan account to 25-30 years, but the share of such cars will be reducing through the time.
- The world's major automakers began producing EURO 5 cars some time ago: in the EU countries from 2009-2010; in Japan, USA, Korea, China and Russia from 2013-2015. Even in a worst case (the majority of cars in RK will be of the age of 25-30 years old in 2045) it means that all of them will be produced after 2015.
- In addition, in 2018 the Kazakh government adopted a restriction to import passenger vehicles of any other type of environmental class except EURO5 (<https://regnum.ru/news/2400037.html>) and oil refinery production is also now oriented to increasing production of gasoline of EURO5 class. For import of freight vehicles such restrictions are valid from 2013 (<http://www.petroleumjournal.kz/index.php?aid1=52&aid2=259&id=632&outlang=3&p=article>).

The significance of negative impact was estimated based on the most hazardous substance – NOx. Considering the adopted scenarios, the mileage emission of NOx will be reduced from 0,52 g/km in 2021 to 0,244 g/km in 2045. At the same time intensity of traffic will be 3 times more. Therefore emissions per second will increase from 0,36 g/sec\*km in 2021 to 0,48 g/sec\*km in 2045.

Therefore, the “worst case” scenario will be the one for 2045.

### Description of the modelled scenario

The air impact of traffic was estimated for the year 2045, when traffic intensity is expected to be at its highest (reaching 80-90 thousand vehicles per day at specific sections of the road). By this time, traffic intensity will be three times bigger than that expected during the first year of the road’s operation, although emissions are expected to halve, as vehicles will be going “greener”.

Table 2.1-11 below shows the traffic structure and intensity estimates for the different parts of the road. It should be noted that traffic will predominantly consist of passenger cars, whose share is expected at 70-90%.

**Table 2.1-11 Traffic structure and intensity at different parts of BAKAD (estimate made for the year 2045)**

Section of BAKAD		Traffic intensity, vehicles per day	Traffic structure, %				
			Passenger vehicles	Freight vehicles			
No	100 m mark (PK)			Capacity <3.5 t	Capacity 3.5 to 7.5 t	Capacity >7.5 to 16 t	Capacity >16 to 32 t
8	PK0 - PK55	39,819	81.3	12.6	1.0	4.0	1.1
1	PK55 - PK240	41,355	70.6	16.6	1.4	7.4	4.0
2	PK240 - PK440	78,567	73.6	14.4	1.3	7.0	3.7
3	PK440 - PK470	92,863	81	10.5	1.0	5.0	2.5
4	PK470 - PK570	81,692	86	6.6	1.9	2.6	2.9
9	PK570 - PK660	22,767	89	8.1	0.1	0.8	2.0

Information on radial streets crossing BAKAD was used as the baseline data. Table 2.1-12 shows current traffic intensity on these radial roads. 80% of the traffic is represented by passenger vehicles, 20% by freight vehicles. It is expected that traffic on these roads will increase by 50% by 2045.

**Table 2.1-12 Current (2018) and future (2045) intensity of traffic on BAKAD-crossing roads**

BAKAD	Road / street	Traffic intensity, vehicles per hour	
		2018	2045
0 km	A4 Verkhnyaya Kaskelenskaya motorway (Karaguldy)	1,010	1,520
6 km	A2 Bishkekskaya motorway (Rayimbek)	3,390	5,080
21 km	KV67 Burundayskaya motorway (Aksengir)	940	1,410
34 km	Karagandinskaya motorway (Zhapeg-Batyr)	860	1,290
36,2 km	Altayeva Street	610	920
37,4 km	Almatinskaya Street	850	1,280
41 km	Abaya Street - KV21 road	580	870
43,3 km	A3 Kapchagayskaya motorway (Yntymak)	2,170	3,260
46,5 km	KV15 Iliyskaya motorway (Otigen-Batyr village)	1,890	2,840



BAKAD	Road / street	Traffic intensity, vehicles per hour	
		2018	2045
52,8 km	Basybekova Street – AL91 road (Almarek village)	650	980
55,7 km	A2 Kuldzhinskaya motorway (Panfilovo village)	2,000	3,000
58 km	Road along Bolshoy Almatinsky channel	480	720
59 km	Alatau motorway (Alatau village)	590	890
65 km	R17 Talgarskaya motorway (Kyzyl-Kairat)	1,680	2,520

### Estimation of air emissions

Air emission estimations took into account environmental parameters of vehicle engines. The average age of vehicles in Almaty is 10-12 years, with a prevalence of EURO 2 and 3 class vehicles.

By 2045, the vehicle fleet of the city is expected to be fully replaced. It is highly likely that all vehicles will at least have the EURO 5 class.

In line with the corresponding methodology, specific running emissions, weight-averaged to vehicle types, were used to show emissions from one vehicle at different sections of BAKAD (see *Table 2.1-13*).

**Table 2.1-13** *Specific emissions, weight-averaged to vehicle types, from one vehicle at different sections of BAKAD (for the year 2045)*

Section of BAKAD	Emissions of pollutants, g/km				
	CO	NOx	Hydrocarbons	PM	SO <sub>2</sub>
8 PK0 -PK55	1.92	0.211	0.124	0.0011	0.028
1 PK55 - PK240	2.45	0.325	0.218	0.0019	0.037
2 PK240 – PK440	2.39	0.310	0.207	0.0018	0.036
3 PK440 – PK470	2.04	0.244	0.151	0.0014	0.031
4 PK470 – PK570	2.01	0.235	0.150	0.0013	0.029
9 PK570 – PK660	1.19	0.128	0.041	0.0010	0.025
Radial roads	1.92	0.211	0.124	0.0011	0.028

Intensity of emissions (g/s\*km), which are used in emission dispersion modelling, are proportionate to traffic intensity and are shown in *Table 2.1-14* (for BAKAD) and *Table 2.1-15* (for radial roads).

**Table 2.1-14 Maximum emissions per second at different sections of BAKAD**

Section of BAKAD	Traffic intensity, vehicle per hour	Emissions of pollutants, g/s*km					
		CO	NOx	Hydro-carbons	PM10*	PM2.5*	SO <sub>2</sub>
8 PK0 -PK55	3026	1.61	0.177	0.104	0.0005	0.0003	0.024
PK55 1 - PK240	3143	2.14	0.284	0.190	0.0009	0.0006	0.033
2 PK240 – PK440	5971	3.97	0.510	0.343	0.0017	0.0011	0.060
3 PK440 – PK470	7057	4.00	0.580	0.296	0.0015	0.0009	0.061
4 PK470 – PK570	6028	3.36	0.393	0.253	0.00012	0.0008	0.049
9 PK570 – PK660	1730	0.57	0.061	0.020	0.0003	0.0002	0.012

**Table 2.1-15 Maximum emissions per second on BAKAD-crossing roads**

Crossing with BAKAD, km mark	Traffic intensity, vehicle per hour	Emissions of pollutants, g/s*km					
		CO	NO <sub>x</sub>	Hydro-carbons	PM10*	PM2.5*	SO <sub>2</sub>
0 km	1,520	0.811	0.089	0.052	0.00026	0.00015	0.0118
6 km	5,080	2.709	0.298	0.175	0.00086	0.00051	0.0395
21 km	1,410	0.752	0.083	0.049	0.00024	0.00014	0.0110
34 km	1,290	0.688	0.076	0.044	0.00022	0.00013	0.0100
36.2 km	920	0.491	0.054	0.032	0.00016	0.00009	0.0072
37.4 km	1,280	0.683	0.075	0.044	0.00022	0.00013	0.0100
41 km	870	0.464	0.051	0.030	0.00015	0.00009	0.0068
43.3 km	3,260	1.739	0.191	0.112	0.00055	0.00033	0.0254
46.5 km	2,840	1.515	0.166	0.098	0.00048	0.00028	0.0221
52.8 km	980	0.523	0.057	0.034	0.00017	0.00010	0.0076
55.7 km	3,000	1.600	0.176	0.103	0.00051	0.00030	0.0233
58 km	720	0.384	0.042	0.025	0.00012	0.00007	0.0056
59 km	890	0.475	0.052	0.031	0.00015	0.00009	0.0069
65 km	2,520	1.344	0.148	0.087	0.00043	0.00025	0.0196

\* Standard classification of particulate matter of different particle size was used (PM10 = 0.55xTSP; PM2.5 = 0.33xTSP, where TSP is total suspended particulate. Also see P2.1.10.1920-04 "Guidelines on assessing risk for human health associated with exposure to chemicals polluting the environment").

Annual emissions of key pollutants for the whole length of BAKAD were also estimated (Table 2.1-16).

**Table 2.1-16 Annual emissions of pollutants from traffic (in tonnes per annum) at different sections of BAKAD**

Section of BAKAD	Length of section, km	Traffic intensity, vehicle per day	Emissions of pollutants, tpy				
			CO	NO <sub>x</sub>	Hydrocarbons	PM	SO <sub>2</sub>
8 PK0 -PK55	5.5	39,819	153.5	16.9	9.9	0.09	2.24
1 PK55 - PK240	18.5	41,355	684.2	90.8	60.9	0.53	10.4
2 PK240 – PK440	20	78,567	1370	177.7	118.6	1.03	20.6
3 PK440 – PK470	3	92,863	207.1	24.8	15.3	0.14	3.2
4 PK470 – PK570	10	81,692	599.3	70.5	45.3	0.39	8.7
9 PK570 – PK660	9	22,767	89.0	9.6	3.0	0.07	1.9
<b>Total:</b>	<b>66</b>	<b>-</b>	<b>3,103.1</b>	<b>390.3</b>	<b>253</b>	<b>1.22</b>	<b>47</b>

During the operation stage BAKAD will be a **source of minor emissions** of air pollutants in 2045 (in accordance with the IFC General EHS Guidelines).

### Impact on residential air

The methodology and key results of air pollution modelling are presented in Appendix 1. The area of modelling was taken as 45 by 31.5 km. It covers BAKAD, the parts of existing roads that cross BAKAD, and nearby communities (see Figure 1.5-1). Concentrations of pollutants were estimated for three different grid options:

- Grid that overlaps BAKAD and its immediate surroundings of up to 450 m on both sides of the roads. The grid is made up by 10 rows of cells with a 500 m interval along the ring, and ±50, 150, 250, 350 and 450 m lateral intervals from the ring’s axis. In total, the grid contains 10 rows each consisting of 130 cells. This grid is used for a detailed assessment of air pollution in the immediate vicinity of BAKAD (Figure 2.1-16).
- Similar cells along BAKAD-crossing roads: 10 rows with a 500 m interval along each of the cross-sections, and the distance to roads of ±50, 100, 150, 200, and 250 m from the axis of the crossing road (Figure 2.1-17).
- 9 grids made by cells measuring 260 by 260 m in residential areas, where a significant impact on air is possible (Figure 2.1-18 and Figure 2.1-19).

*Figure 2.1-16 Sources of vehicle emissions (highlighted in red): BAKAD and radial roads*



*Figure 2.1-17 Modelling cells (highlighted in white) along BAKAD*





*Figure 2.1-18 Modelling cells (highlight in white) along radial roads*



Figure 2.1-19 Modelling cells (highlighted in white) in residential areas

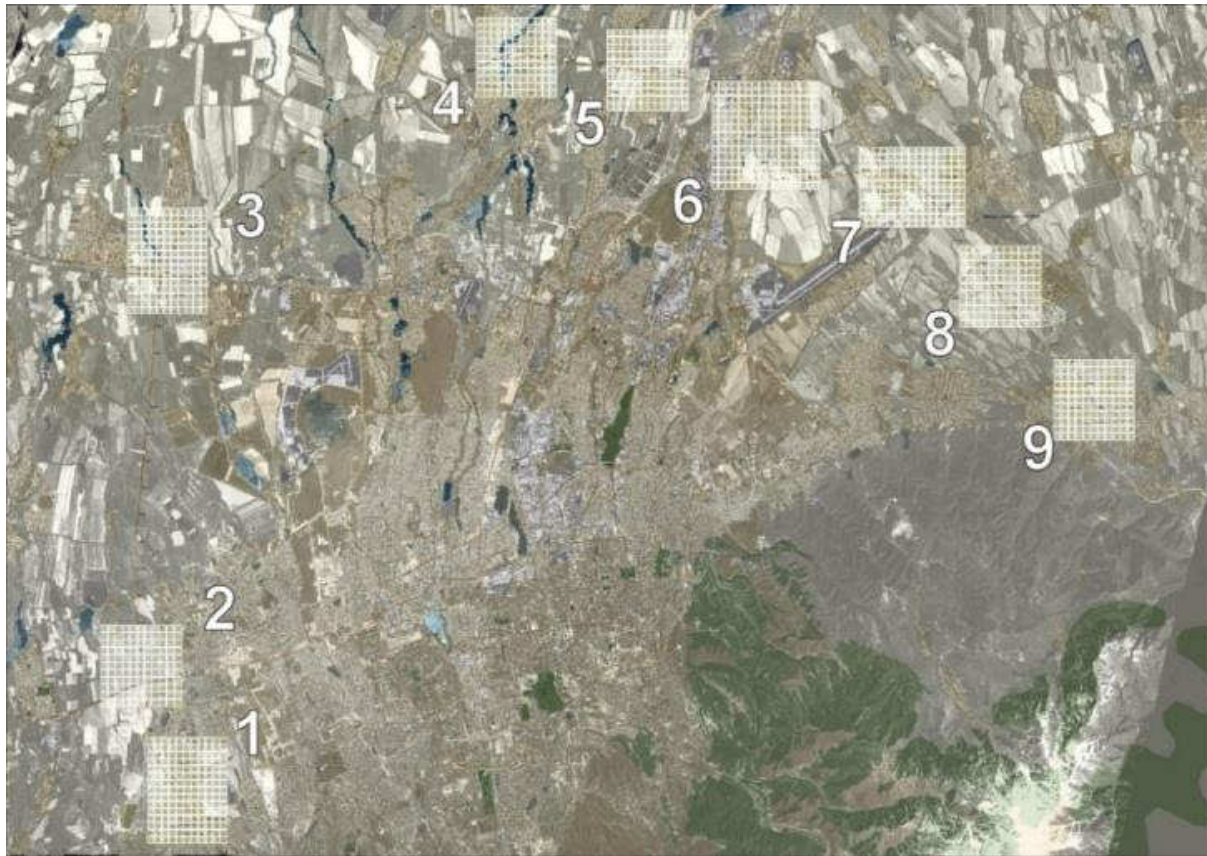




Figure 2.1-20 Layout of 9 modelling areas in Almaty

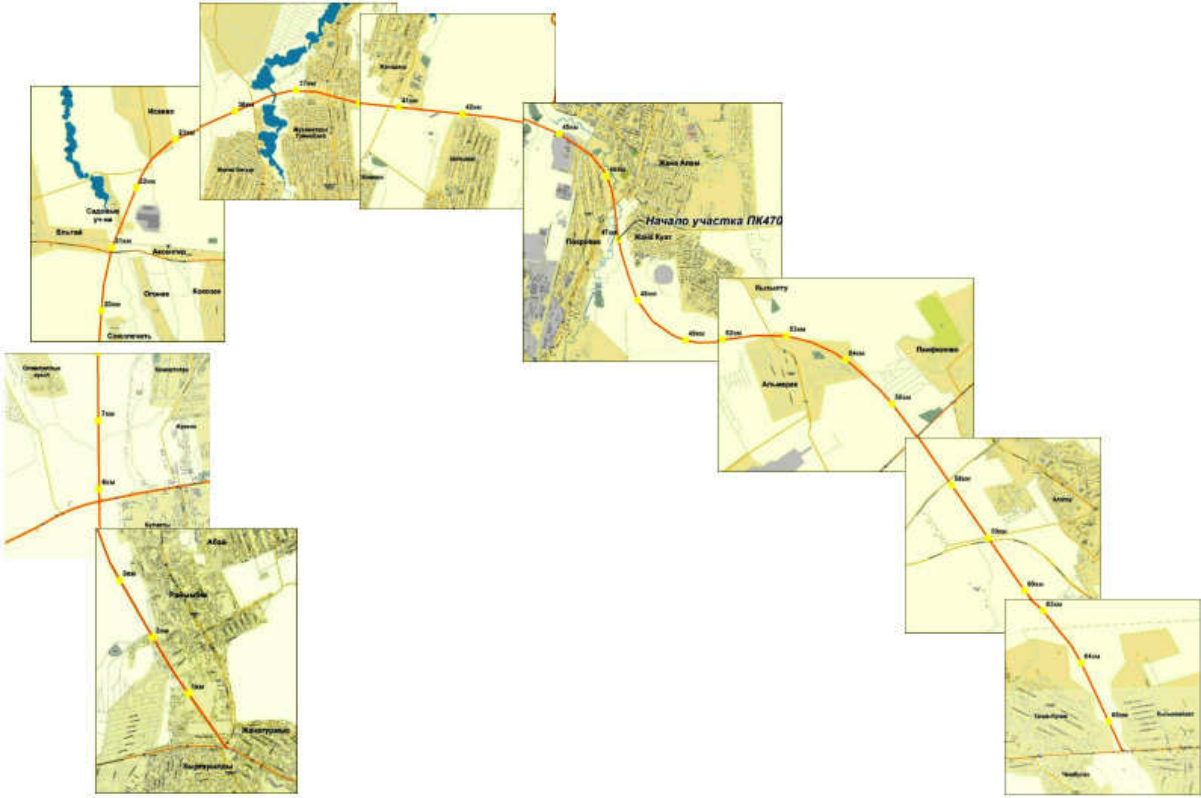




Figure 2.1-21 Area within 450 m from BAKAD



Figure 2.1-22 Area within 250 m from radial roads



Figure 2.1-23 Pokrovka and Zhana Alev neighbourhoods (Area 6)

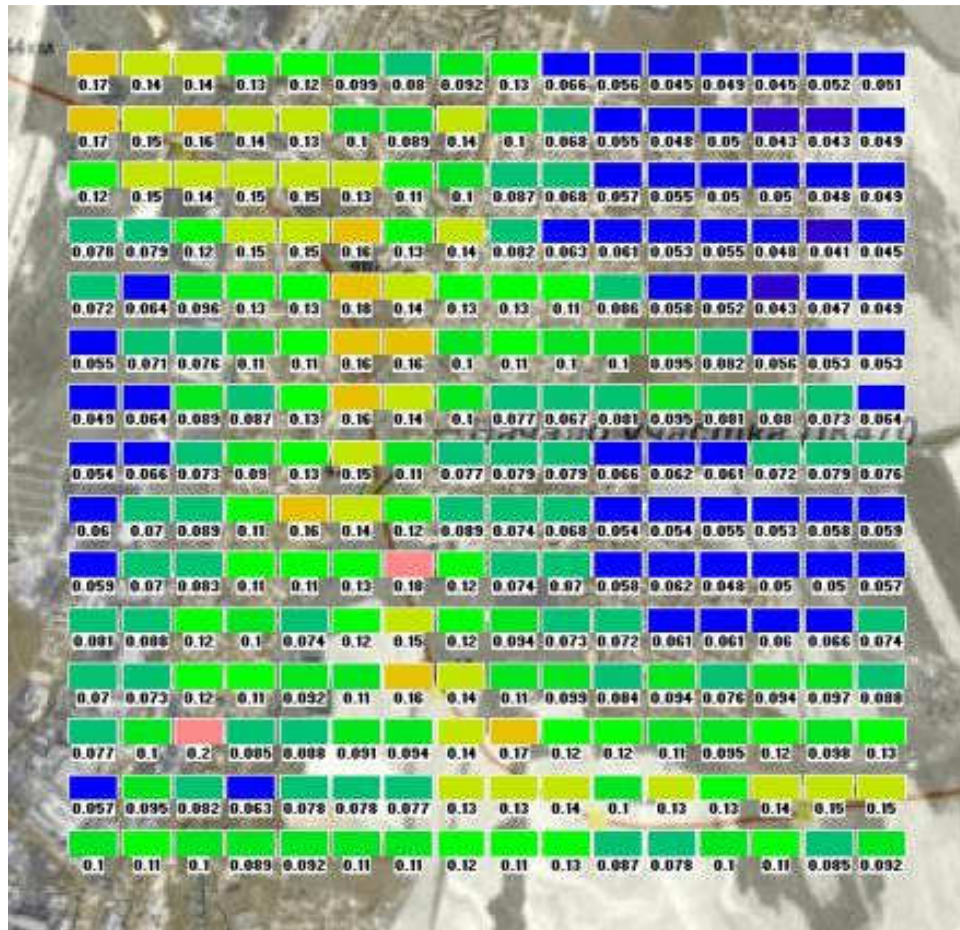
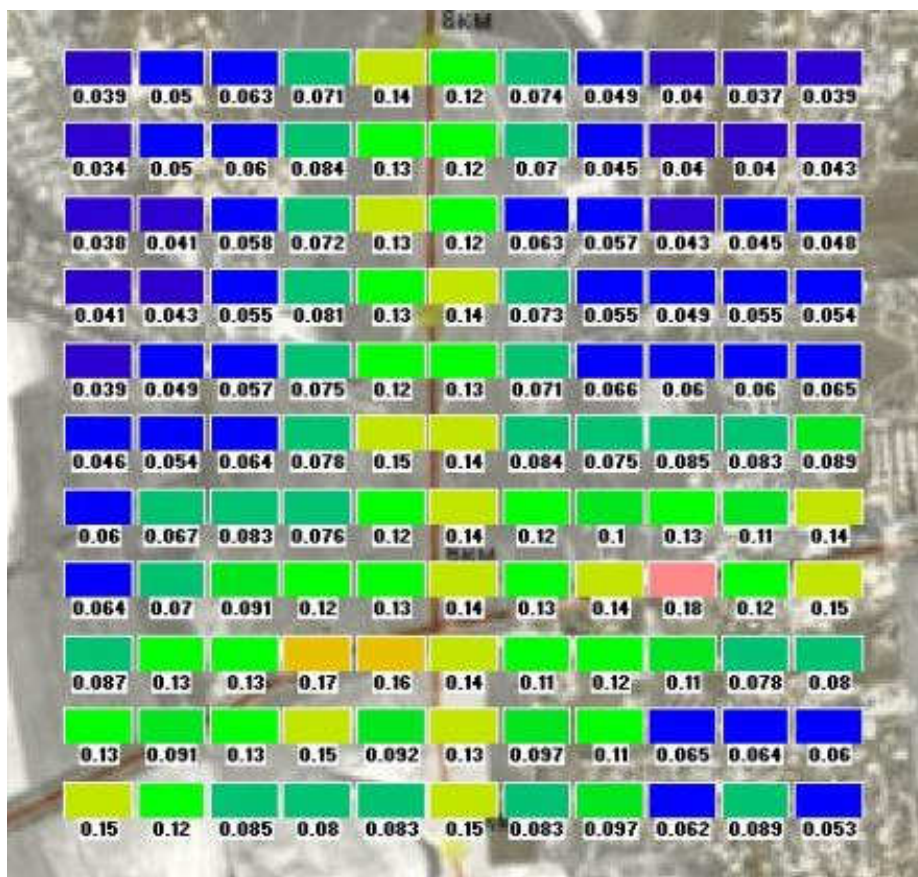




Figure 2.1-24 *Kyrgauldy and Rayimbek (Area 1)*



During interpretation of modelling results, detailed maps of air pollution in residential areas with nitrogen oxides, carbon monoxide, sulphur dioxide, PM 2.5, PM 10 and non-methane hydrocarbons (kerosene vapour) were used, which were generated using the SURFER interpolation tool.

#### *Nitrogen dioxide*

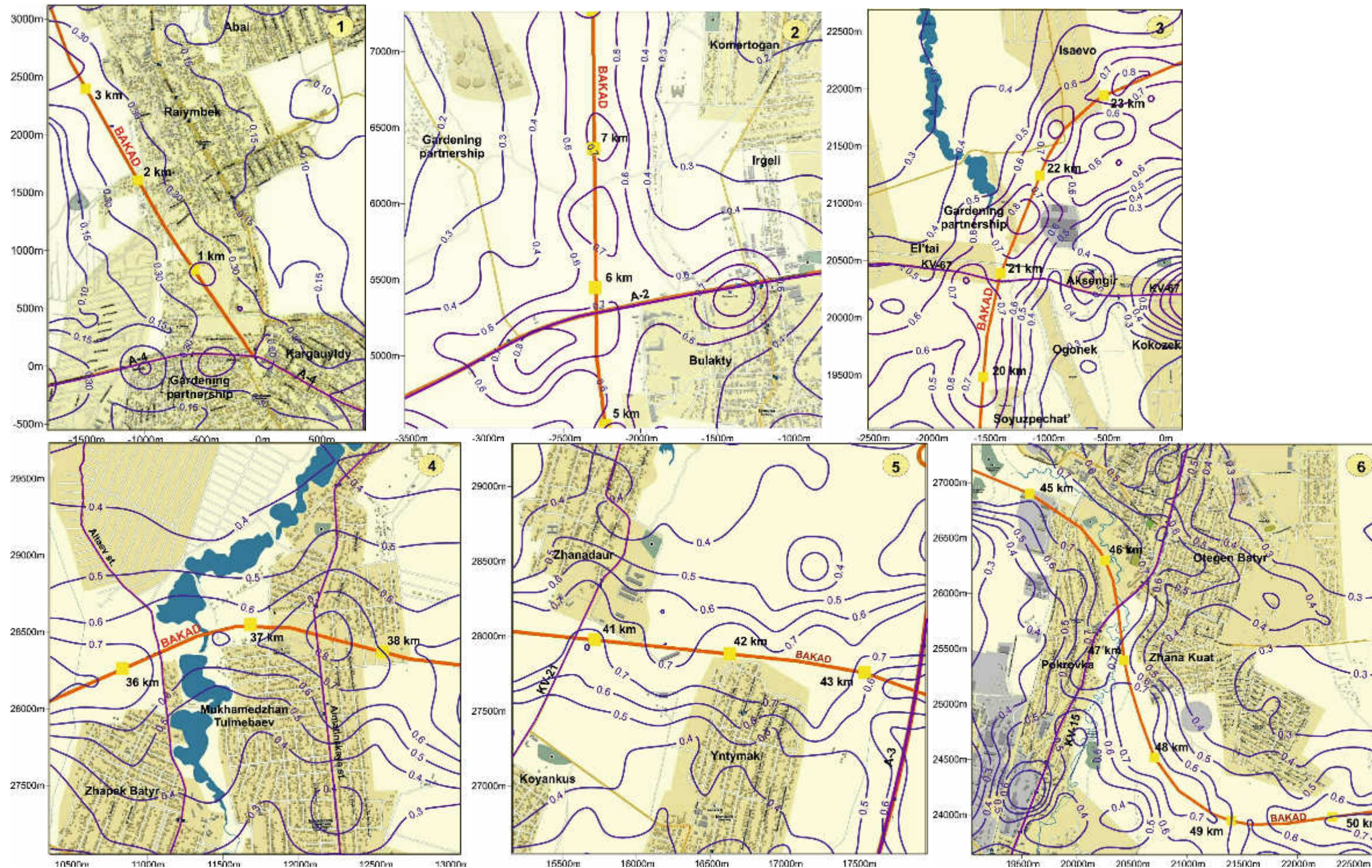
Nitrogen oxides were found to be the most problematic pollutants.

These compounds are emitted by vehicle engines and contain up to 95% of NO. Both NO and NO<sub>2</sub> have a considerably ozone-induced limitation of transformation of nitrogen monoxide into nitrogen dioxide.

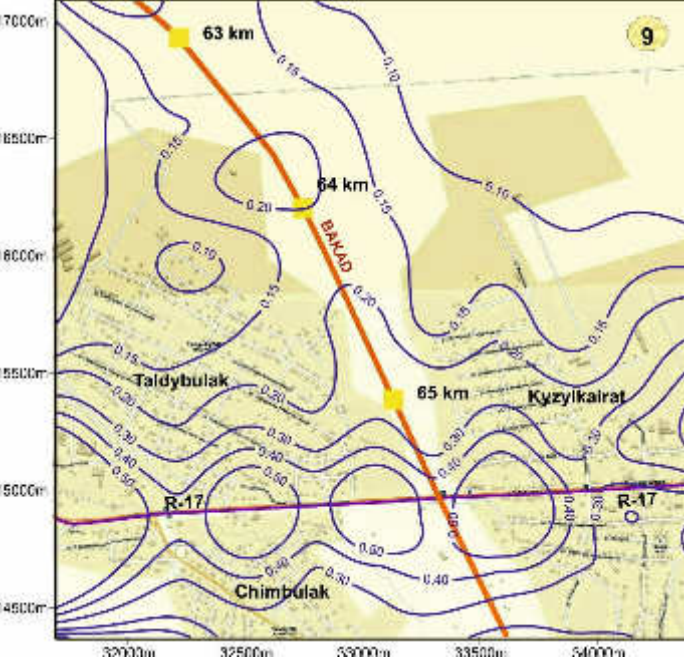
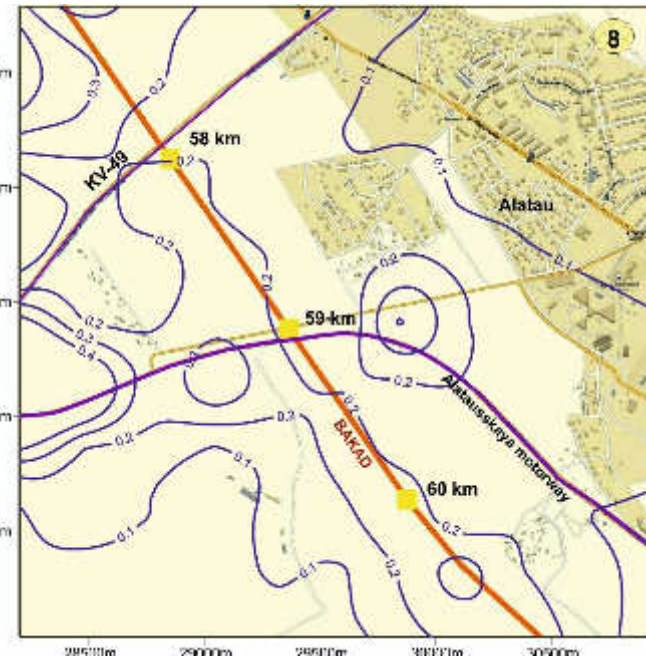
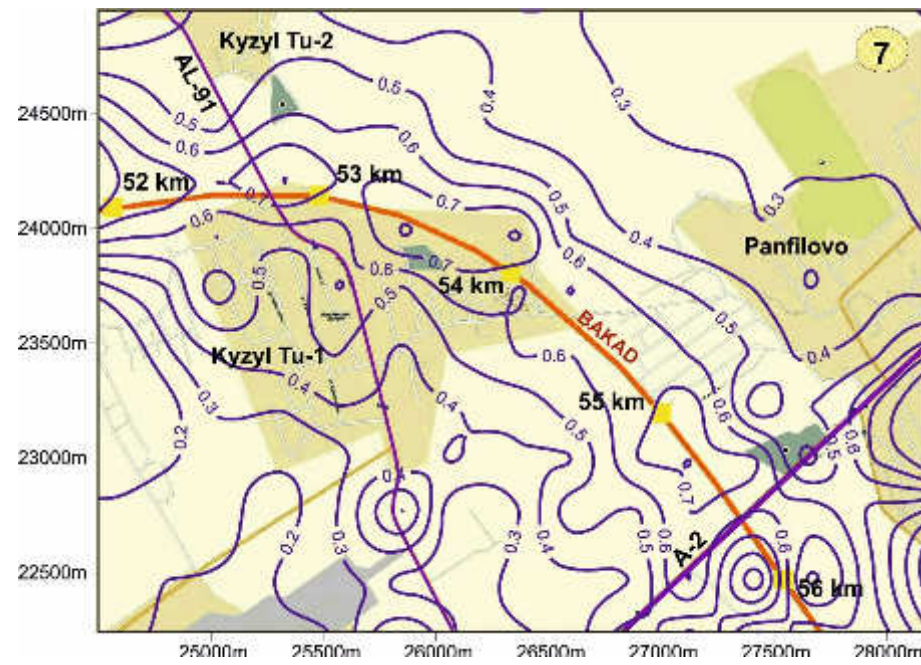
Maximum one-time concentrations of nitrogen dioxide (as a share of one-time MPC) in air within investigated areas (Areas 1-9) are shown in *Figure 2.1-25*



Figure 2.1-25 Maximum one-time concentrations of nitrogen dioxide







The modelling yielded the following maximum one-time concentrations of nitrogen dioxide in the air of residential areas:

- Area 1. In the immediate vicinity (50-150 m) of BAKAD = 0.3-0.5 MPC. At the crossing with A4 road = up to 0.9 MPC. In residential parts of Kyrgauyldy and Rayimbek = 0.1-0.3 MPC.
- Area 2. In the immediate vicinity (50-250 m) of BAKAD and the A2 road = 0.7-0.8 MPC. At Kamertogan, Irgeli neighbourhoods and gardening plots = 0.2-0.4 MPC.
- Area 3. In the immediate vicinity (50-250 m) of BAKAD = 0.7-0.5 MPC. At the crossing with the KV67 road = up to 1.15 MPC. In residential parts of Yeltai = 0.3-0.7 MPC. In residential parts of Aksengir, Kokozek, Ogonyok and Soyuzpechat = 0.4-0.7 MPC.
- Area 4. In the immediate vicinity (50-250 m) of BAKAD = 0.6-0.9 MPC. In residential parts of Zhapek Batyr and Mukhametzhan Tuymebayev = 0.3-0.8 MPC.
- Area 5. In the immediate vicinity (50-250 m) of BAKAD = 0.6-0.8 MPC. At the crossing with the A3 road = up to 1.0 MPC. In residential parts of Yntymak and Zhandur = 0.3-0.8 MPC.
- Area 6. In the immediate vicinity (50-250 m) of BAKAD = 0.6-0.8 MPC. At the crossing with the KV15 road = 1.15 MPC. In residential parts of Pokrovka, Otegen Batyr and Zhana Kuat = 0.2-0.7 MPC.
- Area 7. In the immediate vicinity (50-250 m) of BAKAD = 0.6-0.8 MPC. In residential parts of Kyzyl Tu 1 = 0.3-0.8 MPC, in Kyzyk Tu 2 = 0.3-0.5 MPC, in Panfilovo = 0.3-0.6 MPC.
- Area 8. In the immediate vicinity (50-250 m) of BAKAD = 0.2-0.3 MPC, in Altai – less than 0.2 MPC. Low air pollution.
- Area 9. In the immediate vicinity (50-250 m) of BAKAD = 0.2-0.3 MPC. 50 metres from the crossing with R17 road = up to 1.3 MPC (apparently, this is caused by the pied mountainous terrain). In residential areas = up to 0.6-0.7 MPC.

Maximum one-time concentrations of nitrogen dioxide will not exceed in the residential areas across all monitoring areas. A slight exceedance (of up to 10-30%) of air quality regulations is only possible at specific parts of BAKAD where it crosses existing radial roads.

**Average annual concentrations** of nitrogen dioxide (as a share of annual MPC) along the whole length of BAKAD are shown in *Figure 2.1-26*, and concentrations in residential air (Areas 6 and 7) near the northern part of the road, where the highest traffic is expected, are shown on *Figure 2.1-27* and *Figure 2.1-28*.

Figure 2.1-26 Average annual air concentrations of nitrogen dioxide within 450 m from BAKAD



Figure 2.1-27 Average annual concentrations of nitrogen dioxide (as a share of annual MPC) in residential air (Area 6) near the northern part of the road

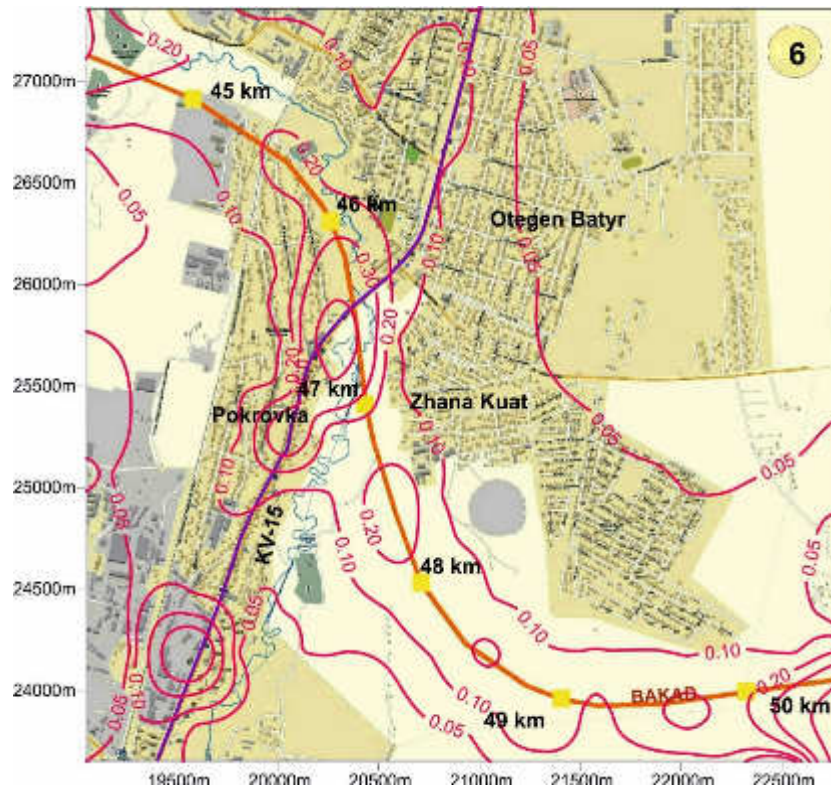
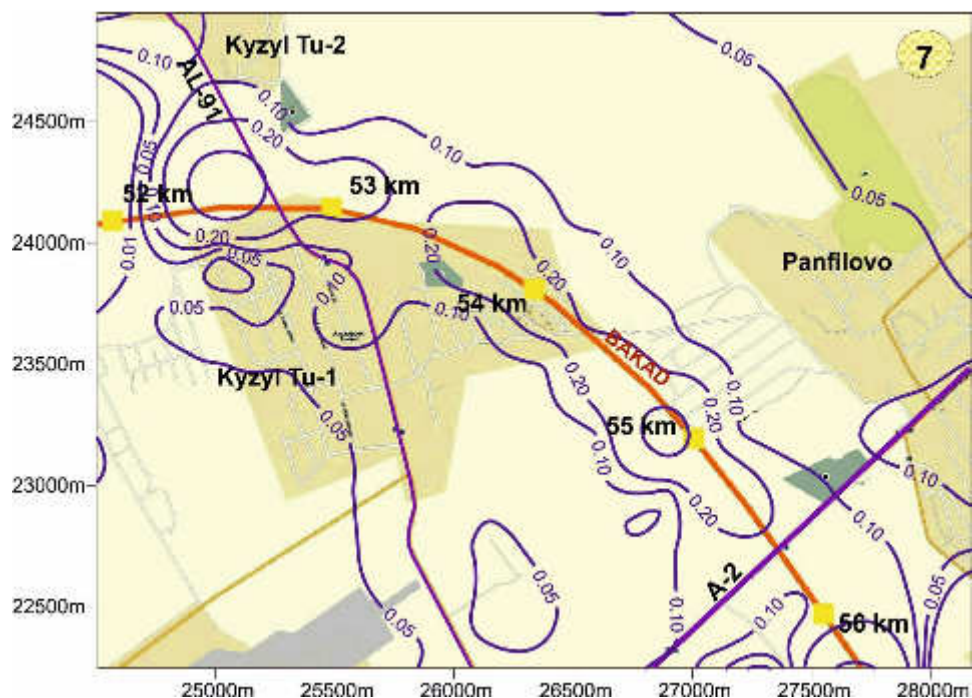




Figure 2.1-28 Average annual concentrations of nitrogen dioxide (as a share of annual MPC) in residential air (Area 7) near the northern part of the road



Annual average concentrations of NO<sub>2</sub> were found to be low at 0.1-0.3 MPC along the whole length of BAKAD, 150-450 m from the road's centreline. This may increase to 0.5-0.6 MPC at 50 m from the road in its northern part (PK24-PK45). In all modelled residential areas, NO<sub>2</sub> concentrations are expected to be below 0.5 MPC.

#### Nitrogen oxide

**Maximum one-time concentrations** of nitrogen oxide (as a share of one-time MPC) along the whole length of BAKAD are shown in Figure 2.1-29, and concentrations in residential air (Areas 6 and 7, PK24-PK25) near the northern part of the road, where the highest traffic is expected, are shown in Figure 2.1-30 and Figure 2.1-31.

Figure 2.1-29 Maximum one-time air concentrations of nitrogen oxide within 450 m from BAKAD



Figure 2.1-30 Average annual concentrations of nitrogen oxide (as a share of annual MPC) in residential air (Area 6) near the northern part of the road

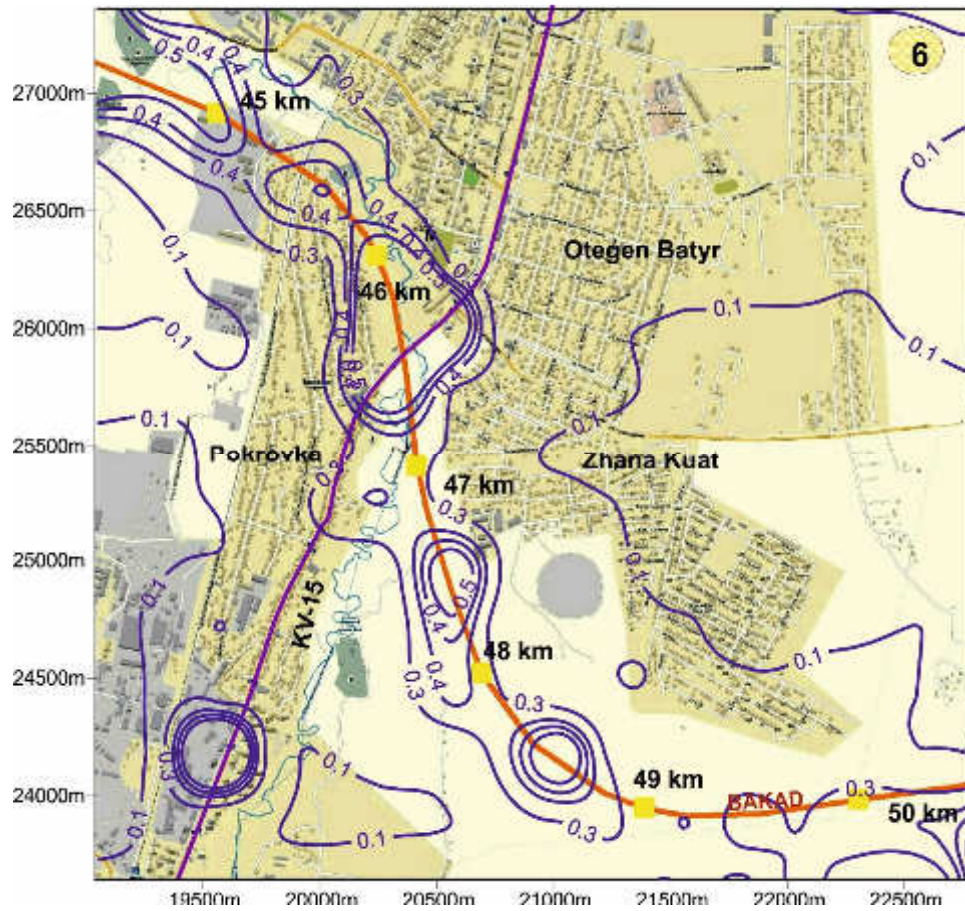
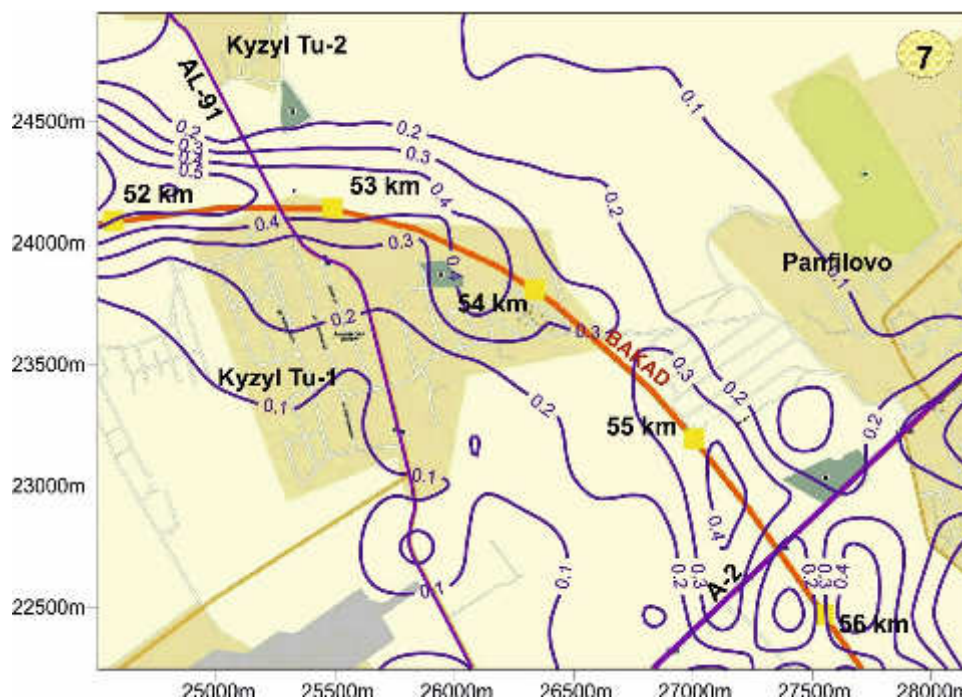




Figure 2.1-31 Average annual concentrations of nitrogen oxide (as a share of annual MPC) in residential air (Area 7) near the northern part of the road



Maximum one-time concentrations of NO are expected to be within air quality thresholds at up to 0.6 MPC along the whole length of BAKAD, 50-250 m from the road's centreline. At most of the modelled residential areas, NO concentrations are expected to be below 0.4 MPC.

MPC may be exceeded at a number of crossings with radial roads: maximum one-time concentrations of NO may reach 1 MPC where BAKAD crosses the KV67 and R17 roads and 1.2 MPC at the KV15 road crossing.

**Average annual concentrations** of nitrogen oxide (as a share of annual MPC) along the whole length of BAKAD are shown in Figure 2.1-32, and concentrations in residential air (Areas 3 and 7) in Yeltai, Aksengir, Kokozeq, Kyzyl Tu 1, Kyzyl Tu 2, and Panfilovo are shown on Figure 2.1-33 and Figure 2.1-34.



*Figure 2.1-32 Average annual air concentrations of nitrogen oxide within 450 m from BAKAD*



Figure 2.1-33 Average annual concentrations of nitrogen oxide (as a share of annual MPC) in residential air (Area 3) in Yeltai, Aksengir and Kokozeck

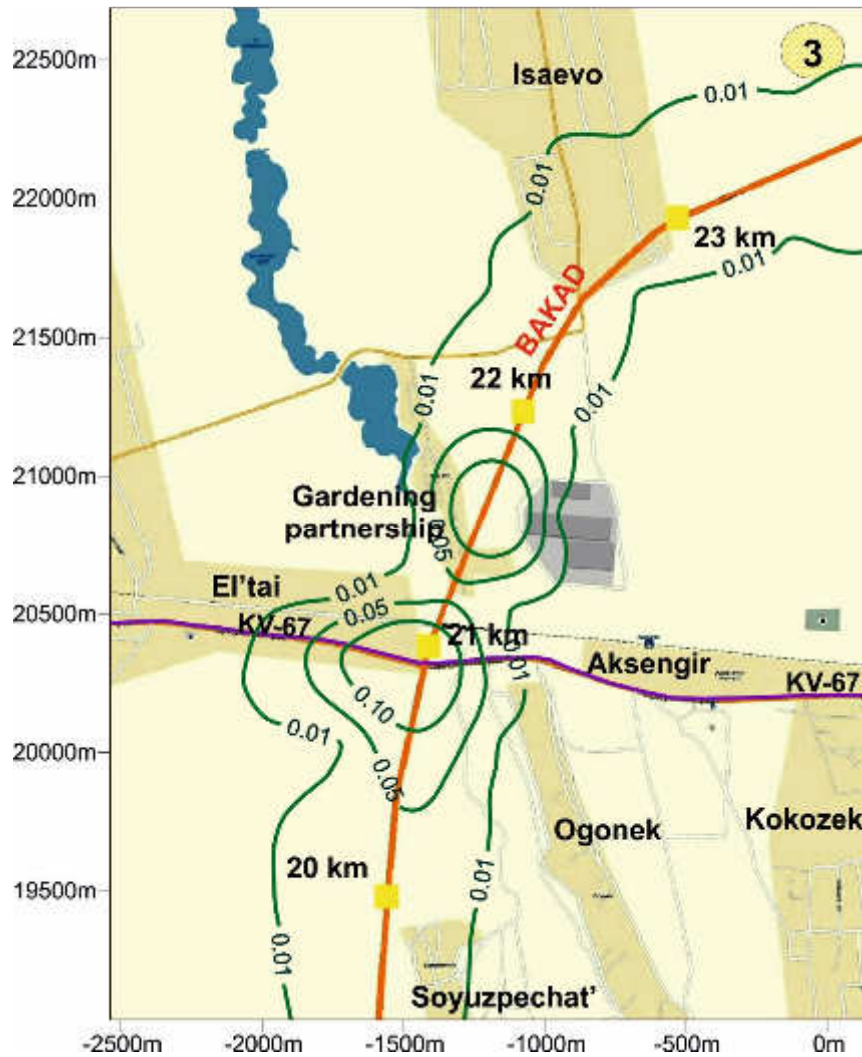
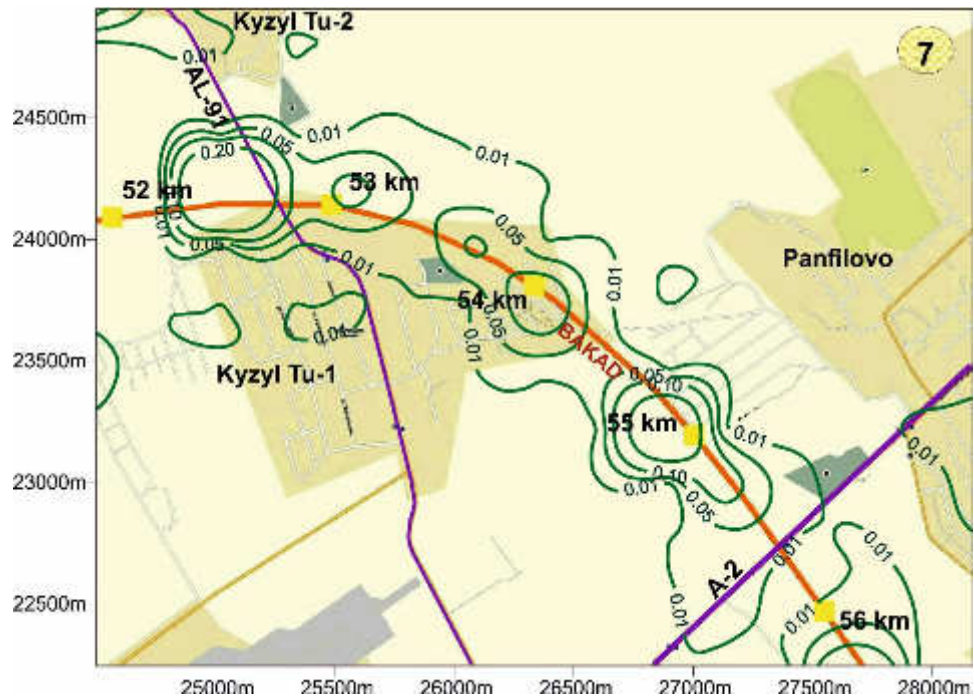


Figure 2.1-34 Average annual concentrations of nitrogen oxide (as a share of annual MPC) in residential air (Area 7) in Kyzyl Tu 1, Kyzyl Tu 2, and Panfilovo



Average annual concentrations of NO in the vicinity of BAKAD (50-150 m from the road) will be low at 0.1-0.2 MPC and will be even lower at most of the residential areas.

*Carbon monoxide*

**Maximum one-time concentrations** of carbon monoxide (as a share of one-time MPC) along the whole length of BAKAD are shown in *Figure 2.1-35*.

*Figure 2.1-35* Maximum one-time air concentrations of carbon monoxide within 450 m from BAKAD



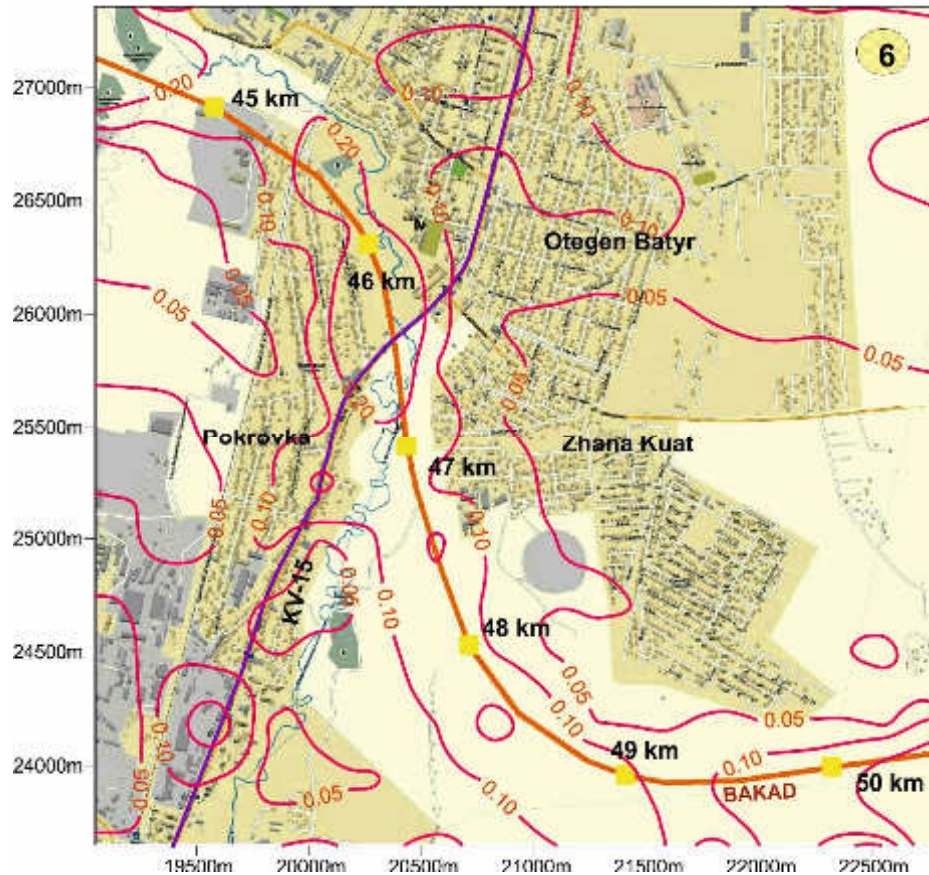
*Figure 2.1-36* and *Figure 2.1-37* show, for illustrative purposes, maximum one-time concentrations of CO in residential areas (Areas 3 and 6).



Figure 2.1-36 Maximum one-time concentrations of carbon monoxide in residential areas (Area 3)



Figure 2.1-37 Maximum one-time concentrations of carbon monoxide in residential areas (Area 6)



Maximum one-time concentrations of CO are expected to be low along the whole length of BAKAD (50-250 m from the road) at the levels not exceeding 0.3 MPC; at most of the residential areas concentrations are expected to be even lower at 0.1-0.2 MPC.

**Maximum daily concentrations** of carbon monoxide (as a share of one-time MPC) along the whole length of BAKAD are shown in Figure 1.5-31.

Figure 1.5-31. Maximum daily air concentrations of carbon monoxide within 450 m from BAKAD

*Figure 2.1-38 Maximum daily air concentrations of carbon monoxide within 450 m from BAKAD*



Daily concentrations of CO are expected to be within the limits along the whole length of BAKAD, peaking at up to 0.6 MPC in the immediate vicinity of the road (50 m).

Maximum daily concentrations of CO (as a share of daily MPC) at residential areas are shown below in Figures 1.5-32 and 1.5-33.



Figure 2.1-39 Maximum daily concentrations of CO (as a share of daily MPC) at residential areas (Area 3)

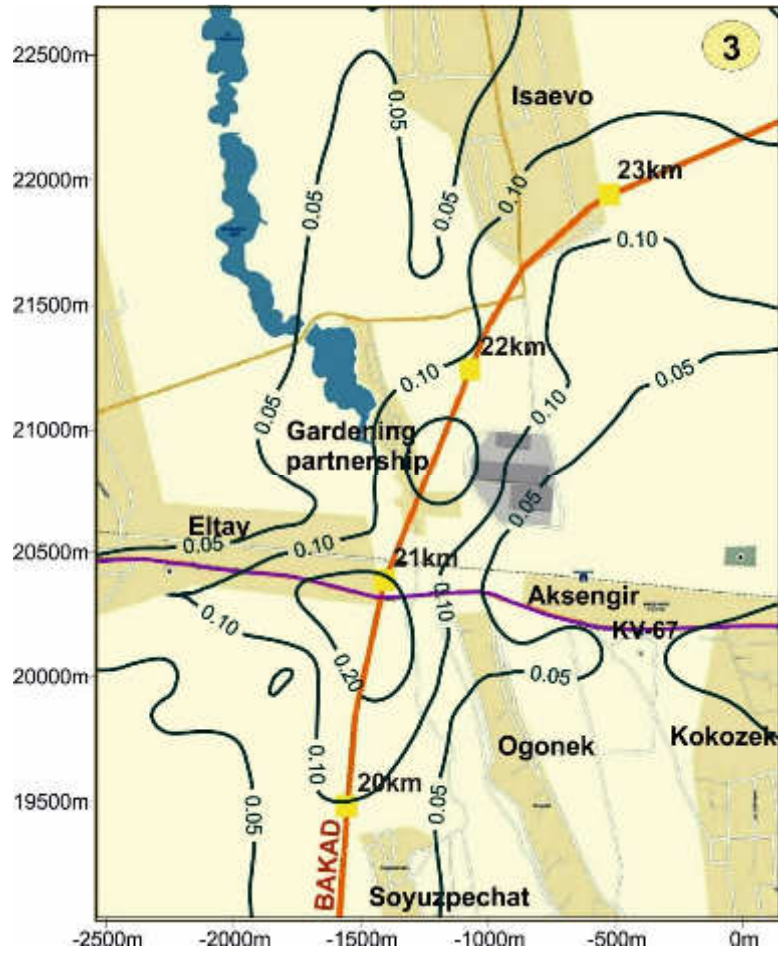
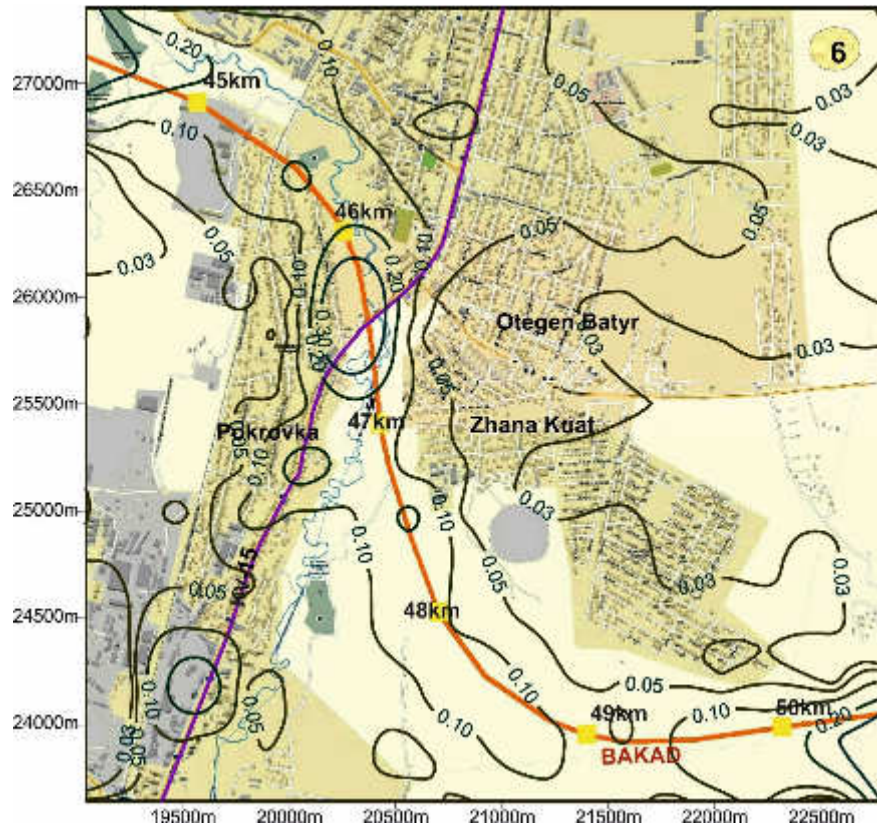


Figure 2.1-40 Maximum daily concentrations of CO (as a share of daily MPC) at residential areas (Area 6)



At most residential areas, the maximum daily concentrations of CO will be below 0.1 MPC.

#### Sulphur dioxide

**Maximum one-time concentrations** of sulphur dioxide (as a share of one-time MPC) along the whole length of BAKAD are shown in Figure 2.1-41, and concentrations in residential parts of Panfilovo and Kyzyl (Area 7), where the highest traffic is expected, are shown on Figures 1.5-23 and 1.5-24.

*Figure 2.1-41 Maximum one-time air concentrations of sulphur dioxide within 450 m from BAKAD*





Figure 2.1-42 Maximum one-time concentrations of sulphur dioxide in residential area (Area 6)

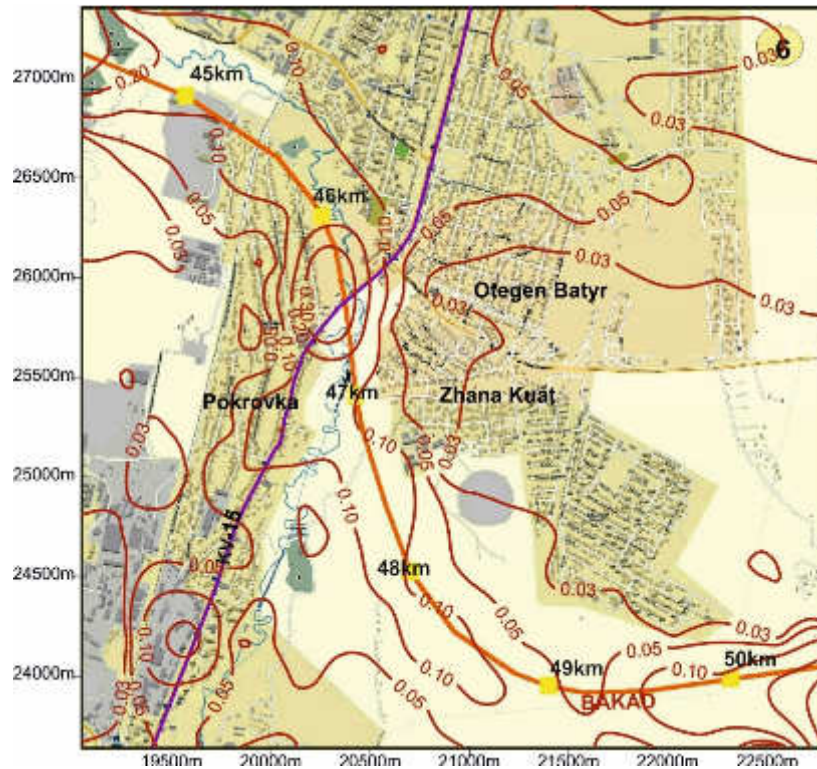
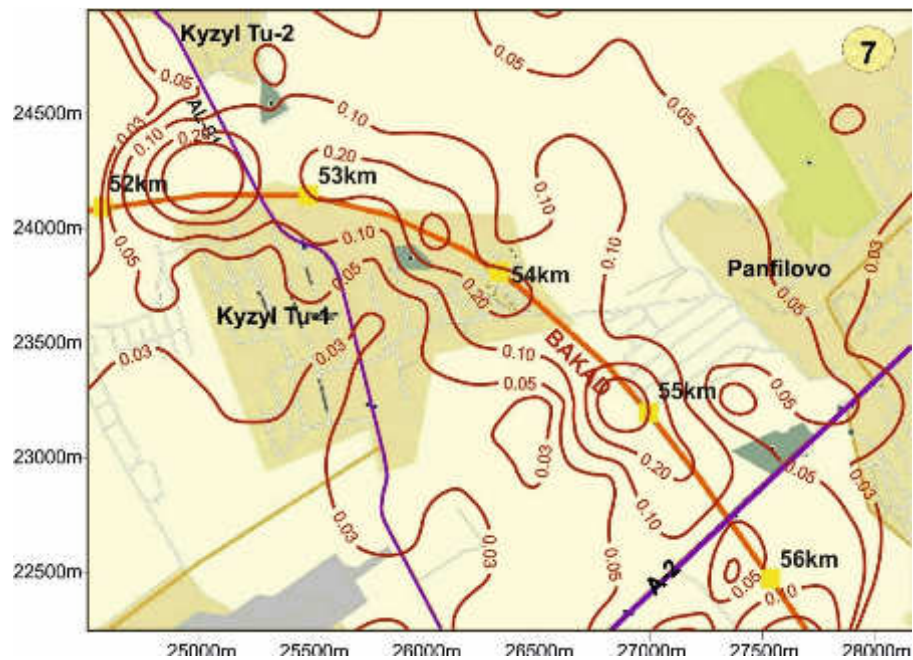


Figure 2.1-43 Maximum one-time concentrations of sulphur dioxide in residential area (Area 7)



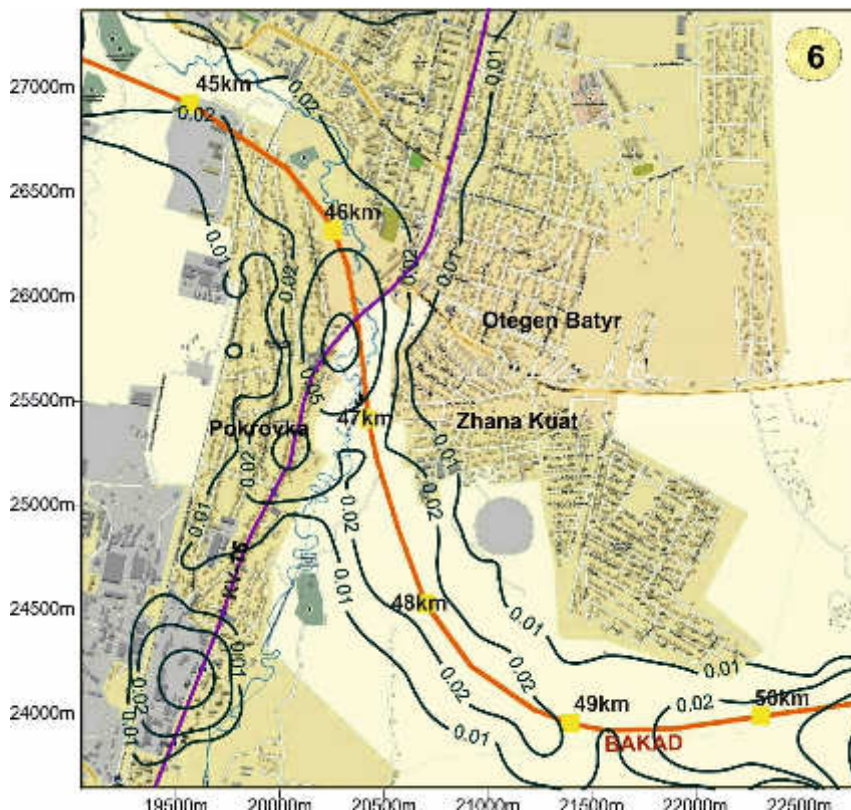
In the immediate vicinity of the road (50-450 m), maximum one-time concentrations of SO<sub>2</sub> will amount to 0.1-0.4 MPC. At crossings with certain roads, they may reach 0.5-0.6 MPC. At most of the residential areas, concentrations will be below 0.1-0.2 MPC.

**Maximum daily concentrations** of sulphur dioxide are expected to be low across the investigated territory: not more than 0.5 MPC along BAKAD and up to 0.7-0.8 MPC at several crossings with radial roads. At most of the residential areas, maximum daily concentrations of SO<sub>2</sub> will be below 0.1 MPC.

**Average annual** concentrations of sulphur dioxide along the whole length of BAKAD will be low and will not exceed 0.1 MPC.

In residential areas, average annual concentrations are generally expected to be even lower at not more than 0.05 MPC (e.g. see Figure 2.1-44).

Figure 2.1-44 Average annual concentrations of sulphur dioxide in residential area



#### Non-methane hydrocarbons

**Maximum one-time concentrations** of hydrocarbons along the whole length of BAKAD will not exceed sanitary limits. It is expected that at 100-450 m from the road, the concentrations will amount to 0.1-0.2 MPC, peaking at 0.5-0.7 MPC at a 50 m distance at the northern section of the road.

At the crossing with the KV15 Iliyskay and A2 Kuldzhinskaya motorways, hydrocarbon concentrations may reach 0.8-0.9 MPC.

At most of the residential areas, hydrocarbon concentrations will be below 0.1 MPC (see *Figure 2.1-45* and *Figure 2.1-46* for an example of estimated air pollution in residential parts of Pokrovka, Zhana Kuat, Zhana Alem, Panfilovo, and Kyzyl, where the highest traffic is anticipated).

**Figure 2.1-45** Maximum one-time concentrations of non-methane hydrocarbons in residential area (Area 6)

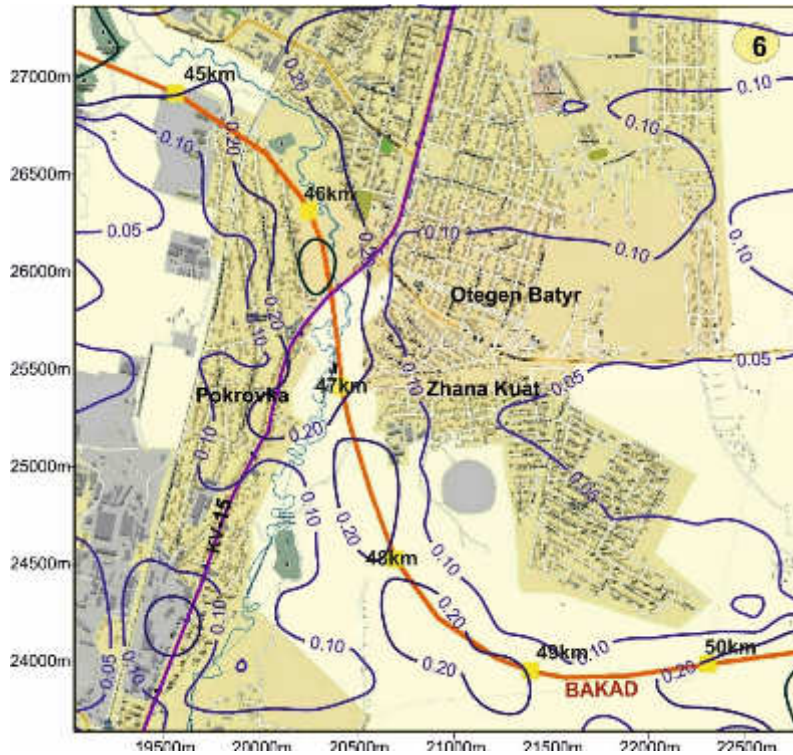
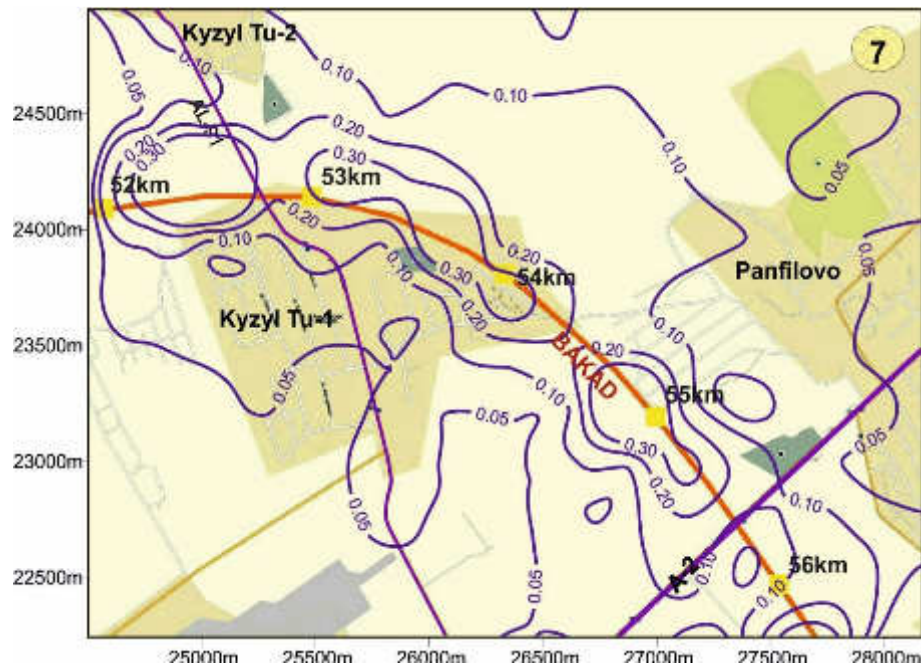




Figure 2.1-46 Maximum one-time concentrations of non-methane hydrocarbons in residential area (Area 6)



*PM<sub>10</sub> and PM<sub>2.5</sub> particulate matter*

Anticipated maximum one-time, maximum daily and average annual concentrations of particulate matter along the whole length BAKAD including crossings with radial roads and residential areas will be extremely low and are not expected to exceed 0.05 MPC.

Figure 2.1-47 and Figure 2.1-48 show, for illustrative purposes, maximum one-time concentrations of PM<sub>10</sub> and maximum daily concentrations of PM<sub>2.5</sub> at residential areas (as a share of MPC).



Figure 2.1-47 Maximum one-time concentrations of PM10 in residential area

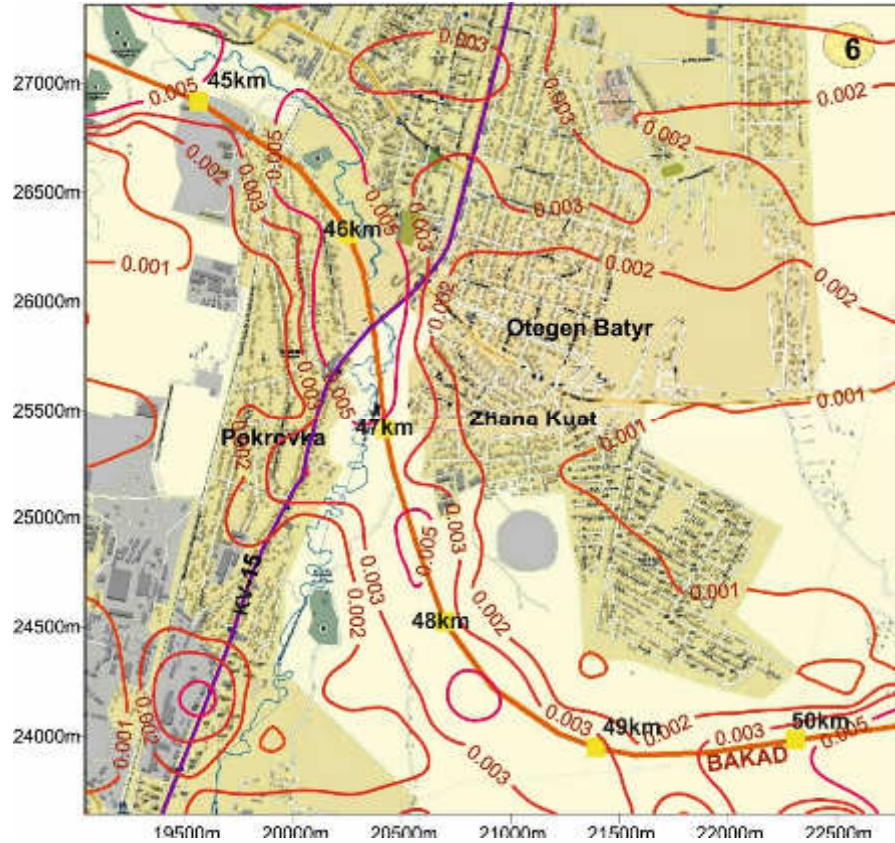
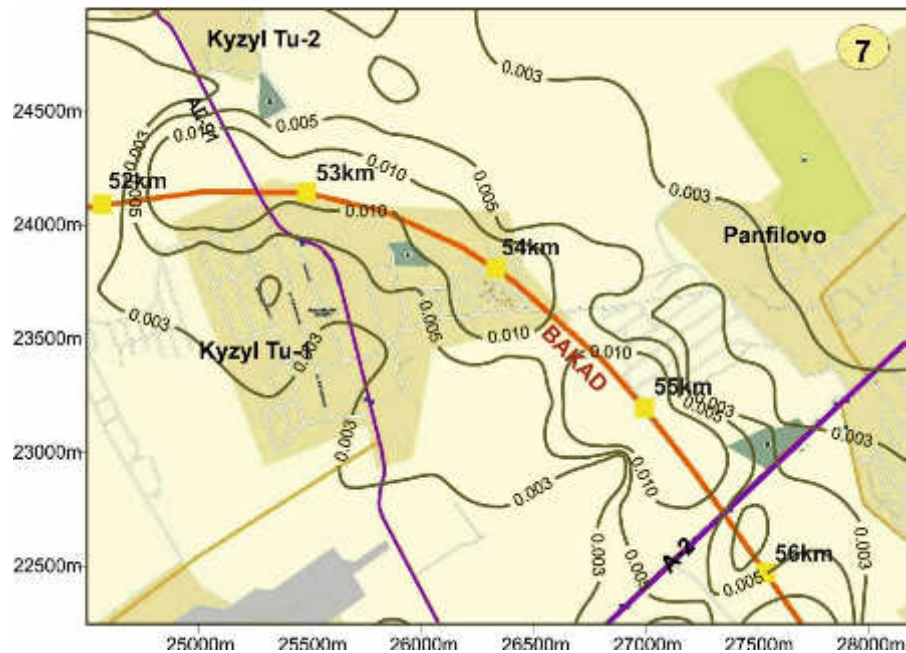


Figure 2.1-48 Maximum daily concentrations of PM2.5 in residential area



## Conclusions

Based on the modelling, the following conclusions can be made in relation to the estimated vehicular emissions during the BAKAD Operational phase.

The highest air pollution levels are expected at the northern section of BAKAD (PK24-PK45), where the highest traffic intensity is anticipated.

Emissions of nitrogen oxide will be the biggest contributor to air pollution. In the immediate vicinity of the road (at a distance of 50-250 metres), the maximum one-time concentrations of NO<sub>2</sub> in ambient air may reach 0.7-0.9 MPC, of NO – 0.6 MPC. At residential areas, NO<sub>2</sub> concentrations will be below 0.8 MPC, and of NO – not more than 0.4 MPC.

A slight exceedance of MPC is anticipated at BAKAD's crossings with existing radial roads: up to 1.15 MPC for NO<sub>2</sub> and up to 1.2 MPC for NO at the crossing with KV15 Iliyskaya motorway; up to 1.15 MPC for NO<sub>2</sub> and up to 1.0 MPC for NO at the crossing with KV67 Burundayskaya motorway; and up to 1.3 MPC for NO<sub>2</sub> and up to 1.0 MPC for NO at the crossing with R17 Talgarskaya motorway. It should be however noted that 1) the exceedances shall be confined to the crossings and will not spread to residential areas, and 2) recurrence of high one-time concentrations is extremely low (not more than three times a year on the R17 motorway and once a year on other motorways).

Average annual concentrations of nitrogen oxides in residential air will be visibly lower: up to 0.5 MPC for NO<sub>2</sub> and 0.1-0.2 MPC for NO.

Concentrations of CO, SO<sub>2</sub> and hydrocarbons will be low, within 0.1-0.2 MPC at most of the residential areas in question. In the immediate vicinity of BAKAD (within 150 m from the road), concentrations may reach 0.3 MPC for CO, 0.4 MPC for SO<sub>2</sub>, and 0.5-0.7 MPC for hydrocarbons.

Pollution with PM<sub>10</sub> and PM<sub>2.5</sub> particulate matter is expected to be negligibly low, with concentrations below 0.05 MPC.

It can therefore be concluded that even with the highest traffic intensity expected during the operation of BAKAD air quality standards will not be exceeded in the suburban residential parts of Almaty.

Summary of pollutants' concentrations is presented in the table below (*Table 2.1-17*).

All predicted concentration values vary between 15% and 80% of the relevant air quality standards, therefore the magnitude of air quality impacts will vary from negligible to medium (

Table 2.1-18).

Based on the impact magnitude and sensitivity of receptors, impact significance was determined (Table 2.1-19).

**Table 2.1-17 Concentrations of pollutants in the ambient air resulting from the Project operation**

Receptor location	Pollutant concentration as proportion of MPC <sub>MNR</sub>					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	0.10-0.30	<0.10	<0.10	<0.10	<0.10	<0.10
Rayimek	0.10-0.30	<0.10	<0.10	<0.10	<0.10	<0.10
Abay	<0.15	<0.10	<0.10	<0.10	<0.10	<0.10
Bulakty	0.30-0.80	<0.10	<0.10	<0.10	<0.10	<0.10
Irgeli	0.20-0.40	<0.10	<0.10	<0.10	<0.10	<0.10
Kemertogan	0.20	<0.10	<0.10	<0.10	<0.10	<0.10
Dachas (7 km)	0.20-0.40	<0.10	<0.10	<0.10	<0.10	<0.10
Soyuzpechat' dacha community	0.40-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Ogonek	0.20-0.40	<0.10	<0.10	<0.10	<0.10	<0.10
Kokzek	0.30-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Eltay	0.30-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Dachas (21-22 km)	0.40-0.80	<0.10	<0.10	<0.10	<0.10	<0.10
Isayevo	0.30-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Aksengir	0.40-0.50	<0.10	<0.10	<0.10	<0.10	<0.10
Zhalek Batyr	0.20-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Mukhametzhann Tuymebaev	0.30-0.80	<0.10	<0.10	<0.10	<0.10	<0.10
Yntymak	0.30-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Zhanadaur	0.30-0.70	<0.10	<0.10	<0.10	<0.10	<0.10
Koyankus	0.30-0.50	<0.10	<0.10	<0.10	<0.10	<0.10
Pokrovka	0.40-0.70	0.10-0.50	<0.20	<0.10	<0.20	<0.10
Zhana Kuat	0.30-0.70	0.10-0.40	<0.10	<0.10	<0.20	<0.10

Receptor location	Pollutant concentration as proportion of MPC <sub>MNR</sub>					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Otegen Batyr	0.30-0.70	0.10-0.40	<0.20	<0.10	<0.20	<0.10
Kyzyl-Tu-1	0.30-0.70	0.10-0.50	<0.10	<0.20	<0.20	<0.10
Kyzyl-Tu-2	0.30-0.70	0.10	<0.10	<0.10	<0.10	<0.10
Panfilovo	0.30-0.40	<0.20	<0.10	<0.10	<0.10	<0.10
Kyzylkairat	0.20-0.50	<0.10	<0.10	<0.10	<0.10	<0.10
Taldybulak	0.10-0.50	<0.10	<0.10	<0.10	<0.10	<0.10
Chimbulak	0.20-0.50	<0.10	<0.10	<0.10	<0.10	<0.10
Alatau	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

\* non-methane hydrocarbons



**Table 2.1-18 Magnitude of air quality impacts during operation stage**

Receptor location	Impact magnitude					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Rayimek	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Abay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bulakty	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Irgeli	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Kemertogan	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (7 km)	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Soyuzpechat' dacha community	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Ogonek	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Kokzek	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Eltay	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (21-22 km)	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Isayevo	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Aksengir	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Zhalek Batyr	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Mukhametzhan Tuymebaev	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Yntymak	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Zhanadaur	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Koyankus	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Pokrovka	Medium	Small	Negligible	Negligible	Negligible	Negligible
Zhana Kuat	Medium	Small	Negligible	Negligible	Negligible	Negligible
Otegen Batyr	Medium	Small	Negligible	Negligible	Negligible	Negligible

Receptor location	Impact magnitude					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyzyl-Tu-1	Medium	Small	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-2	Medium	Negligible	Negligible	Negligible	Negligible	Negligible
Panfilovo	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzylkairat	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Taldybulak	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Chimbulak	Small	Negligible	Negligible	Negligible	Negligible	Negligible
Alatau	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

\* non-methane hydrocarbons

**Table 2.1-19 Significance of air quality impacts during operation stage**

Receptor location	Impact significance					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyrgauyldy	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Rayimek	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Abay	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bulakty	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Irgeli	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Kemertogan	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (7 km)	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Soyuzpechat' dacha community	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Ogonek	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Kokzek	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Eltay	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Dachas (21-22 km)	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Isayevo	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Aksengir	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Zhalek Batyr	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Mukhametzhan Tuymebaev	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Yntymak	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Zhanadaur	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Koyankus	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Pokrovka	Moderate	Minor	Negligible	Negligible	Negligible	Negligible
Zhana Kuat	Moderate	Minor	Negligible	Negligible	Negligible	Negligible
Otegen Batyr	Moderate	Minor	Negligible	Negligible	Negligible	Negligible

Receptor location	Impact significance					
	NO <sub>2</sub>	NO	CO	SO <sub>2</sub>	NMH*	PM
Kyzyl-Tu-1	Moderate	Minor	Negligible	Negligible	Negligible	Negligible
Kyzyl-Tu-2	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible
Panfilovo	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Kyzylkairat	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Taldybulak	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Chimbulak	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Alatau	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

\* non-methane hydrocarbons

## 2.1.6 Assessment of the impact on vegetation associated with air pollution

The international environmental practice uses air quality standards in terms of impact on human health and on the environment. These secondary air quality standards serve to protect vegetation, agricultural crops, domestic animals etc.

In protection of vegetation and natural ecosystems, the international practice uses the concept of the critical level (CLE), which is defined as the concentration of a pollutant in the air above which direct adverse effects on individual plant species and ecosystems on the whole may occur.

Directive 2008/50/EC of the European Parliament and Council dated 21 May 2008 on ambient air quality and cleaner air for Europe sets average annual limit concentrations at 0.020 mg/m<sup>3</sup> for sulphur dioxide and 0.030 mg/m<sup>3</sup> for nitrogen oxides for vegetation sited away from agglomerations.

The critical levels are based on recommendations from various European organisations. Also, UNECE conferences recommended, after a number of revisions, new average annual concentration limits of sulphur dioxide and nitrogen dioxide at 20 and 29 µg/m<sup>3</sup> respectively.

In 2000, the WHO adopted critical levels of sulphur dioxide and nitrogen dioxide for various types of vegetation. For instance, for lichens, the average annual critical level of sulphur dioxide is 10 µg/m<sup>3</sup>, for forest ecosystems – 20 µg/m<sup>3</sup>, and for small grain crops – 30 µg/m<sup>3</sup>.

The critical levels set by said international organisations (UNECE, WHO, IUFRO) are presented in *Table 2.1-20*.

**Table 2.1-20** *Critical levels of pollutants in ambient air for different types of vegetation in force in the EU, µg/m<sup>3</sup>*

Pollutant		Period	Lichens	Forest ecosystems	Small grain crops	
Sulphur dioxide	WHO	Average annual	10	20	30	
		Average daily				
	UNECE	Average annual	20			
		Average daily	70			
	IUFRO	Average annual		5		
		Average daily		10		
		One-time		15		
	Nitrogen oxide	WHO	Average annual		3	
			Average daily		75	
UNECE		Average annual		29		



Average annual concentrations of sulphur and nitrogen dioxides from vehicular traffic on BAKAD were estimated for the whole length of the road. For illustrative purposes, below are maps of average annual concentrations of NO<sub>2</sub> (Figure 1.6-1) in Bulakty, Irgeli, Kamertogan neighbourhoods of Almaty, and of SO<sub>2</sub> (Figure 2.1-49) in Panfilovo, Kyzyl Tu 1 and Kyzyl Tu 2 neighbourhoods of Almaty.

*Figure 2.1-49 Average annual concentrations of nitrogen dioxide at residential and cultivated areas,  $\mu\text{g}/\text{m}^3$*

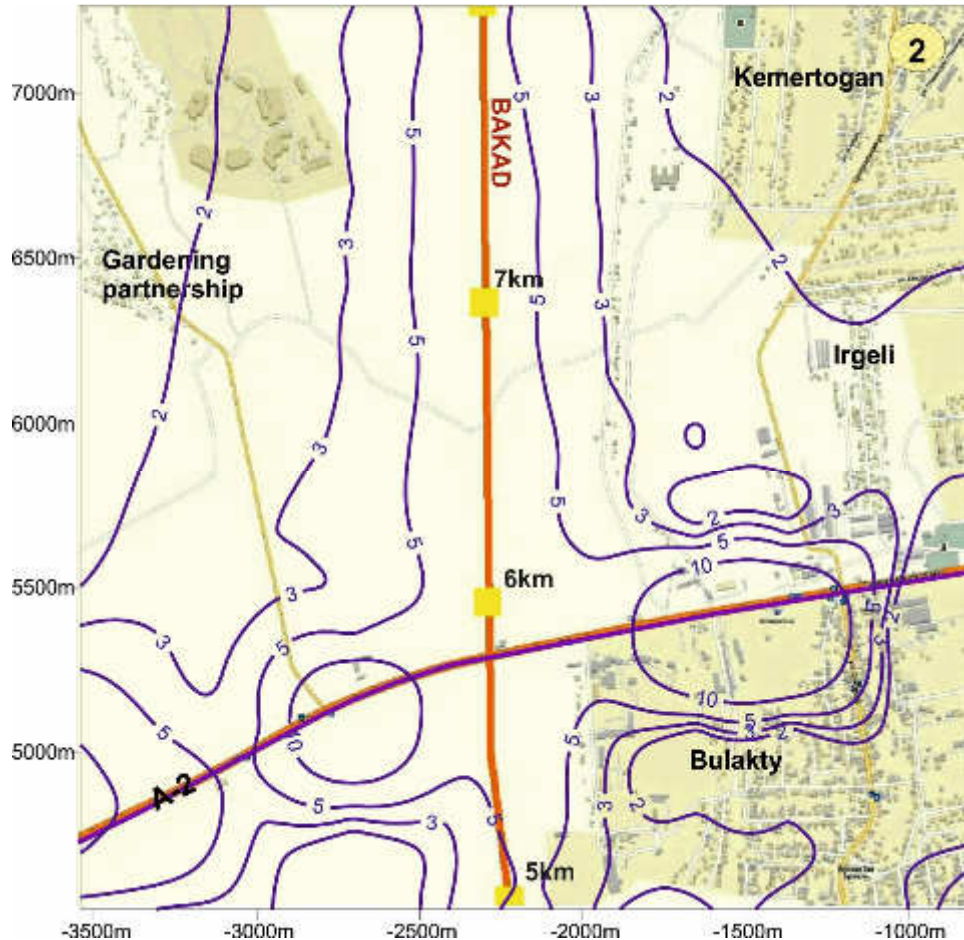
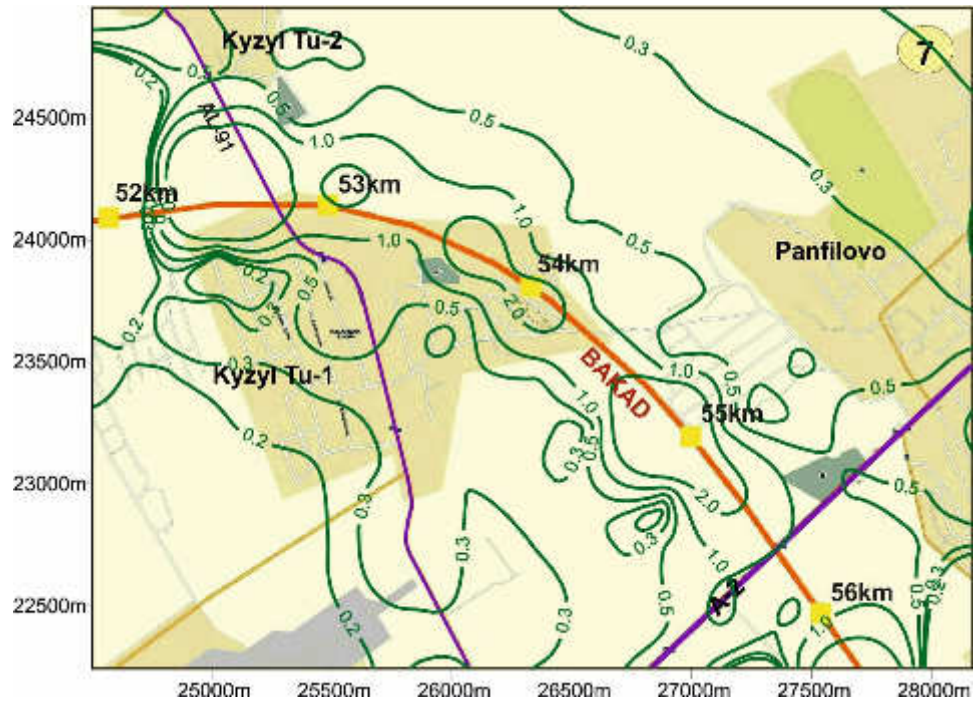


Figure 2.1-50 Average annual concentrations of sulphur dioxide at residential and cultivated areas,  $\mu\text{g}/\text{m}^3$



The estimations show that average annual concentrations within 150-250 m from BAKAD will be below 5-10  $\mu\text{g}/\text{m}^3$  for nitrogen dioxide and below 1-2  $\mu\text{g}/\text{m}^3$  for sulphur dioxide.

This is considerably below international threshold values and therefore the impact of  $\text{SO}_2$  and  $\text{NO}_2$  emissions on vegetation can be rated as negligibly low.

### 2.1.7 Measures to mitigate air quality impacts

During the construction phase of the BAKAD project, the measures to reduce the impact on atmospheric air will mainly involve reduction of emissions from construction machinery and vehicles.

The biggest effect can be achieved by using modern machinery whose engines comply with EURO 3-4 environmental classes. This measure alone is expected to reduce emissions of nitrogen oxides, soot, formaldehyde, carbon monoxide, and hydrocarbons by 2-3 times.

Other measures involve organisational and technical activities like:

- Allocation of different time slots for operation of machinery and equipment not involved in the same process;
- Regular preventive maintenance and inspection of construction machines, mechanisms, and motor vehicles for quality of engine exhaust emissions (at least annual scheduled inspections and also after every engine overhaul or adjustment);
- Ban on using machinery / equipment that have not passed a technical inspection involving an engine exhaust check;
- Allocation of different time slots for traffic of construction machinery and vehicles to and from construction sites;
- Using tents when transporting dusting cargoes;
- Artificial watering during unloading of trucks with soil, sand and stone chippings;
- Operation of diesel generators in compliance with operating manuals;
- Ban on burning construction debris (cable isolation, timber, oily rags etc.);
- Optimal utilisation of construction and machinery to reduce fuel consumption and emissions;
- Leak-proof delivery and loading of fuels and oils to avoid emissions of volatile components;
- Use of low-sulphur fuels to reduce emissions of sulphur dioxide;
- Ban on using construction machinery during adverse weather conditions.

## 2.1.8 Emissions of Greenhouse Gases

Emissions of greenhouse gases during the construction phase were estimated in line with the Guidelines for National Greenhouse Gas Inventories (IPCC, 2006).

According to this document, combustion of diesel fuel generates the following specific emissions of greenhouse gases:

**Table 2.1-21 Specific GHG emission values**

Fuel	GHG emissions, t/t of fuel		
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
Diesel fuel	3.13	0.000129	0.000026

The global warming potential in CO<sub>2</sub> equivalent units is 21 for methane and 310 for nitrogen oxide.

Consumption of diesel fuel by construction machinery and dump trucks during transportation of loose materials is estimated at 8,400 tpy, which corresponds to GHG emissions of 26,383 tonnes of CO<sub>2</sub> equivalent per year.

Temporary (for up to 3 years) annual emission of GHG during BAKAD's construction will be very slightly above the intervention level of 25,000 tonnes of CO<sub>2</sub> equivalent set by the IFC Performance Standards.

Emissions of greenhouse gases for the operational phase were estimated in line with the Guidelines for Inventories of Air Emissions from Road Transport in the Largest Agglomerations (Moscow, NIIAT, 2012).

These guidelines were harmonised with EMEP/CORINAIR Emission Inventory Guidebook and the corresponding software programme (COPERT 4, Version 9.1), and take into account the structure and pattern of vehicular traffic in large cities with over 1 million residents.

The estimation of GHG emission was made for the year 2045, when the highest traffic intensity is expected, and following the formula below:

$$Gi = Mi [g/km] \times L [km] \times N [vehicles/day] \times 365 [days/year] \times 10^{-6} (tpy),$$

Where:

Mi - is the running exhaust emissions of Substance "i" by one vehicle, weight-averaged to the traffic structure, in g/km;

L - is the length of a section of BAKAD, in km; and

N - is the traffic intensity within this section, in vehicles per day.

Table 2.1-22 Projects' GHG emissions by 2045

Section	L, km	N, vehicles/day	CO <sub>2</sub>		CH <sub>4</sub>		N <sub>2</sub> O	
			g/km	tpy	g/km	tpy	g/km	tpy
8	5.5	32,391	538.4	35,000	0.0157	1.0	0.050	3,3
1	18.5	29,216	818.1	161,170	0.025	4.9	0.0194	3,8
2	20	57,858	755.9	319,000	0.023	9.7	0.018	7,6
3	3	75,047	583.7	47,860	0.017	1.4	0.013	1,0
4	10	70,288	477.1	122,600	0.014	3.6	0.011	2,8
9	8.5	20,278	384.6	24,230	0.0096	0.6	0.0089	0,6
<b>Total:</b>				<b>709,860</b>		<b>18.2</b>		<b>19.1</b>

Given the global warming potential of methane and nitrogen oxide, the cumulative emission of greenhouse gases during the operational phase may amount to 716,130 tonnes of CO<sub>2</sub> equivalent annually, which should be viewed as a significant level.

To assess the significant of the risk associated with this impact, the emission estimate should be compared against the national quota for Kazakhstan. According to official data<sup>9</sup>, the base GHG emissions for 1990 are set at 358.38 million tonnes of CO<sub>2</sub> equivalent annually. The forecast is that by 2030, the quota for free emissions of greenhouse gases will only amount to 5% of the base level, i.e. 17.92 million tonnes of CO<sub>2</sub> equivalent annually.

According to our estimates, GHG emissions from road transport on BAKAD may amount in 2030 to 0.365 million tonnes of CO<sub>2</sub> equivalent annually (or 2% of the national quota).

<sup>9</sup> The first biannual report by Kazakhstan presented in accordance with Resolution 1/CP.16 of participants of the UN Framework Convention on Climate Change (Astana, 2014).



## Appendix 2: Noise Impact Assessment

# 1 ENVIRONMENTAL TOPICS

## 1.1 PHYSICAL IMPACT FACTORS. NOISE IMPACT

This Chapter reports an assessment of the potential noise impacts that may arise from the construction and operation of the Project. The noise impact assessment included:

- identification of sources of external noise, determination of their noise characteristics;
- estimation of noise levels in the adjacent residential areas and its assessment against hygienic requirements;
- in cases when noise levels are expected to exceed hygienic standards, development of measures to reduce noise to the hygienic standards.

Noise impacts have been assessed in accordance with the regulations in force in Kazakhstan and in accordance with the recommendations outlined in the IFC and WHO General EHS Guidelines.

### 1.1.1 Area of Influence

The area of influence for noise impact has been determined as the area where additional noise generated by the Project reach receptors. Based on the noise modelling results, the area of influence will have the extent of about 1 km both sides from BAKAD and 500 m from point noise sources (quarries, construction sites, plants).

People living in residential areas in the vicinity to BAKAD, as well as people living near quarries, construction sites, asphalt and concrete plants were considered as impact receptors. During construction stage, Project construction personnel in shift camps will be noise impact receptors either.

### 1.1.2 Methodology

#### 1.1.2.1 Baseline survey methodology

To evaluate baseline noise in the area of influence, noise level measurements were taken at 14 points during the day and at night. Location of the noise measurement points were selected so as the measurement results to describe baseline noise levels in the residential areas closest to BAKAD and to the Project's auxiliary facilities (quarries, road maintenance facility), taking into account existing noise sources.

In addition, measurements were also carried out at the border of the residential zones of future shift camps.

Location of the measurement points is shown in the figure below (*Figure 1.1-1*).

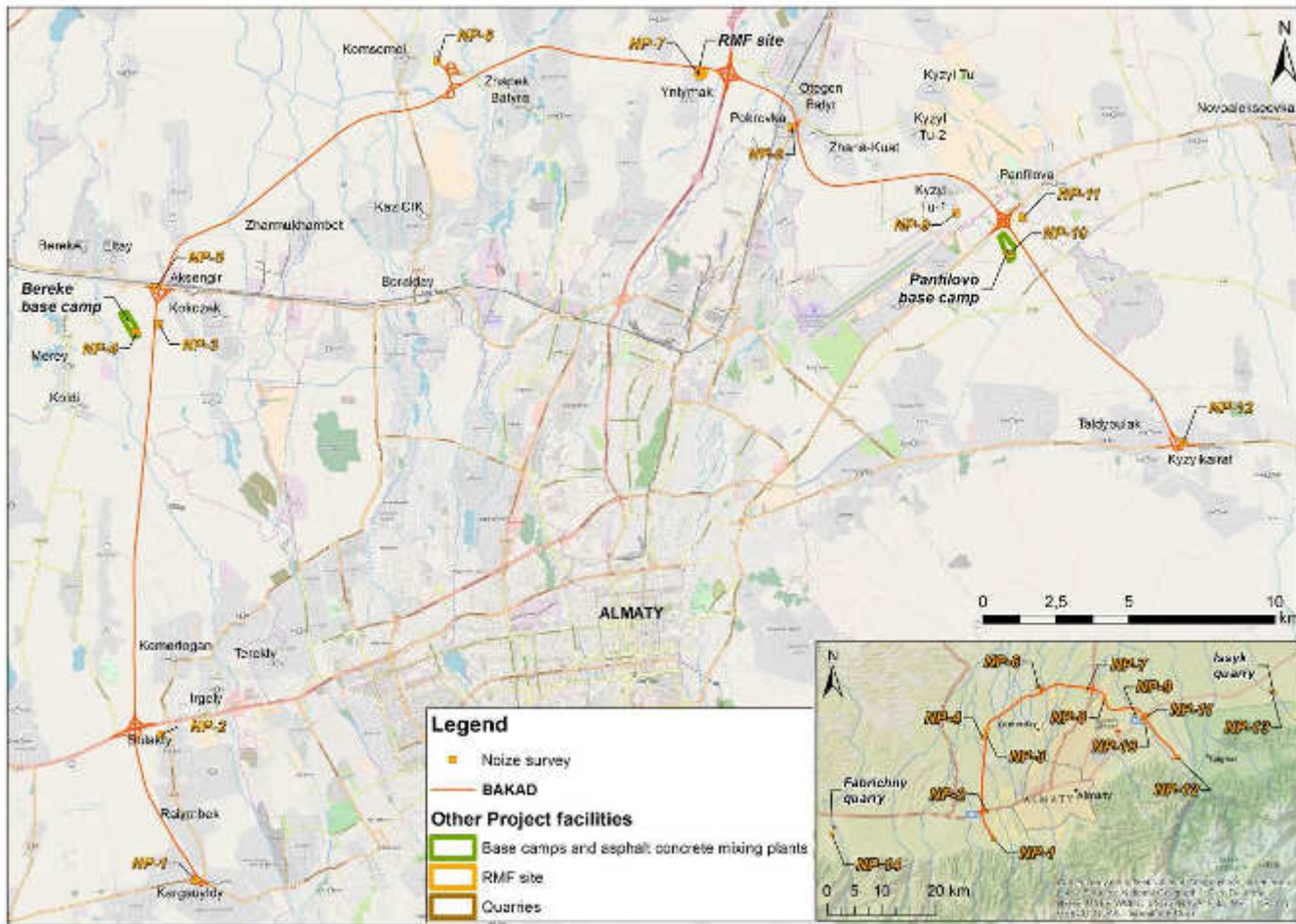


Figure 1.1-1 Location of noise measurement points along BAKAD

### 1.1.2.2 *Noise modelling methodology and applicable standards*

#### **Noise modelling methodology**

Noise levels in Project's area of influence were estimated by modelling tool in accordance with the ISO 9613-2: 1996 "Noise. Attenuation of sound with distance", which also has been adopted by Kazakhstan<sup>1</sup>.

The tool is certified by the Federal Agency for Technical Regulation and Metrology and is recommended for use by the R&D Institute of Construction Physics of the Russian Academy of Architecture and Construction Sciences.

Information related to the scenarios considered during impact assessment see in *Sections 1.1.5.1-1.1.5.2*.

#### **Applicable standards**

The noise impact was assessed in accordance with modern regulations in force in Kazakhstan and in accordance with the recommendations outlined in the IFC and WHO General EHS Guidelines.

Applicable standards provide the following assumptions:

- indoor noise levels refer to normal air exchange conditions (i.e. ventilating windows / fanlights should be open);
- noise levels are defined for both daytime and night-time.

Thus, when compliance with sanitary noise limits is achieved within areas in the immediate vicinity of residential facilities, then it would automatically mean compliance in terms of the noise penetrating such facilities.

In this assessment, the national standards are used. National noise level standards are established by Order No 169 of the Minister of National Economy of the Republic of Kazakhstan "On the Approval of Hygienic Norms to Physical Factors Influencing Humans" dated 28 February 2015 (*Table 1.1-1*).

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<sup>1</sup> GOST 31295.2-2005 "Attenuation of sound with distance. Part 2. General calculation method".



**Table 1.1-1** *Permissible sound levels, maximum and equivalent sound levels within regulated territories*

Parameter	Average compound frequencies of octave bands, Hz								Sound level $L_A$ and equivalent sound level $L_{Aeq}$ , dB(A)	Maximum sound level, $L_{Amax}$ , dB(A)
	63	125	250	500	1,000	2,000	4,000	8,000		
Territories directly adjacent to residential buildings, recreational facilities, homes for the elderly and disabled										
07:00 – 23:00	75	66	59	54	50	47	45	44	55	70
23:00 – 07:00	67	57	49	44	40	37	35	33	45	60
Living rooms in apartments										
07:00 – 23:00	63	52	45	39	35	32	30	28	40	55
23:00 – 07:00	55	44	35	29	25	22	20	18	30	45
Living rooms in dormitories										
07:00 – 23:00	67	57	49	44	40	37	35	33	45	60
23:00 – 07:00	59	48	40	34	30	27	25	23	35	50

The noise level standards recommended by international organisations are presented in *Table 1.1-2*.

**Table 1.1-2** *Permissible noise levels within regulated territories*

Land type		IFC & World Bank	WHO
		Equivalent noise levels, dB(A)	
Residential zone (outdoor)	Day	55	55
	Night	45	45
Commercial and industrial zone	Administrative buildings	70	70
	Production buildings	-	-

It should be noted that the WHO Guidelines<sup>2</sup> also provide recommended maximum sound levels ( $L_{Amax}$ ) for dwelling premises (outdoor) at night, which are 60 dB(A).

<sup>2</sup> Guidelines for Community Noise, World Health Organization (WHO), 1999.

### Magnitude of Impact

Magnitude of impact was evaluated with consideration for the following characteristics/parameters of impact: scale, duration, frequency, extent.

Out of extent, frequency and duration of impacts, the basic characteristic was selected, i.e. having the most unfavourable rate (for example, long-term duration of impacts is the basic characteristic under conditions of long-term, instantaneous and local impacts).

Magnitude of impacts is determined as combination of the basic characteristic and the scale of impact (*Table 1.1-3*).

**Table 1.1-3** *Determination of Impact Magnitude*

Basic Characteristic			Scale			
Duration	Frequency	Extent	Negligible	Small	Medium	Large
<i>Instantaneous</i>	<i>Single</i>	<i>Site</i>				
<i>Short-term</i>	<i>Occasionally</i>	<i>Local</i>				
<i>Medium-term</i>	<i>Regularly</i>	<i>Regional</i>				
<i>Long-term</i>	<i>Frequent</i>	<i>National</i>				
<i>Permanent</i>	<i>Continuous</i>	<i>International</i>				

### Scale of Impact

The scale of noise impact is the predicted equivalent noise level (dB(A)) inclusive of baseline noise levels. Noise impact receptors are humans in residential, office, institutional, educational, industrial and commercial buildings.

Criteria for evaluation of the Scale of noise impact are based on the noise level standards of Russian Federation and WHO recommendations set out in the General IFC EHS Guidelines<sup>3</sup>.

Receptors are normally not sensitive to any noise level changes within 0 to 3 dB(A), whereas an increase of 10 dB(A) is perceived as a twofold increase in the noise pressure. Criteria identifying the scale of noise impact during construction and operation of the project facilities are detailed in *Table 1.1-4*.

<sup>3</sup> SNiP 23-03-2003 "Protection from Noise"; WHO, 1999

**Table 1.1-4** *Criteria for evaluation of the Scale of noise impact on receptors*

Scale of impact	Time period: Daytime (07:00 – 22:00)/ Night-time (22:00 – 07:00)	Duration of impacts of noise at the construction stage, noise level (La eq., dB(A))			Operational stage, noise level (La eq. dB(A))  Recipients are located in residential areas
		Recipients are located in residential areas and construction camps			
		<1 month	1-6 months	>6 months	
Negligible	Daytime	<70	65	<55	<50
	Night-time	<55	<45	<45	<40
Small	Daytime	70-75	65-70	55-60	50-55
	Night-time	55-60	45-55	45-50	40-45
Medium	Daytime	>75-80	>70-75	>60-65	>55-60
	Night-time	>60-65	>55-60	>50-55	>45-50
Large	Daytime	>80	>75	>65	>60
	Night-time	>65	>60	>55	>50

Frequency of Impact

Categories of impacts frequency and consequences for receptors are presented in *Table 1.1-5*.

**Table 1.1-5** *Categories of the Frequency of Impact*

Category of impacts frequency	Criteria
<b>Single (unlikely)</b>	Impact occurs once during Project implementation (unlikely, but the potential exists)
<b>Occasionally (unfrequently)</b>	Impact caused by the features of the construction or production cycle (there is a probability of occurrence)
<b>Regularly</b>	Impact occurs with a regular frequency (a high probability of occurrence)
<b>Frequent</b>	Impact occurs with a frequency of once a month or more (predetermined)
<b>Continuous</b>	Means static impact without discontinuity points over a certain period of time

Duration of Impact

Categories for identification of the impact duration are determined in the table below (*Table 1.1-6*).

**Table 1.1-6 Categories of the Impact Duration**

Category of the Impact Duration	Assessment of impacts on environmental components
<b>Instantaneous</b>	Temporary, short impact on ecosystems, not affecting the seasonal background processes
<b>Short-term</b>	Temporary, lasts from one season up to one year, predicted usually for the construction stage
<b>Medium-term</b>	Temporary, lasts for one to five years, usually in the case of long-term construction and commissioning period, in the early stages of operation
<b>Long-term</b>	Temporary, lasts for five or more years, until the end of the Project and restoration of baseline conditions
<b>Permanent</b>	Persistent (permanent) change in the baseline conditions during the Project that are not restored after the closure

### Extent of Impact

The impact extent characterizes spatial distribution of the given impact. The impact extent categories are detailed in *Table 1.1-7*.

**Table 1.1-7 Categories of the Extent of Impact**

Category of the Extent of Impact	Assessment of impacts on environmental components
<b>Site</b>	Impact that does not go beyond the limits of impacts on primary natural complexes (local populations of species, geological and soil ranges, etc.)
<b>Local</b>	Impact affecting baseline properties of individual landscapes and locations, not usually associated with the impact on long watercourses
<b>Regional</b>	Impacts related to a change in the baseline conditions of natural regions, usually associated with the impact on long watercourses and significant air pollution
<b>National</b>	Affecting national significant natural resources, territories and sustainable development of nations
<b>International</b>	Affecting the environment components, territory and processes of international importance

### **Responsivity of Resources and Recipients**

Besides the above-discussed *magnitude*, the other component for evaluation of impact *significance* is the *responsivity* of the affected resource/recipient (receptor), which may be of the physical, biological, cultural, and anthropological nature.

*Responsivity* is an integral characteristic comprising:

- own characteristics of the impacted receptor/environmental component (its vulnerability/importance); and
- sensitivity of the impacted receptor/environmental component to the given impact.

The category of responsivity is identified based on the combinations of *vulnerability/importance* and *sensitivity* of receptors/environmental components in accordance with the *responsivity matrix* (Table 1.1-8).

**Table 1.1-8** *Determination of Responsivity of Resources and Recipients*

Vulnerability/ Importance	Sensitivity		
	Low	Medium	High
Low	Low		
Medium		Medium	
High			High

Vulnerability/ Importance of Resources and Recipients

The evaluation of *vulnerability/importance* of the affected resources or receptors is based on their properties as follows:

- Protected status;
- Policy of the regional government;
- Views of stakeholders;
- Economic value;
- Expert opinion of specialists involved in the ESIA development;
- International / national standards and regulations;
- Special features of ecosystems, such as resistance to change, rarity, adaptability, diversity, and fragility, ability for recovery;
- The importance of individual components as environmental components, etc.).

Sensitivity of Resources and Recipients

*Sensitivity* of the receptor to a particular kind of impact is “severity” of consequences, the potential for recovery and the reversibility of effects.

The category of responsivity of receptors is identified based on their adaptation/recovery abilities (Table 1.1-9).



**Table 1.1-9 Designation of Sensitivity of Resources and Recipients**

Sensitivity	Environmental resources
<b>Low</b>	High ability to recover the initial properties and functions, minor changes of spatial and dynamic indicators
<b>Medium</b>	Limited / low ability to recover the initial properties and functions. Measures to minimize disturbance of ecosystems are required.
<b>High</b>	Lack of ability to recover the initial properties and functions. Irreversible disturbances may be caused by minor impacts.

**Significance of Impact**

The category of *significance* is identified based on the combinations of *magnitude* and *responsivity* of receptors in accordance with *Table 1.1-10*.

**Table 1.1-10 Determination of Impact Significance**

Magnitude of Impact	Responsivity of Resources and Recipients		
	Low	Medium	High
Negligible	Negligible		
Small		Minor	
Medium		Moderate	
Large			Major

Description of categories of environmental and social impacts’ significance is represented in tables below (*Table 1.1-11*).

**Table 1.1-11 Evaluation of Impact Significance**

Significance of impact	Description
Negligible	Impacts practically do not change the social baseline conditions, local in extent and temporary or short-term in duration
Minor	Site, local and regional impacts which are not accompanied by long-term degradation of sensitive resources; effects are usually reversible and minor (do not require special mitigation measures); usually do not exceed the applicable standards (criteria, i.e. noise, vibration, light, etc.) in relation to the less sensitive resources
Moderate	Site and local environmental impacts, mostly long-term; impacts which do not affect critical resources but result in irreversible loss of biodiversity and habitats; impacts with regional effects persisting from 1 to 5 years; require development of cost reasonable impact mitigation measures
Major	Significant impacts of regional and of the larger scale; medium-term, long-term and permanent impacts resulting in irreversible changes and degradation of baseline conditions; usually having adverse effects exceeding national environmental standards or associated with transnational environmental issues; involving effects of toxic substances and associated with potential emergencies affecting critical resources and sensitive receptors

**1.1.3 Baseline noise levels**

To evaluate baseline noise in the area of influence, noise level measurements were taken at 14 points during the day and at night (Section 1.1.2.1, Figure 1.1-1).

The results indicate that the permissible noise levels are exceeded the threshold values at Points NP-1, NP-2, NP-5, NP-6, NP-8, NP-9, NP-11, NP-12, and NP-13:

- the equivalent sound level was observed to exceed the threshold values by 3-12 dB(A) in the daytime (1.1-1.3 MPL), and by 2-19 dB(A) at night (1.1-1.4 MPL);
- maximum sound level was observed to exceed the threshold values by 2-18 dB(A) (1.1-1.4 MPL). At Points NP-3, NP-4, NP-7 and NP-10, the noise levels were compliant with sanitary standards.

These exceedances result from the location of the areas close to the existing roads. In addition, the main noise sources at Point NP-5 (Aksengir) were motor and rail transport.

Noise measurement results are given in Table 1.1-12.

**Table 1.1-12 Results of noise measurements in the areas adjacent to BAKAD**

No	Measurement point	Baseline noise levels			
		Day (7:00-23:00)		Night (23:00-7:00)	
		L <sub>Aeq</sub> , dB(A)	L <sub>Amax</sub> , dB(A)	L <sub>Aeq</sub> , dB(A)	L <sub>Amax</sub> , dB(A)
1.	NP-1, Kyrgauyldy	66.8 (1.2)	78.4 (1.1)	63.9 (1.4)	78.4 (1.3)
2.	NP-2, Bulakty	52.8	66.4	51.7 (1.1)	59.1
3.	NP-3, Soyuzpechat	44.3	55.1	40.8	54.2
4.	NP-4, Bereke	46.9	61.2	37.6	51.9
5.	NP-5, Aksenger	58.2 (1.1)	66.0	57.4 (1.3)	70.0 (1.2)
6.	NP-6, Nurbereke	51.9	62.3	47.1 (1.1)	57.6
7.	NP-7, Yktymak	43.6	54.6	44.0	50.7
8.	NP-8, Pokrovka	63.6 (1.2)	82.0 (1.2)	62.3 (1.4)	71.6 (1.2)
9.	NP-9, Kyzyl Tu 1	59.5 (1.1)	72.5 (1.1)	59.6 (1.3)	69.2 (1.2)
10.	NP-10, Panfilovo camp	46.1	59.0	43.1	51.3
11.	NP-11, Panfilovo	69.1 (1.3)	85.0 (1.2)	64.6 (1.4)	78.0 (1.3)
12.	NP-12, Kyzylkairat	46.3	52.7	50.7 (1.1)	59.2
13.	NP-13, Issyk (Issyk quarry)	41.3	55.6	48.0 (1.1)	59.2
14.	NP-14, Kargaly (Fabrichny quarry)	44.5	55.0	40.5	52.1
Kazakhstan national standards (MPL)*		55	70	45	60
IFC/WHO standards (MPL)*		55	-	45	-

Notes: \* - the standards apply to the outdoor noise levels; MPL – maximum permissible level

## 1.1.4 Embedded Controls

### 1.1.4.1 Construction Stage

The following embedded controls are provided by the Project for the construction stage:

- mandatory compliance of construction equipment, mechanisms, vehicles, processes and operations with national laws and regulations;
- construction machinery and vehicles to strictly follow designated routes; adherence to speed limits on access roads.

#### 1.1.4.2 *Operation Stage*

The following embedded controls are provided by the Project for the operation stage:

- installation of culverts and drain ditches in the roadbed;
- landscaping along the right-of-way;
- installation of noise barriers (however, in accordance with the ToR, modelling did not consider them in order to verify the locations independently).

#### 1.1.5 *Impact Assessment*

##### 1.1.5.1 *Assessment of the noise impact during the construction stage*

#### **Receptors of impact**

People living in residential areas in the vicinity of BAKAD were taken as impact receptors. For the construction stage, receptors also included people living near quarries, construction sites, asphalt and concrete plants, and construction personnel in Bereke and Panfilovo shift camps (*Figure 1.1-2*).

The modelling points were located at the border of residential areas at a height of 1.5 m from the ground (*Figure 1.1-2*).

Since all potential receptors of the impact are humans, their *Vulnerability* and *Importance* should be classified as *high* (due to the primary value of human life and health).

The *sensitivity* of the identified Receptors to noise impacts was determined as *medium* for the permanent residents and *low* for construction workers in the shift camp due to the limited ability to adapt to the changing conditions caused by the Project activities.

Assessment of receptors' *responsivity* to potential noise impact is reported in *Table 1.1-13*.

**Table 1.1-13** *Receptors' Responsivity to potential noise impact*

Receptor	Vulnerability/ Importance	Sensitivity	Responsivity
Local residents	<i>High</i>	<i>Medium</i>	<b>Medium</b>
Constriction workers		<i>Low</i>	

## **Modelling scenarios**

The construction of BAKAD is expected to take 34 months and will involve the following major activities (*Table 1.1-14*).



**Table 1.1-14 Main construction activities**

No	Type of work	Characteristics
<i>Roadbed construction</i>		
1.	Preparatory stage	<ul style="list-style-type: none"> <li>Erection of construction sites and construction of temporary roads;</li> <li>Land grading, demolition works and removal of barriers within the right-of-way, construction of an asphalt plant, concrete plants, accommodation camps, development of quarries.</li> </ul>
2.	Construction of the earth roadbed	<ul style="list-style-type: none"> <li>Construction of the road body or excavations;</li> <li>Compaction of backfilled soil;</li> <li>Roadbed and slope reinforcement.</li> </ul>
3.	Construction of the road surface	<ul style="list-style-type: none"> <li>Filling and compaction of the metalling layer;</li> <li>Bituminous grouting;</li> <li>Asphalting.</li> </ul>
4.	Construction of fencing, illumination, marking, steelwork welding and painting	
5.	Roadside landscaping	
<i>Construction of bridges and overpasses</i>		
1.	Preparatory stage	<ul style="list-style-type: none"> <li>Erection of construction sites and construction of temporary roads;</li> <li>Land grading.</li> </ul>
2.	Construction of bearing structures	<ul style="list-style-type: none"> <li>Installation of bored piles;</li> <li>Construction of a pile sheeting;</li> <li>Excavation of the pit;</li> <li>Concreting of foundations;</li> <li>Concreting of bearing structures.</li> </ul>
3.	Installation of superstructures	
4.	Construction of the road surface	
5.	Roadside landscaping	

These works will be carried out sequentially at each section of the road and will be separated in time. Therefore, for assessing the noise impact during the construction of the road, the most intense stages of construction were considered, when the greatest number of simultaneously running road-building machinery is involved at small construction sites. Such situation (with over 30 units of machinery) is expected during excavation and concrete works, during backfilling and compaction of the roadbed and during concreting of bearing structures of bridges and overpasses.

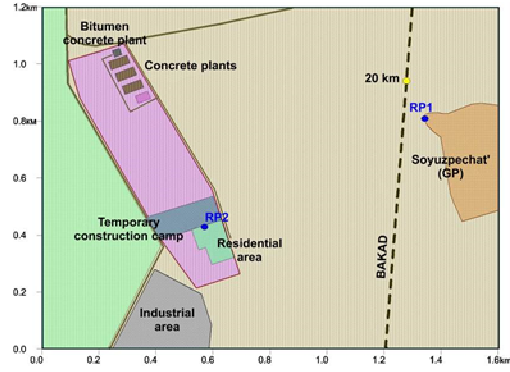
Noise impact during excavations was considered using the example of the roadbed construction at the 37<sup>th</sup> km of BAKAD, where the road would pass directly through residential areas.

The noise impact during concrete works was considered using the example of the construction of the longest (over 800 m) overpass near Bereke.

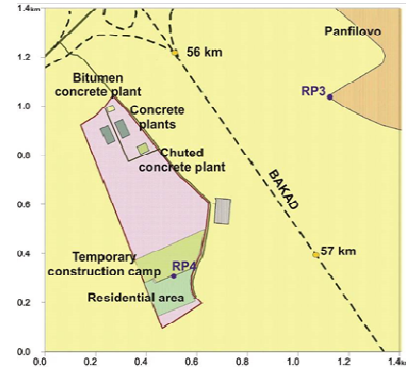
In addition to the impact during construction of linear sections, junctions and bridges, the impact from auxiliary construction facilities was considered:

- two asphalt and five concrete plants near Bereke and Panfilovo;

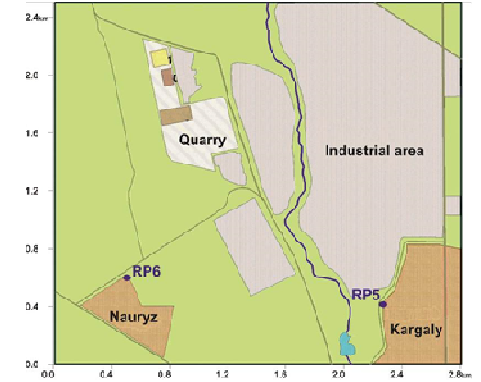
- two stone quarries near Kargaly (Fabrichny quarry) and Bolek (Issyk quarry).



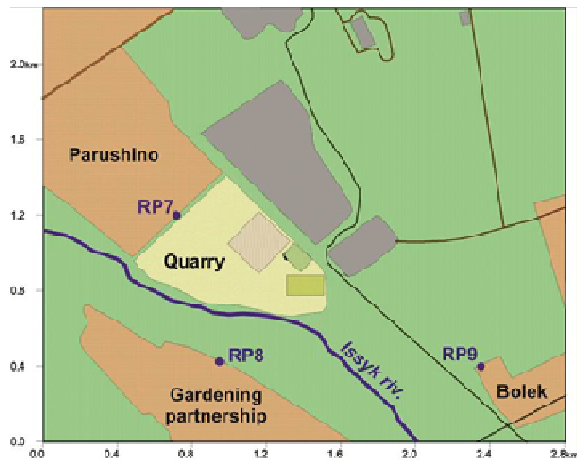
Location of the construction site near Bereke



Location of the construction site near Panfilovo



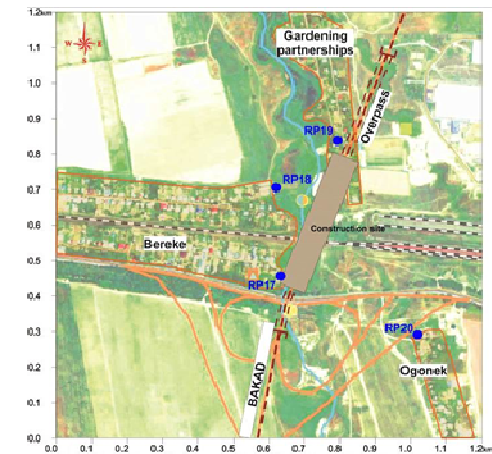
Location of the Fabrichny quarry



Location of the Issyk quarry



A section of BAKAD located within a residential area (an example)



Location of the overpass near Bereke

Figure 1.1-2 Location of the modelling points used in the noise impact assessment

## Noise sources

The main sources of noise during construction will be vehicles, road construction machinery, and asphalt-concrete plants.

The list of noise sources during the construction stage is given in *Table 1.1-15*.

**Table 1.1-15** *List of noise sources during construction stage*

Facility	Noise source and path	Source ID
Construction site near Bereke ( <i>Figure 1.1-3</i> )	Asphalt plant	NS01
	Concrete plants	NS02 – NS04
	Ready-mix concrete plants	NS05 – NS06
	Access road	NS07
Construction site near Panfilovo ( <i>Figure 1.1-3</i> )	Asphalt plant	NS08
	Concrete plants	NS09 – NS10
	Concrete mixture plants	NS11 – NS12
	Access road	NS13
Fabrchny quarry ( <i>Figure 1.1-4</i> )	Mining area (hydraulic hammers, excavators, bulldozers)	NS14 - NS15
	Rock crushing area (screens, crushers, conveyors)	NS16
	Loading area (loaders, dump trucks)	NS17
Issyk quarry ( <i>Figure 1.1-4</i> )	Mining area (hydraulic hammers, excavators, bulldozers)	NS18 - NS19
	Rock crushing area (screens, crushers, conveyors)	NS20
	Loading area (loaders, dump trucks)	NS21
Construction of a linear section	Bulldozers, graders, watering trucks, soil rollers, dump trucks	NS22
Construction of an overpass	Drilling machines, crawler cranes, excavators, concrete pumps, concrete mixers, vibratory dumpers, dump trucks	NS23

The following equipment and machinery will be in operation at the site near Bereke and Panfilovo:

Bereke shift camp	Panfilovo shift camp
<ul style="list-style-type: none"> <li>• 240 t/h asphalt plant</li> <li>• 115 m<sup>3</sup>/h concrete plant</li> <li>• Two 105 m<sup>3</sup>/h concrete plants</li> <li>• Two 400 t/h ready-mix concrete plants</li> <li>• 100 vehicles per hour of dump trucks, cement trucks, concrete trucks, asphalt trucks</li> </ul>	<ul style="list-style-type: none"> <li>• 170 t/h asphalt plant</li> <li>• 115 m<sup>3</sup>/h concrete plant</li> <li>• 105 m<sup>3</sup>/h concrete plant</li> <li>• Two 400 t/h ready-mix concrete plants</li> <li>• 75 vehicles per hour of dump trucks, cement trucks, concrete trucks, asphalt trucks</li> </ul>

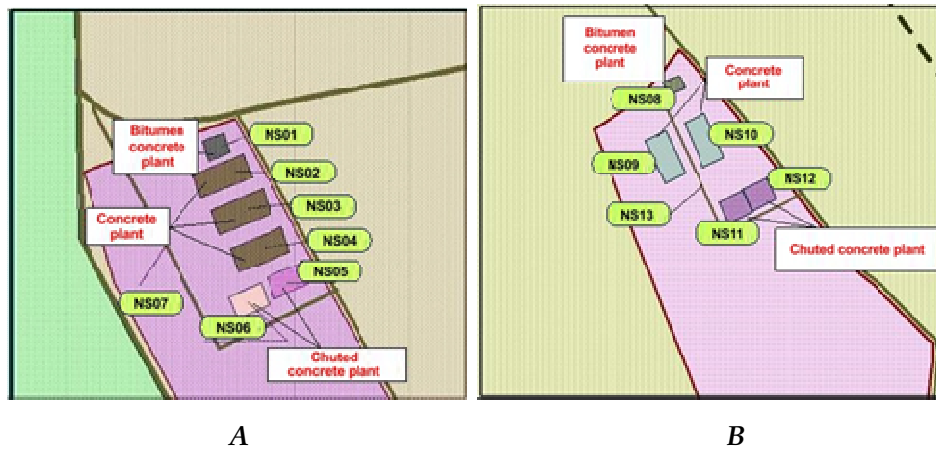


Figure 1.1-3 Noise sources at the sites near Bereke (A) and Panfilovo (B)

Production of crushed stone at Fabrichny quarry is planned at 800 t/h. The quarry equipment includes 4 hydraulic hammers, 5 excavators, 8 dump trucks, 3 bulldozers, 6 loaders, and a rock crushing plant.

Issyk quarry will produce up to 300 t/h of crushed stone. The quarry equipment includes 2 hydraulic hammers, 3 excavators, 6 dump trucks, 2 bulldozers, 4 loaders, and a rock crushing plant.

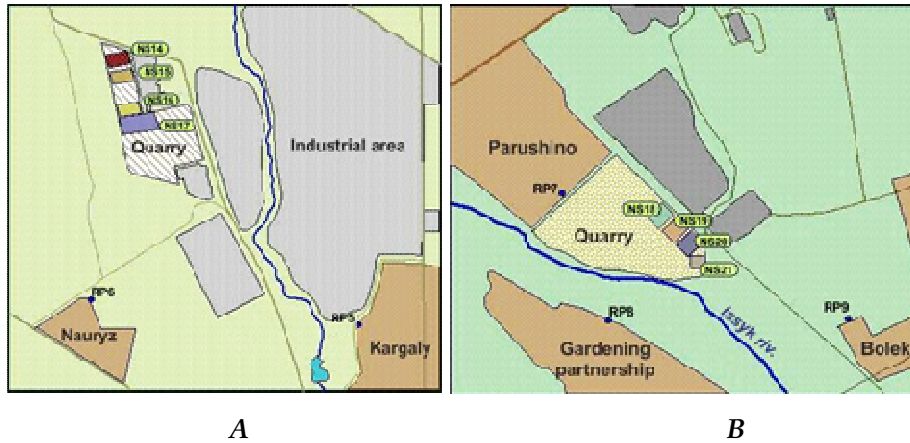


Figure 1.1-4 Noise sources at Fabrichny (A) and Issyk quarries (B)

Constriction of the linear section will involve simultaneous operation of 7 bulldozers, 6 graders, 6 watering machines, and 8 rollers. The soil will be delivered to the site by 20-tonne dump trucks (50 vehicles per hour). The roadbed construction pace is estimated on average at 200 m per day (2 working shifts). All sources of noise are confined to the construction site (see Figure 1.1-2).

Construction of the overpass bearing structures will involve simultaneous operation of 8 dump trucks, 2 drilling machines, 2 crawler cranes, 4 excavators, 2 concrete pumps, 2 concrete mixers, and 10 vibrating loaders. All sources of noise are confined to the construction site (see *Figure 1.1-2*).

During the modelling, the construction site was considered as a spatial noise source, when noise characteristics of all machinery and equipment operating at this site were aggregated.

The characteristics of the noise sources are given in *Table 1.1-16*.

**Table 1.1-16 Parameters of sources of noise used in the construction process**

No	Noise source	Measurement distance, m	L <sub>A</sub> , dB(A)	L <sub>Aeq</sub> , dB(A)	L <sub>Amax</sub> , dB(A)
1.	NS01, NS08	100	-	60	-
2.	NS02-NS06 NS09-NS12	0	110	--	-
3.	NS07	7.5	-	69	87
4.	NS13	7.5	-	69	87
5.	NS14	0	121	-	127
6.	NS15	0	105	-	111
7.	NS16, NS20	0	102	-	-
8.	NS17	0	109	-	115
9.	NS18	0	118	-	124
10.	NS19	0	103	-	109
11.	NS21	0	106	-	112
12.	NS22	0	114	-	119
13.	NS23	0	112	-	119

## Noise levels during construction

### *Asphalt plant and quarries*

Noise modelling results for residential areas near Project construction sites and auxiliary facilities are presented in *Table 1.1-17*. Resulting noise levels were compared against daytime sanitary standards.

Equivalent and maximum sound levels near the construction sites and quarries are presented in *Figure 1.1-5*.



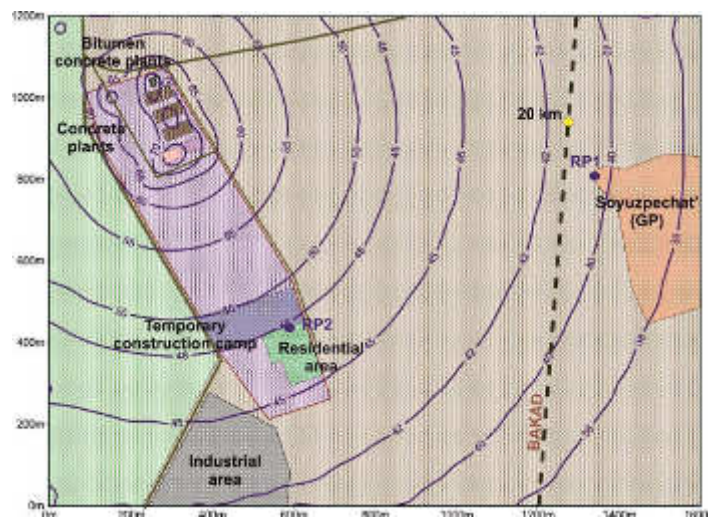
**Table 1.1-17 Sound levels, equivalent and maximum sound levels from construction machinery at the asphalt plant and quarries during the construction stage**

Modelling point		Sound pressure level, dB								L <sub>Aeq</sub> , dB(A)	L <sub>Amax</sub> , dB(A)
		Average compound frequencies of octave bands, Hz									
		63	125	250	500	1000	2000	4000	8000		
<i>Residential area</i>											
RP1	Soyuzpechat	53.3	39.8	36.7	35.6	38.3	30	0	0	40.5	50.0
RP3	Panfilovo	56.6	46	39	40.5	44.2	38.5	19.5	0	46.4	57.4
RP5	Kargaly	62	41	27.3	23.6	33.1	19.2	0	0	38.2	41.9
RP6	Nauryz	65.9	45.3	32.2	29.2	40	31.1	0	0	43.6	47.9
RP7	Parushino	72.7	58.4	39.8	37.7	51.1	47.9	36.8	2.6	54.5	59.3
RP8	Houses near Issyk quarry	69.9	52.8	36.5	33.9	46.2	41.1	21.5	0	49.6	53.3
RP9	Bolek	63.6	43.1	29.4	26.2	37.3	27.8	0	0	41.1	44.6
<i>Construction camps</i>											
RP2	Bereke camp	58.5	47.1	42.2	41.5	45.1	39.7	20.8	0	47.5	57.7
RP4	Panfilovo camp	53.8	41.5	36.3	37.4	40.7	33.7	8.8	0	42.8	53.1
<i>Kazakhstan national standards (MPL)*</i>										55	70
<i>IFC/WHO standards (MPL)*</i>										55	-

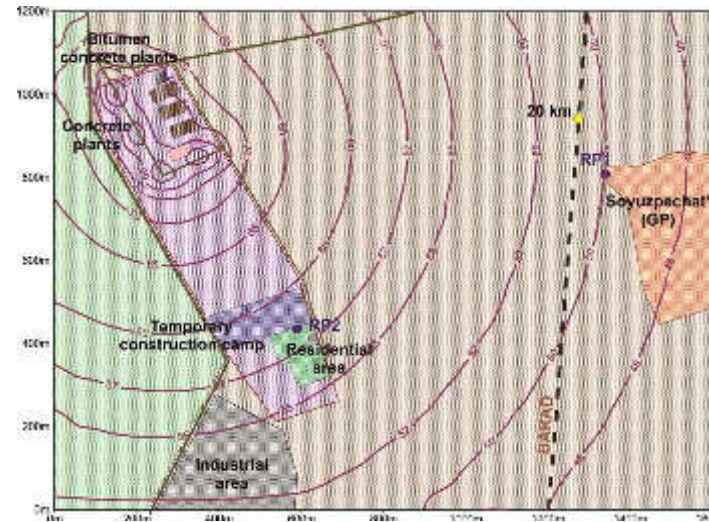
Notes: \* - the standards apply to the outdoor noise levels; MPL – maximum permissible level

**Noise levels resulting from the construction machinery at the asphalt plant and quarries are not expected to exceed permissible levels.**

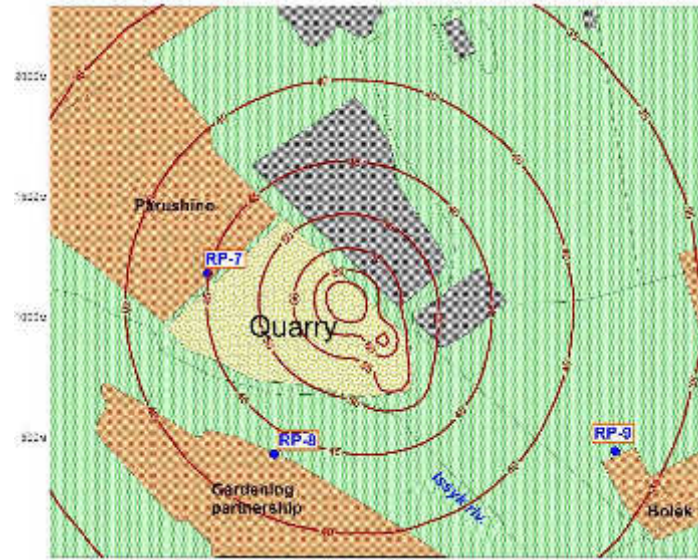




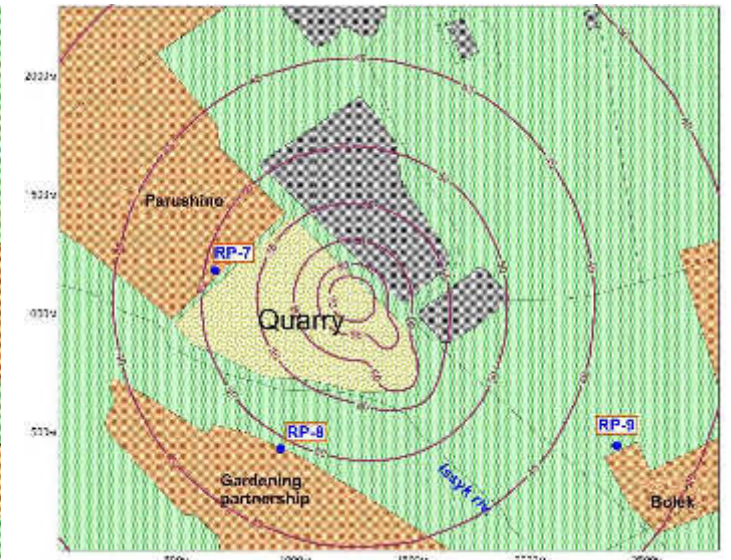
Equivalent sound levels from the asphalt plant at the Bereke site



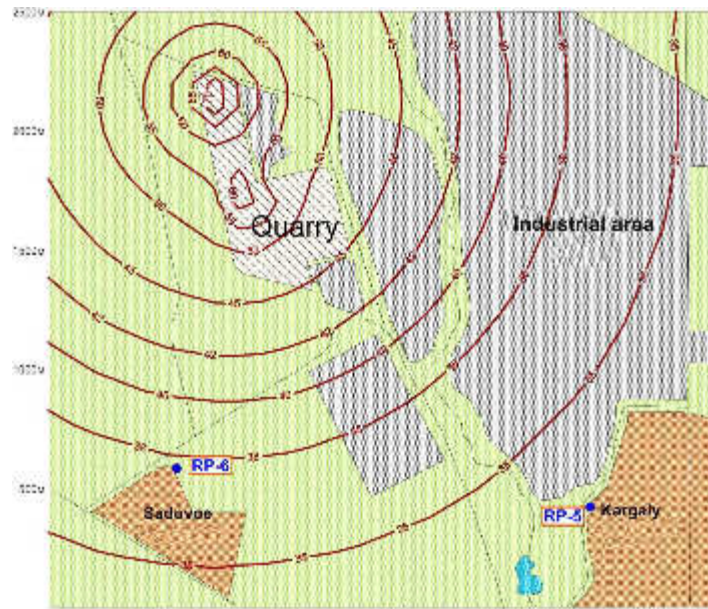
Maximum sound levels from the asphalt plant at the Bereke site



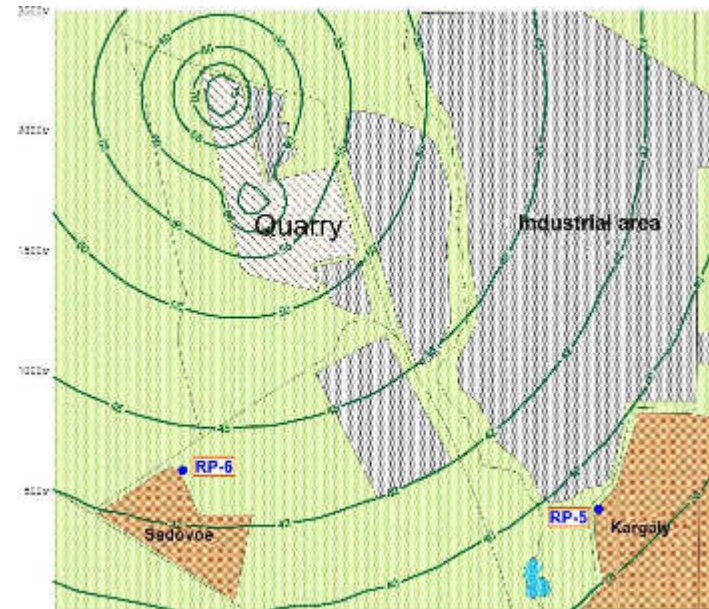
Equivalent sound levels from construction machinery at Issyk quarry



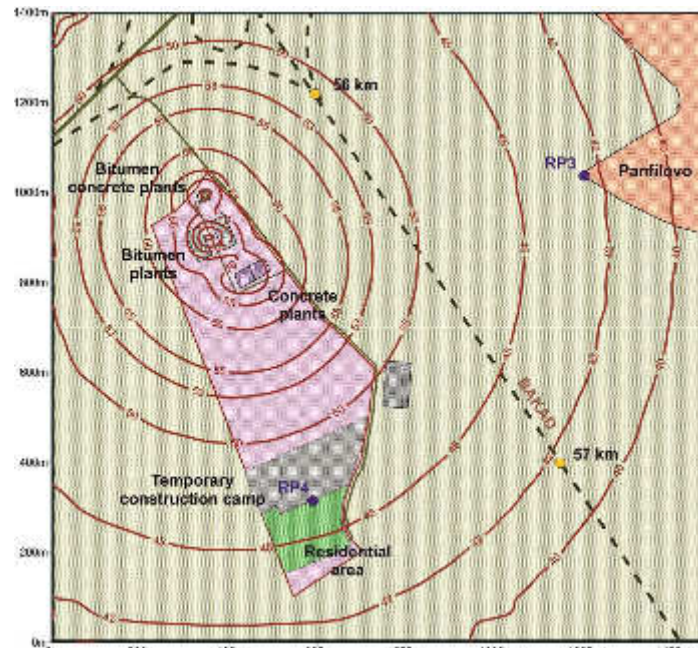
Maximum sound levels from construction machinery at Issyk quarry



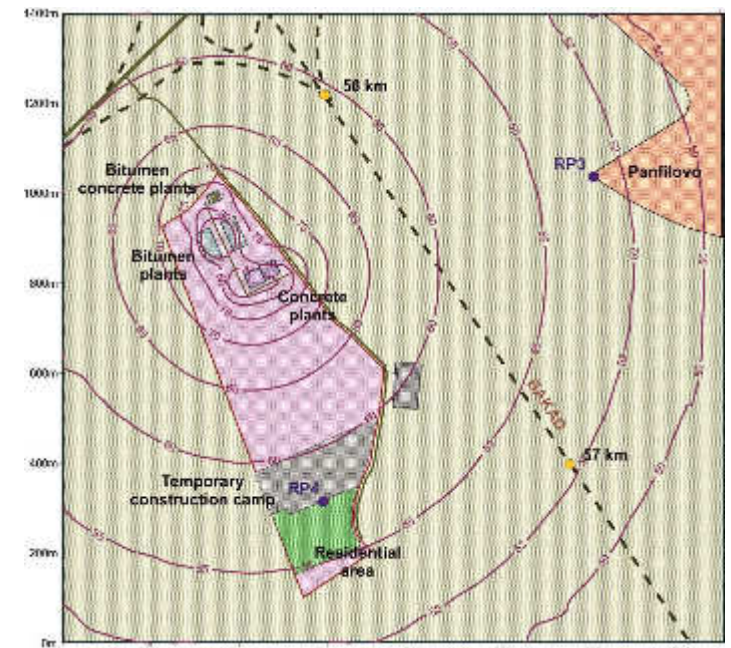
Equivalent sound levels from construction machinery at Fabrichny quarry



Maximum sound levels from construction machinery at Fabrichny quarry



Equivalent sound levels from the asphalt plant at the Panfilovo site



Maximum sound levels from the asphalt plant at the Panfilovo site

Figure 1.1-5 Equivalent and maximum sound levels from the asphalt plants and construction machinery



## Construction of BAKAD

Noise impact during construction of linear part of BAKAD was assessed based on the exemplary scenario for the roadbed construction at the 37<sup>th</sup> km of BAKAD, where the road would pass directly through residential areas. It was assumed that receptors would be positioned 50 to 500 m from the construction site.

Noise impact from concrete works during the construction of foundations for supports was assessed based on the scenario for the construction of the longest overpass near Bereke. Receptor points were positioned within the nearest residential development, located at a distance of 30 to 370 m from the construction site.

Modelling results are presented in *Table 1.1-18*.

**Table 1.1-18** *Sound levels, equivalent and maximum sound levels from construction machinery during construction of linear facilities*

Modelling point	Sound pressure level, dB								L <sub>Aeq</sub> , dB(A)	L <sub>Amax</sub> , dB(A)
	Average compound frequencies of octave bands, Hz									
	63	125	250	500	1,000	2,000	4,000	8,000		
RP10	59.2	47.3	33.7	28.8	38.3	35.4	17.9	0	41.9	47.0
RP11	65.8	57.9	41.4	36.8	46.5	45	33.3	9	50.7	55.8
RP12	66.1	58.3	41.8	37.2	46.9	45.4	33.9	10.1	51.1	56.2
RP13	64.4	55.8	39.6	34.9	44.7	43	30.4	2.6	48.8	53.9
RP14	68.9	62.1	45.9	41.4	50.5	49.2	39	20.3	54.8	59.9
RP15	64.7	56.3	40	35.3	45.1	43.4	31	4.1	49.2	54.3
RP16	56.2	41.6	30.5	25.4	34.6	30.5	8.6	0	37.8	42.9
RP17	67.3	56.7	36.9	34.6	45.8	46.4	36.9	16.2	51.1	57.9
RP18	69	59	39.2	37	48	48.7	40.1	22.5	53.4	60.2
RP19	66.4	55.5	35.8	33.4	44.7	45.3	35.2	12.6	50.0	56.8
RP20	60.7	46.3	29.1	26.5	37.7	36.9	21.8	0	42.3	49.1
<i>Kazakhstan national standards (MPL)*</i>									55	60
<i>IFC/WHO standards (MPL)*</i>									55	60

Equivalent and maximum sound levels near the construction sites are presented in *Figure 1.1-6 - Figure 1.1-9*.

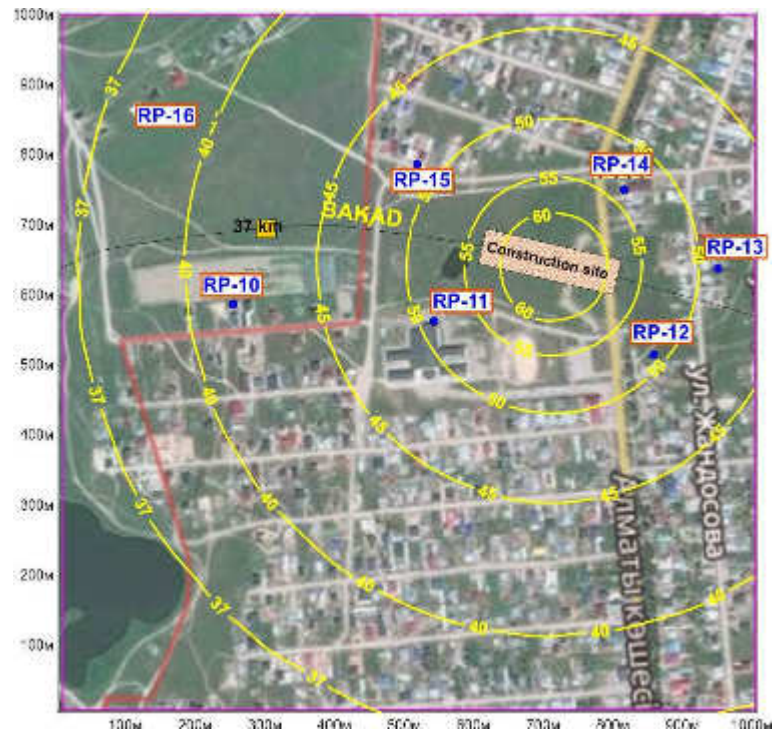


Figure 1.1-6 Equivalent sound levels from construction machinery during construction of a linear section of BAKAD

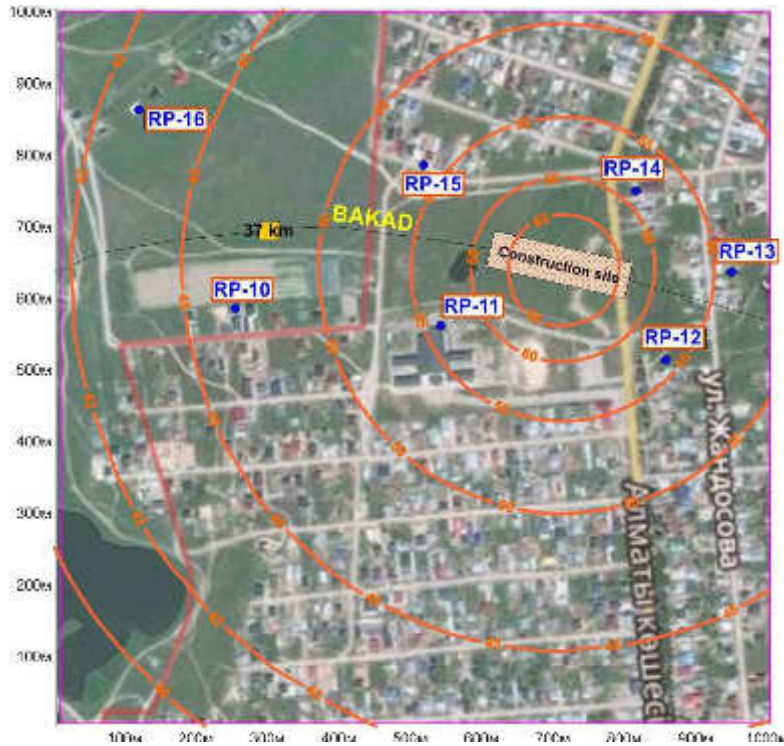


Figure 1.1-7 Maximum sound levels from construction machinery during construction of a linear section of BAKAD

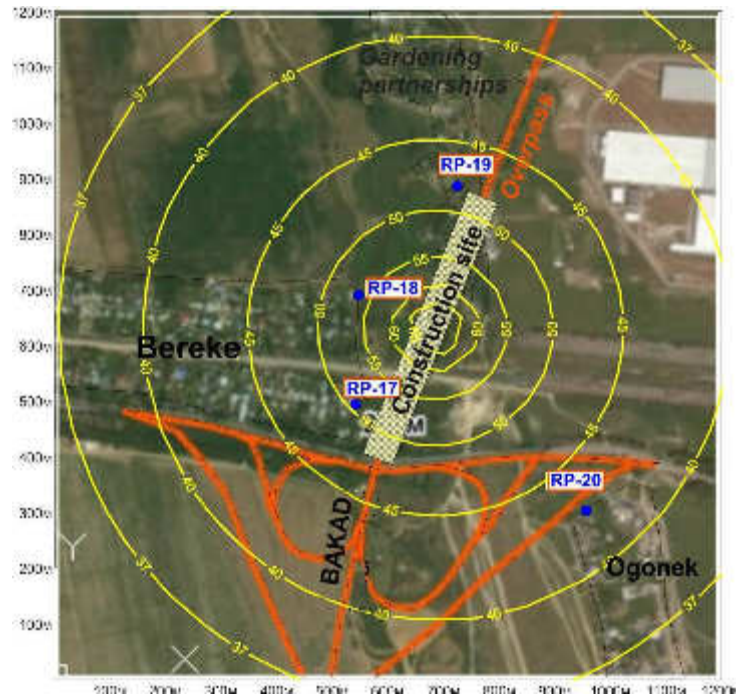


Figure 1.1-8 Equivalent sound levels from construction machinery during construction of the overpass

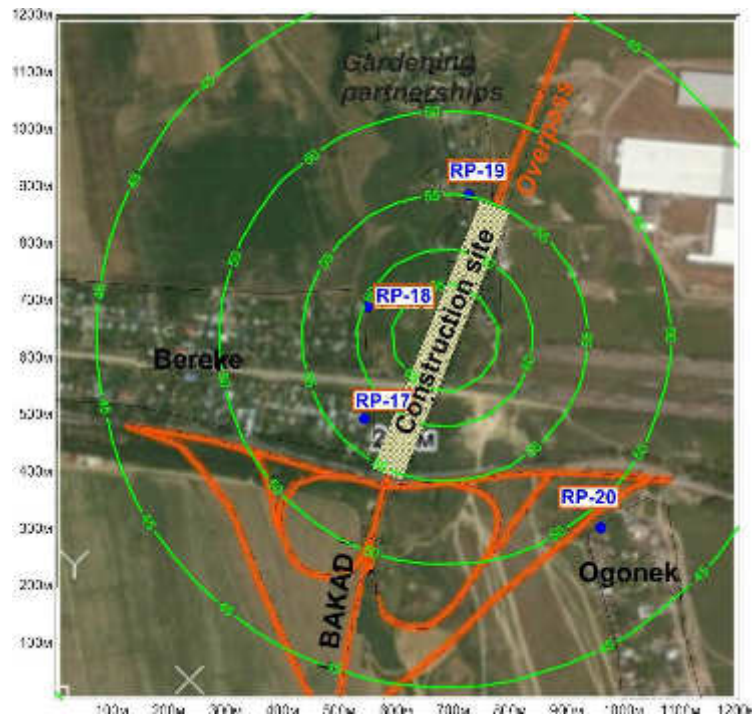


Figure 1.1-9 Maximum sound levels from construction machinery during construction of the overpass

In the nearest residential areas (Kargaly, Nauryz, Parshino, Bolek, dachas), equivalent sound levels generated by road construction equipment at quarries will not exceed 55 dB(A). The maximum sound levels in these areas will not exceed 60 dB(A). The noise impact of the asphalt plant and concrete plants in the residential areas of shift camps will not exceed 48 dB(A) for equivalent and 58 dB(A) for maximum sound levels. The equivalent and maximum sound levels will not exceed 46 dB(A) and 57 dB(A) respectively at the nearest residential development (Panfilovo and Soyuzpechat).

**Noise levels resulting from the construction of linear sections of the road are not expected to exceed permissible levels.**

### Impact Magnitude and Impact Significance

The estimation of the *impact magnitude* during the construction of is given in Table 1.1-19.

**Table 1.1-19 Assessment of the impact Magnitude**

Impact Magnitude criteria	Residential areas and shift camps (BAKAD construction, asphalt plant and quarries operation)
Scale	<i>Negligible</i> LAeq < 55 dB(A)
Frequency	<i>Frequent</i> Occurrence of the impact will depend on the types of the construction works and methods, as well as operation of machinery and plants
Duration	<i>Medium-term</i> The impact will last throughout the construction stage
Extent	<i>Local</i> The extent of the impact will be confined to the nearest residential areas and shift camps
<b>Impact Magnitude</b>	<b>Small</b>

Table 1.1-20 below describes the *Impact Significance* taking into account embedded controls (i.e. mitigation measures provided for by the Project, see Section 1.1.4).



**Table 1.1-20 Assessment of Impact Significance and Residual Impact**

Receptor	Impact Magnitude	Responsivity	Impact Significance
People in residential areas (the nearest settlements) Personnel in the shift camps	Small	Medium	Minor
<b>Additional impact mitigation measures</b> <ul style="list-style-type: none"> <li>Using modern equipment and low-noise mechanisms</li> <li>Strict compliance with construction procedures and work patterns</li> <li>Limiting traffic to pre-approved routes and trips</li> <li>Limiting / shortening use of noisy equipment</li> </ul>			
<b>Residual Impact</b>	Negligible		

1.1.5.2 *Assessment of the noise impact during the operational stage*

**Receptors of impact**

During the operational stage, people in the residential areas adjacent to the road were taken as receptors. Assessment of receptors' *Vulnerability/Importance* and *sensitivity* is described in Section 1.1.5.1.

**Modelling scenarios**

The assessment of the noise impact of traffic flows on BAKAD was carried out for the year 2045, when the maximum traffic intensity is expected (up to 80-90 thousand vehicles per day on certain sections of the road). Compared to the first year of operation, by this time the traffic will grow 3.5 times and the noise load will increase by 5 dB(A).

At the same time, the improvements in vehicles, tyres and road surface will by the same year reduce the noise impact by 5-7 dB(A) (according to preliminary estimates)<sup>4</sup>, which will off-set the above-mentioned increase.

Therefore, the projection made for 2045 is highly likely to match the acoustic load projection made for 2021.

Table 1.1-21 provides data on the composition and intensity of traffic at various sections of the road. Passenger cars will dominate the traffic comprising 87-90% of it.

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<sup>4</sup> N.I. Ivanov N. Engineering acoustics. Theory and practice of noise control. Moscow,, 2008, 22 p. / Иванов Н.И. Инженерная акустика. Теория и практика борьбы с шумом. М., 2008, с.22.

**Table 1.1-21 Composition and intensity of traffic at various sections of BAKAD (2045)**

Section of BAKAD	Traffic intensity, vehicles per day	Passenger vehicles per day	Freight vehicles per day <sup>5</sup>
PK 0-55, 4 lanes	39,819	37,047	2,773
PK55-PK240, 6 lanes	60,175	51,764	8,411
PK240 – PK 440, 6 lanes	78,567	68,323	10,244
PK440 – PK 470, 6 lanes	92,863	84,084	8,780
PK 470-570, 6 lanes. PK470+00-PK556+45 (from Lavreneva Street to Kuldzhinsky motorway)	81,692	74,653	7,039
PK 470-570, 4 lanes. PK556+45-PK570+00 (from Kuldzhinsky motorway towards Talgar)	29,366	25,640	3,725
PK570-PK660, 4 lanes	22,767	22,278	489

The intensity of traffic on the roads that will cross BAKAD (the radial roads) is given in *Table 1.1-22*. Traffic composition: 80% passenger cars, 20% freight cars. It is expected that by 2045 the traffic intensity on these roads will grow by 1.5 times.

**Table 1.1-22 Current (2018) and future (2045) intensity of traffic on BAKAD-crossing roads**

BAKAD	Road / street	Traffic intensity, vehicles per hour	
		2018	2045
0 km	A4 Verkhnyaya Kaskelenskaya motorway (Karaguldy)	1,010	1,520
6 km	A2 Bishkekская motorway (Rayimbek)	3,390	5,080
21 km	KV67 Burundayskaya motorway (Aksengir)	940	1,410
34 km	Karagandinskaya motorway (Zhapeg-Batyr)	860	1,290
36,2 km	Altayeva Street	610	920
37,4 km	Almatinskaya Street	850	1,280
41 km	Abaya Street – KV21 road	580	870
43,3 km	A3 Kapchagayskaya motorway (Yntymak)	2,170	3,260
46,5 km	KV15 Iliyskaya motorway (Otegen-Batyr village)	1,890	2,840
52,8 km	Basybekova Street – AL91 road (Almarek village)	650	980
55,7 km	A2 Kuldzhinskaya motorway (Panfilovo village)	2,000	3,000
58 km	Road along Bolshoy Almatinsky channel	480	720
59 km	Alatau motorway (Alatau village)	590	890
65 km	R17 Talgarskaya motorway (Kyzyl-Kairat)	1,680	2,520

### Noise sources

The noise characteristics of the traffic flow were taken as the equivalent (LAeq) and maximum (LAmx) sound levels created by the traffic at a

<sup>5</sup> Vehicles weighing over 3,500 kg

distance of 7.5 m from the axis of the traffic lane closest to the modelling point and at a height of 1.5 m above the road surface<sup>6</sup>.

$N_d$  and  $N_n$  are estimated traffic intensity during the day-time rush-hour and the highest noise night hour (in units per hour) using the following formula (Table 1.1-23):

$$N_d = 0,076N_{\text{day}}; N_n = 0,039N_{\text{day}}.$$

**Table 1.1-23 Hourly intensity of traffic on BAKAD (2045)**

Section of BAKAD	Daytime rush hour traffic intensity, vehicle per hour	Highest noise night hour traffic intensity, vehicle per hour
PK 0-55, 4 lanes	3,026	1,553
PK55-PK240, 6 lanes	4,573	2,347
PK240 – PK 440, 6 lanes	5,971	3,064
PK440 – PK 470, 6 lanes	7,058	3,622
PK 470-570, 6 lanes. PK470+00-PK556+45 (from Lavreneva Street to Kuldzhinsky motorway)	6,209	3,186
PK 470-570, 4 lanes. PK556+45-PK570+00 (from Kuldzhinsky motorway towards Talgar)	2,232	1,145
PK570-PK660, 4 lanes	1,730	888

For the calculations, the average vehicle speed was taken at 90 km/h on BAKAD and 80 km/h on the radial roads. Equivalent sound levels created by traffic flows on BAKAD and the radial roads are given in Table 1.1-24 and Table 1.1-25.

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<sup>6</sup> Sound characterisation of traffic followed Russian regulations SP 276.1325800.2016 “Buildings and territories. Rules for designing noise protection against traffic noise”

**Table 1.1-24 Equivalent sound levels created by traffic flows on BAKAD**

Modelling point	Sound pressure level, dB								L <sub>Aeq</sub> dB(A)
	Average compound frequencies of octave bands, Hz								
	63	125	250	500	1,000	2,000	4,000	8,000	
<b>Equivalent sound level, daytime</b>									
PK 0-55	87.8	81.4	78.4	75.6	75.7	72.0	67.1	59.1	<b>79.8</b>
PK55-PK240	93.4	87.0	84.0	81.2	81.3	77.6	72.7	64.7	<b>85.4</b>
PK240 – PK 440	94.4	88.0	85.0	82.2	82.3	78.6	73.7	65.7	<b>86.4</b>
PK440 – PK 470	95.0	88.6	85.6	82.8	82.9	79.2	74.3	66.3	<b>87.1</b>
PK470+00-PK556+45	94.5	88.1	85.1	82.3	82.4	78.7	73.8	65.8	<b>86.6</b>
PK556+45-PK570+00	90.6	84.2	81.2	78.4	78.5	74.8	69.9	61.9	<b>82.7</b>
PK570-PK660	88.6	82.2	79.2	76.4	76.5	72.8	67.9	59.9	<b>80.7</b>
<b>Equivalent sound level, night time</b>									
PK 0-55	85.2	78.8	75.8	73.0	73.1	69.4	64.5	56.5	<b>77.3</b>
PK55-PK240	86.8	80.4	77.4	74.6	74.7	71.0	66.1	58.1	<b>78.9</b>
PK240 – PK 440	87.8	81.4	78.4	75.6	75.7	72.0	67.1	59.1	<b>79.9</b>
PK440 – PK 470	88.5	82.1	79.1	76.3	76.4	72.7	67.8	59.8	<b>80.5</b>
PK470+00-PK556+45	88.0	81.6	78.6	75.8	75.9	72.2	67.3	59.3	<b>80.0</b>
PK556+45-PK570+00	84.1	77.7	74.7	71.9	72.0	68.3	63.4	55.4	<b>76.1</b>
PK570-PK660	82.1	75.7	72.7	69.9	70.0	66.3	61.4	53.4	<b>74.2</b>

**Table 1.1-25 Equivalent sound levels created by traffic flows on radial roads**

Modelling point	Sound pressure level, dB								L <sub>Aeq</sub> dB(A)
	Average compound frequencies of octave bands, Hz								
	63	125	250	500	1,000	2,000	4,000	8,000	
<b>Equivalent sound level, daytime</b>									
A4 Verkhnyaya Kaskelenskaya motorway (Karaguldy)	85.4	79.0	76.0	73.2	73.3	69.6	64.7	56.7	<b>77.5</b>
A2 Bishkekskaya motorway (Rayimbek)	90.0	83.6	80.6	77.8	77.9	74.2	69.3	61.3	<b>82.1</b>
KV67 Burundayskaya motorway (Aksengir)	85.1	78.7	75.7	72.9	73.0	69.3	64.4	56.4	<b>77.2</b>
Karagandinskaya motorway (Zhapeg-Batyr)	84.8	78.4	75.4	72.6	72.7	69.0	64.1	56.1	<b>76.8</b>
Altayeva Street	83.5	77.1	74.1	71.3	71.4	67.7	62.8	54.8	<b>75.5</b>
Almatinskaya Street	84.7	78.3	75.3	72.5	72.6	68.9	64.0	56.0	<b>76.8</b>
Abaya Street – KV21 road	83.3	76.9	73.9	71.1	71.2	67.5	62.6	54.6	<b>75.3</b>
A3 Kapchagayskaya motorway (Yntymak)	88.3	81.9	78.9	76.1	76.2	72.5	67.6	59.6	<b>80.4</b>
KV15 Iliyskaya motorway (Otegen-Batyr village)	87.8	81.4	78.4	75.6	75.7	72.0	67.1	59.1	<b>79.9</b>
Basybekova Street – AL91 road (Almarek village)	83.7	77.3	74.3	71.5	71.6	67.9	63.0	55.0	<b>75.8</b>

Modelling point	Sound pressure level, dB								L <sub>Aeq</sub> , dB(A)
	Average compound frequencies of octave bands, Hz								
	63	125	250	500	1,000	2,000	4,000	8,000	
A2 Kuldzhinskaya motorway (Panfilovo village)	88.0	81.6	78.6	75.8	75.9	72.2	67.3	59.3	<b>80.1</b>
Road along Bolshoy Almatinsky channel	82.5	76.1	73.1	70.3	70.4	66.7	61.8	53.8	<b>74.6</b>
Alatau motorway (Alatau village)	83.4	77.0	74.0	71.2	71.3	67.6	62.7	54.7	<b>75.4</b>
R17 Talgarskaya motorway (Kyzyl-Kairat)	87.3	80.9	77.9	75.1	75.2	71.5	66.6	58.6	<b>79.4</b>
<b>Equivalent sound level, night time</b>									
A4 Verkhnyaya Kaskelenskaya motorway (Karaguldy)	82.9	76.5	73.5	70.7	70.8	67.1	62.2	54.2	<b>74.9</b>
A2 Bishkekskaya motorway (Rayimbek)	87.5	81.1	78.1	75.3	75.4	71.7	66.8	58.8	<b>79.5</b>
KV67 Burundayskaya motorway (Aksengir)	82.6	76.2	73.2	70.4	70.5	66.8	61.9	53.9	<b>74.6</b>
Karagandinskaya motorway (Zhapeg-Batyr)	82.2	75.8	72.8	70.0	70.1	66.4	61.5	53.5	<b>74.3</b>
Altayeva Street	80.9	74.5	71.5	68.7	68.8	65.1	60.2	52.2	<b>73.0</b>
Almatinskaya Street	82.2	75.8	72.8	70.0	70.1	66.4	61.5	53.5	<b>74.3</b>
Abaya Street – KV21 road	80.7	74.3	71.3	68.5	68.6	64.9	60.0	52.0	<b>72.8</b>
A3 Kapchagayskaya motorway (Yntymak)	85.8	79.4	76.4	73.6	73.7	70.0	65.1	57.1	<b>77.8</b>
KV15 Iliyskaya motorway (Otegen-Batyr village)	85.2	78.8	75.8	73.0	73.1	69.4	64.5	56.5	<b>77.3</b>
Basybekova Street – AL91 road (Almarek village)	81.2	74.8	71.8	69.0	69.1	65.4	60.5	52.5	<b>73.2</b>
A2 Kuldzhinskaya motorway (Panfilovo village)	85.4	79.0	76.0	73.2	73.3	69.6	64.7	56.7	<b>77.5</b>
Road along Bolshoy Almatinsky channel	80.0	73.6	70.6	67.8	67.9	64.2	59.3	51.3	<b>72.1</b>
Alatau motorway (Alatau village)	80.8	74.4	71.4	68.6	68.7	65.0	60.1	52.1	<b>72.9</b>
R17 Talgarskaya motorway (Kyzyl-Kairat)	84.8	78.4	75.4	72.6	72.7	69.0	64.1	56.1	<b>76.8</b>

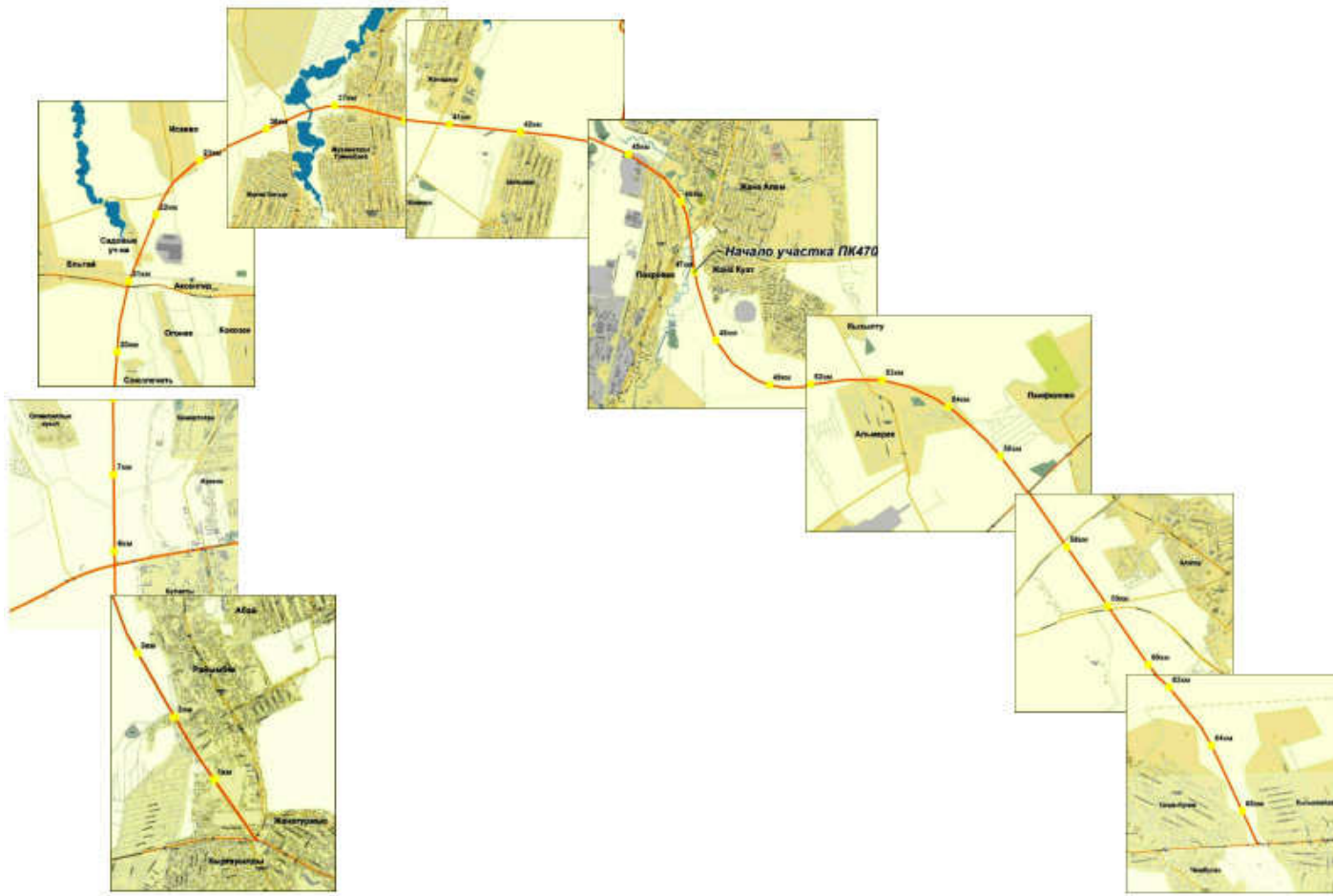
Maximum sound levels were estimated at 87 dB(A) for BAKAD and at 83 dB(A) for the radial roads.

### Noise levels during operation

Estimation of the noise impact was carried out for nine BAKAD sections, where the road would pass at a distance of less than 1 km from the residential areas (Figure 1.1-10).



The estimations took into account the anticipated reduction of noise by 5 dB(A) through absorption by the land surface and through general improvement of vehicles by the year 2045.



*Figure 1.1-10 Maximum sound levels from construction machinery during construction of the overpass*

Section 1 of BAKAD (1-4 km)

The layout of the target section of BAKAD and the reference modelling points are shown in Figure 1.1-11. Equivalent and maximum sound levels at the modelling points are presented in Table 1.1-26 and shown in Figure 1.1-12 - Figure 1.1-14.



Figure 1.1-11 Layout of the Section 1 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-26 Equivalent and maximum sound levels at modelling points for the Section 1

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Kyrgauyldy	62.9	60.3	75
RP2 Kyrgauyldy	60.5	57.9	72.7
RP3 Kyrgauyldy	60.7	58.1	72.9
RP4 Raiymbek	61.7	59.1	73.9
RP5 Raiymbek	62.2	59.6	74.4
RP6 Raiymbek	54.8	52.2	67.0
RP7 Raiymbek	56.0	53.4	68.2
RP8 Raiymbek	62.1	59.5	74.3
RP9 Raiymbek	60.3	57.7	72.5
RP10 Kyrgauyldy	62.1	59.5	74.2
RP11 Kyrgauyldy	63.8	61.2	75.8
RP12 Kyrgauyldy	66.9	64.4	77.7
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-

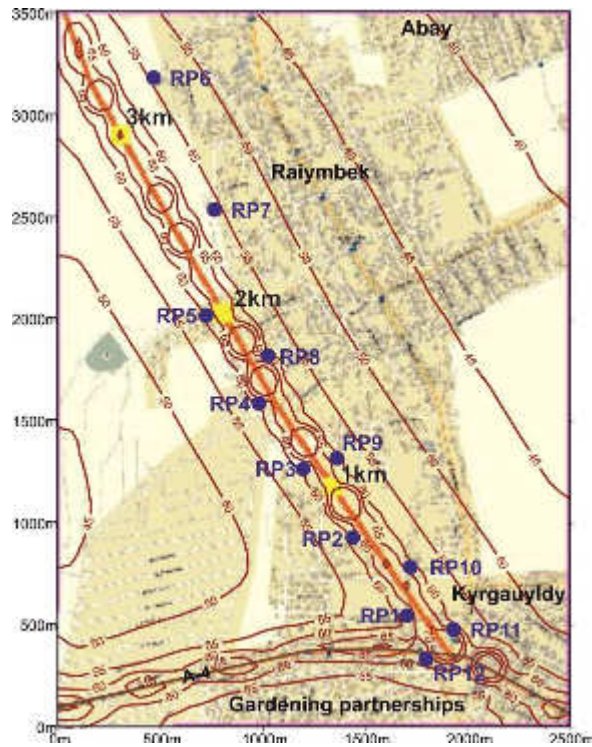


Figure 1.1-12 Equivalent sound levels at the nearest residential area during operation of the Section 1. Daytime estimates

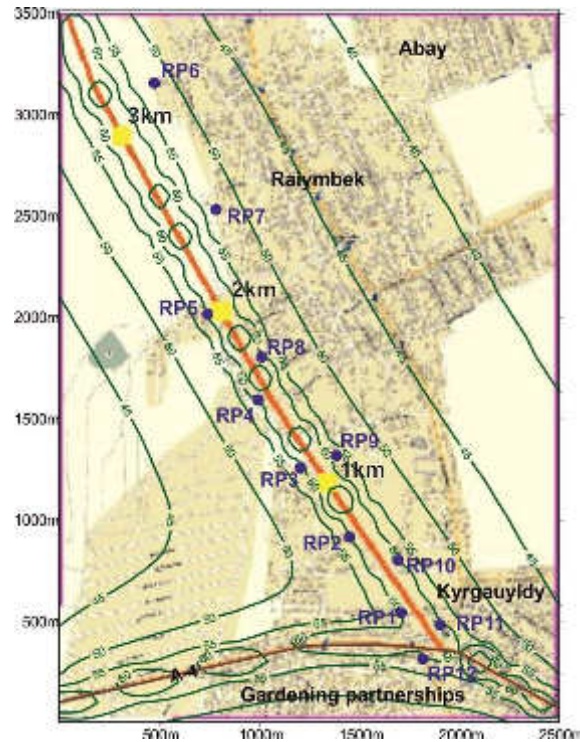
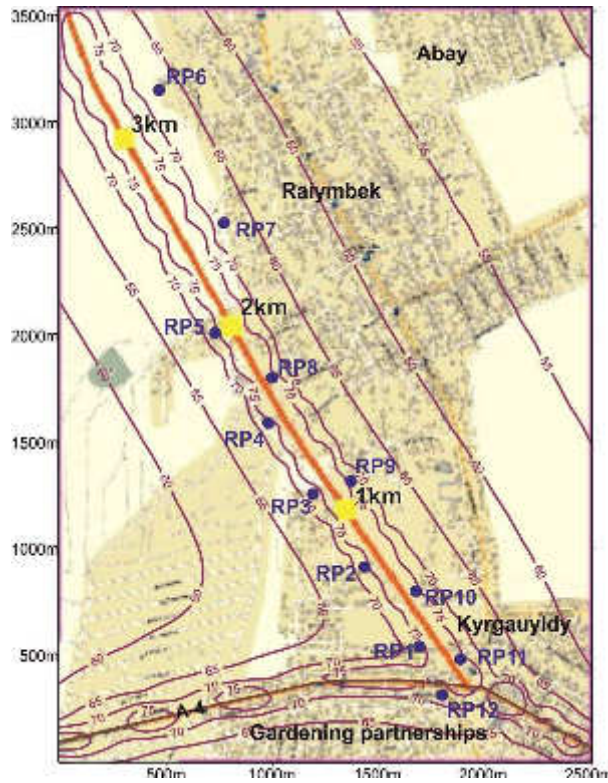


Figure 1.1-13 Equivalent sound levels at the nearest residential area during operation of the Section 1. Night-time estimates



**Figure 1.1-14** Maximum sound levels at the nearest residential area during operation of the Section 1

Baseline noise measurements showed that at RP12 the equivalent sound threshold level was exceeded by 12 dB(A) during the day and by 19 dB(A) at night. The maximum sound threshold level was exceeded by 8 dB(A) during the day and by 18 dB(A) at night.

Modelling results show that the sound level within the residential area near the road will significantly exceed the threshold level. In residential areas located at a distance of 50 m from the road, the equivalent sound threshold levels will be exceeded by up to 12 dB(A) during the day and up to 19 dB(A) at night. The equivalent noise level will reduce to the permissible level at a distance of more than 250 m from the road during the day and 650 m away of the road at night.

The maximum daytime sound levels may exceed the sanitary standard by 8 dB(A), and 7-18 dB(A) at night.

*Section 2: 5-8 km of BAKAD*

The layout of the target section of BAKAD and the modelling points are shown in *Figure 1.1-15*. Equivalent and maximum sound levels at the modelling points are presented in *Table 1.1-27*, and at the lands adjacent to the target section are shown in *Figure 1.1-16 - Figure 1.1-18*.





Figure 1.1-15 Layout of the Section 2 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-27 Equivalent and maximum sound levels at modelling points for the Section 2

Modelling points	$L_{Aeq}$ dB(A)		$L_{Amax}$ dB(A)
	Day	Night	
RP1 Bulakty	53.8	49.4	60.2
RP2 Dachas	51.6	47.2	58
RP3 Irgeli	52.5	46.3	59
RP4 Dachas	54.6	48.2	61.2
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-

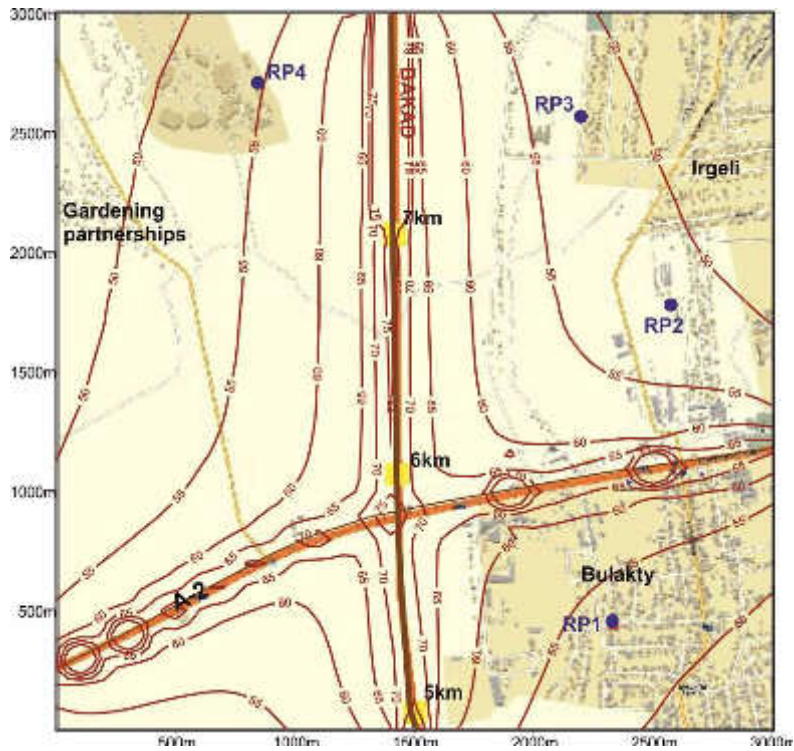


Figure 1.1-16 Equivalent sound levels at the nearest residential area during operation of the Section 2. Daytime estimates

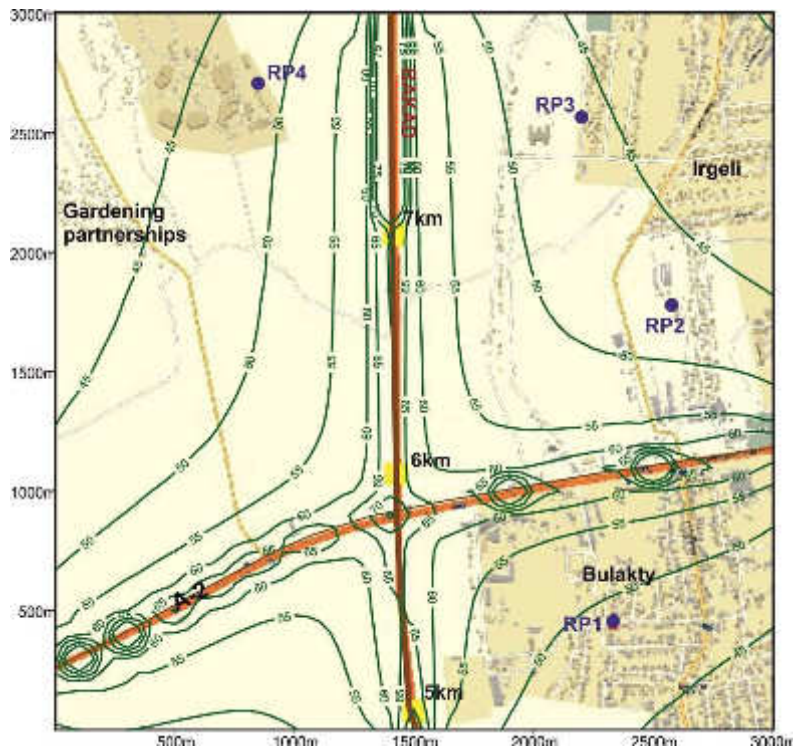
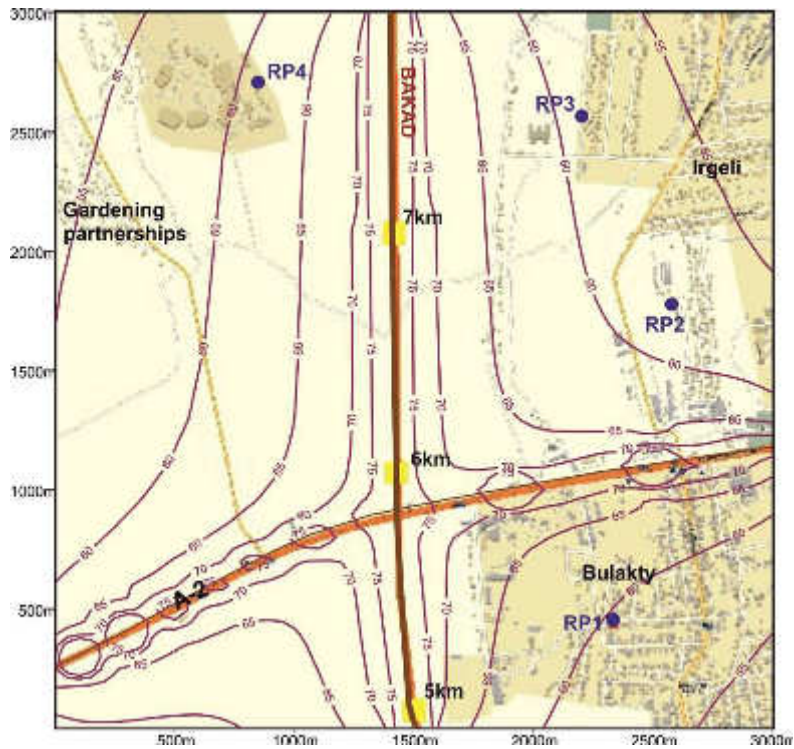


Figure 1.1-17 Equivalent sound levels at the nearest residential area during operation of the Section 2. Night-time estimates



**Figure 1.1-18** Maximum sound levels at the nearest residential area during operation of the Section 2

Baseline noise measurements showed that the day/night equivalent sound level at RP1 was 53/52 dB(A) and maximum sound level at the same point was 66/59 dB(A).

Modelling results show that the equivalent sound level within the residential area will not exceed the permissible level in the daytime, whilst the night-time exceedance can reach 4 dB(A).

The maximum sound levels will be below the permissible level.

*Section 3 of BAKAD (20-23 km)*

The layout of the target section of BAKAD and the modelling points are shown in *Figure 1.1-19*. Equivalent and maximum sound levels at the modelling points are presented in *Table 1.1-28*, and at the lands adjacent to the target section are shown in *Figure 1.1-20 - Figure 1.1-22*.



Figure 1.1-19 Layout of the Section 3 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-28 Equivalent and maximum sound levels at modelling points for the Section 3

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Soyuzpechat	63.3	56.7	69.9
RP2 Ogonek	60.2	55.8	69.1
RP3 Aksengir	58.4	54.5	67.8
RP4 Eltay	67.2	61.2	74.4
RP5 Dachas	68.3	61.7	74.9
RP6 Isaevo	66.5	59.9	73.1
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-



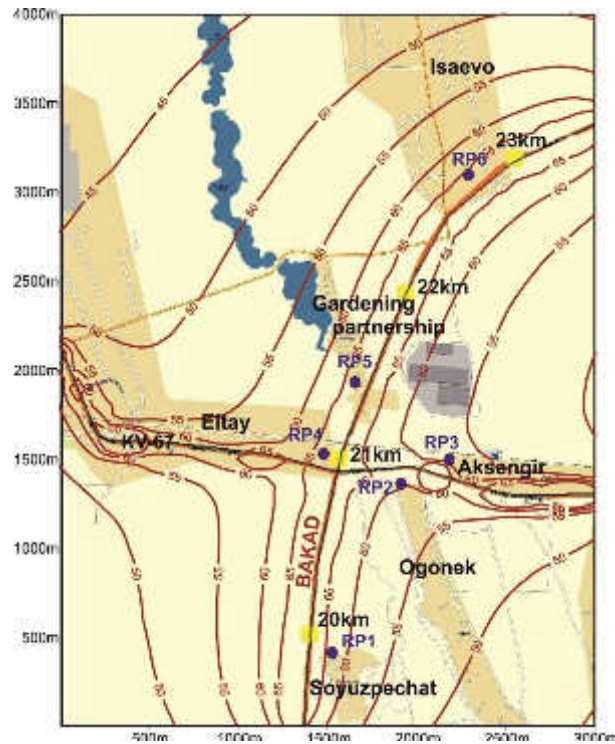


Figure 1.1-20 Equivalent sound levels at the nearest residential area during operation of the Section 3. Daytime estimates

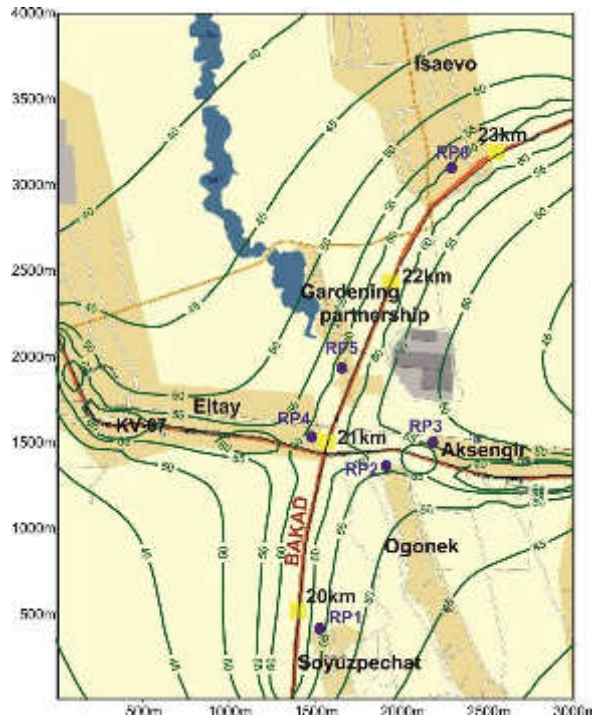
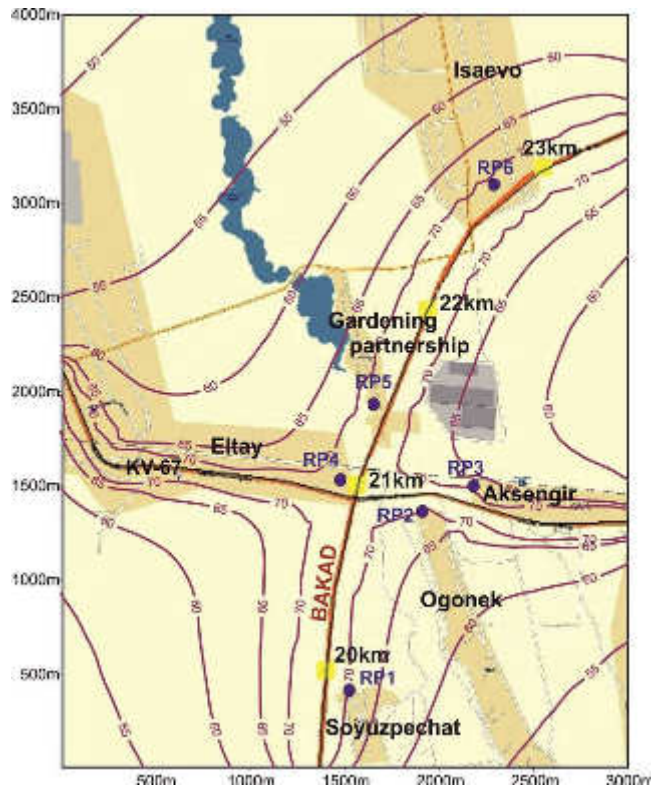


Figure 1.1-21 Equivalent sound levels at the nearest residential area during operation of the Section 3. Night-time estimates





**Figure 1.1-22** Maximum sound levels at the nearest residential area during operation of the Section 3

Baseline day/night noise levels at RP1 were observed as 44/41 dB(A) as equivalent sound level and 55/54 dB(A) as maximum sound level. Those at RP4 were 58/57 dB(A) and 66/70 dB(A) respectively.

Modelling results show that in the Section 3 the threshold values for equivalent sound level is likely to be exceeded at residential areas during the daytime by 4-13 dB(A), while the night-time exceedance can be 10-17 dB(A).

Threshold values for maximum sound levels in the daytime may be exceeded by 5 dB(A), and at night the exceedance can reach 8-15 dB(A).

*Section 4 of BAKAD (36-39 km)*

The layout of the target section of BAKAD and the modelling points are shown in Figure 1.1-23. Equivalent and maximum sound levels at the modelling points are presented in Table 1.1-29, and at the lands adjacent to the target section are shown in Figure 1.1-24 - Figure 1.1-26.

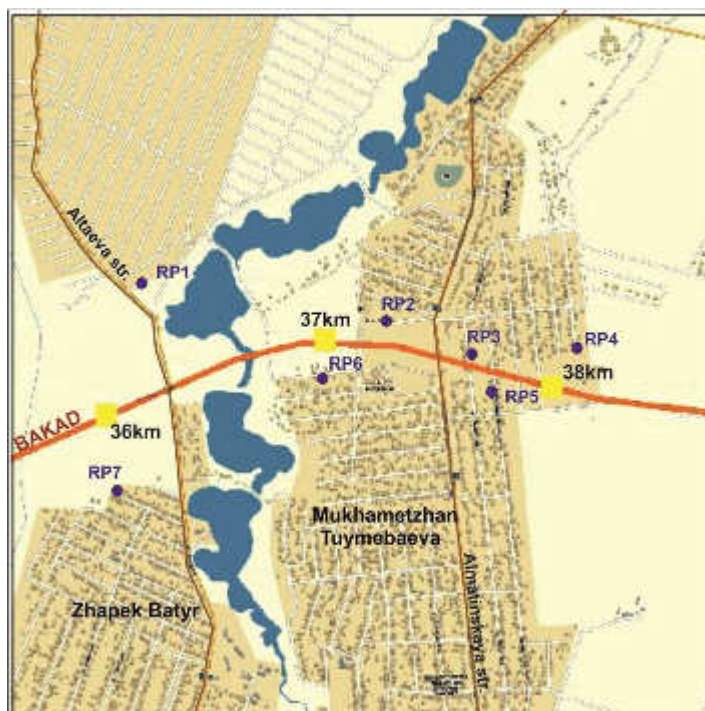


Figure 1.1-23 Layout of the Section 4 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-29 Equivalent and maximum sound levels at modelling points for the Section 4

Modelling points	L <sub>Aeq</sub> dB(A)		L <sub>Amax</sub> dB(A)
	Day	Night	
RP1 Dachas	58	54.5	69.2
RP2 Mukhametzhan Tuymebaev	62.9	56.7	69.1
RP3 Mukhametzhan Tuymebaev	65.7	59.5	71.8
RP4 Mukhametzhan Tuymebaev	59.1	52.7	65
RP5 Mukhametzhan Tuymebaev	64.8	58.5	70.8
RP6 Mukhametzhan Tuymebaev	60.7	54.4	66.7
RP7 Zhapek Batyr	56.5	51	64.4
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-

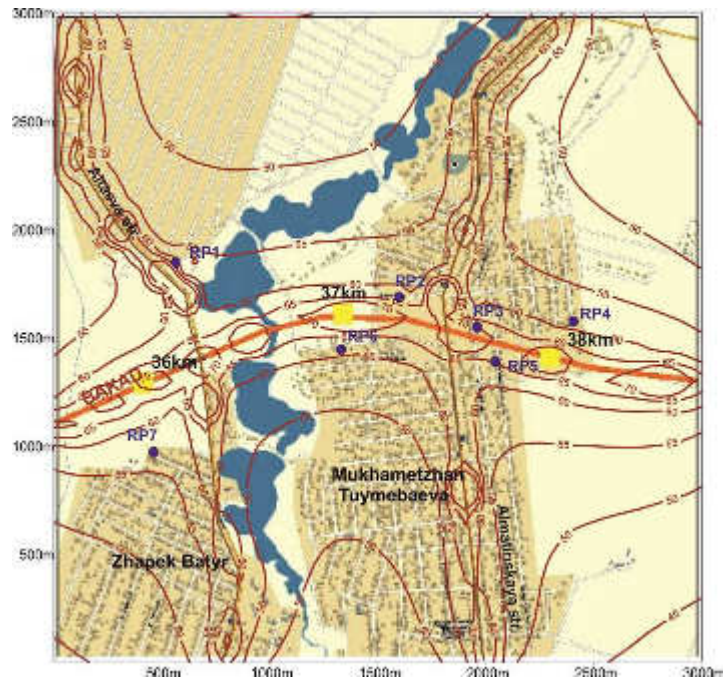


Figure 1.1-24 Equivalent sound levels at the nearest residential area during operation of the Section 4. Daytime estimates

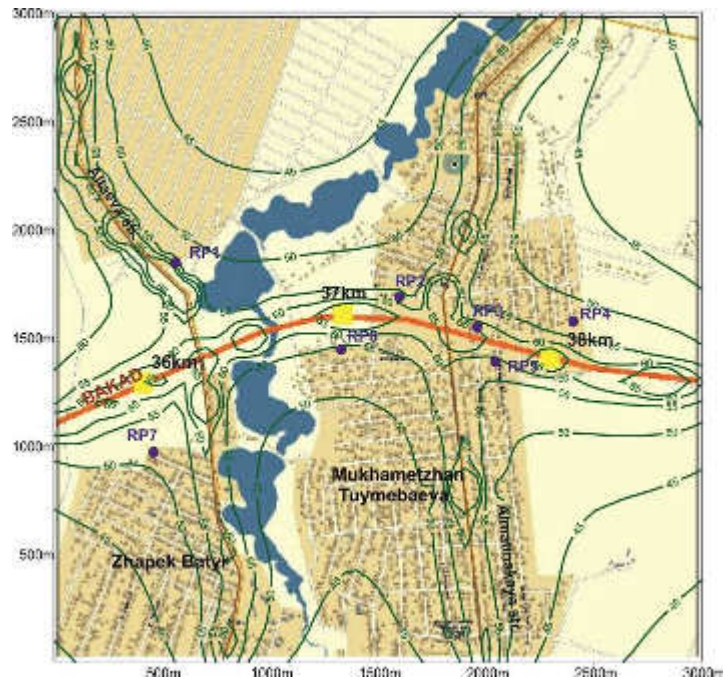
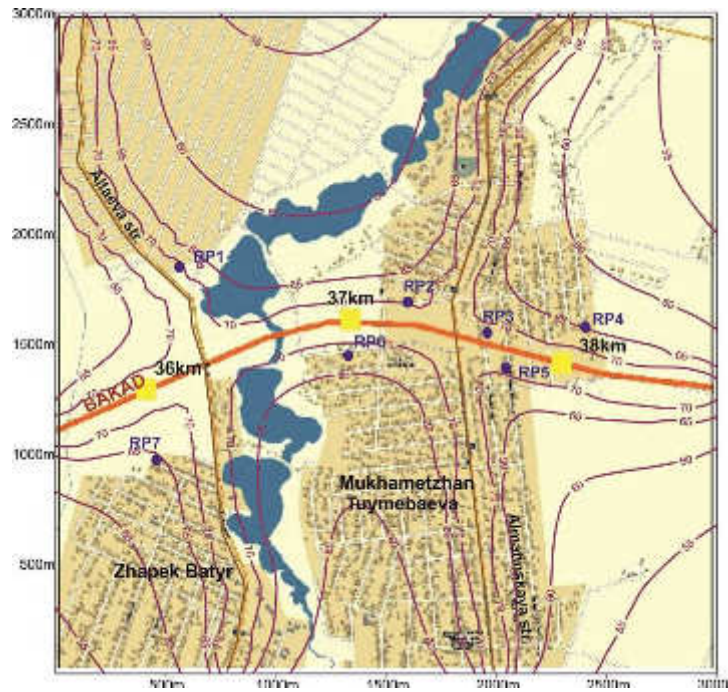


Figure 1.1-25 Equivalent sound levels at the nearest residential area during operation of the Section 4. Night-time estimates





**Figure 1.1-26** Maximum sound levels at the nearest residential area during operation of the Section 4

Modelling results show that that within the Section 4 virtually all nearest residential areas will experience increase in noise levels. Additional acoustic load to the residential areas will not be generated by BAKAD solely, but also by radial roads – Almatinskaya and Altayeva Streets. Equivalent sound levels in these areas will exceed the threshold values by 3-11 dB(A) in daytime and by 8-15 dB(A) at night.

The daytime maximum sound levels will be within the sanitary standard, while at night the exceedance of the standard can reach 4-12 dB(A).

*Section 5 of BAKAD (41-44 km)*

The layout of the target section of BAKAD and the modelling points are shown in Figure 1.1-27. Equivalent and maximum sound levels at the modelling points are presented in Table 1.1-30, and at the lands adjacent to the target section are shown in Figure 1.1-28 - Figure 1.1-30.



Figure 1.1-27 Layout of the Section 5 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-30 Equivalent and maximum sound levels at modelling points for the Section 5

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Yntymak	62.1	55.6	67.7
RP2 Yntymak	69.7	63.1	75.3
RP3 Zhanadaur	60.7	54.6	67.5
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-



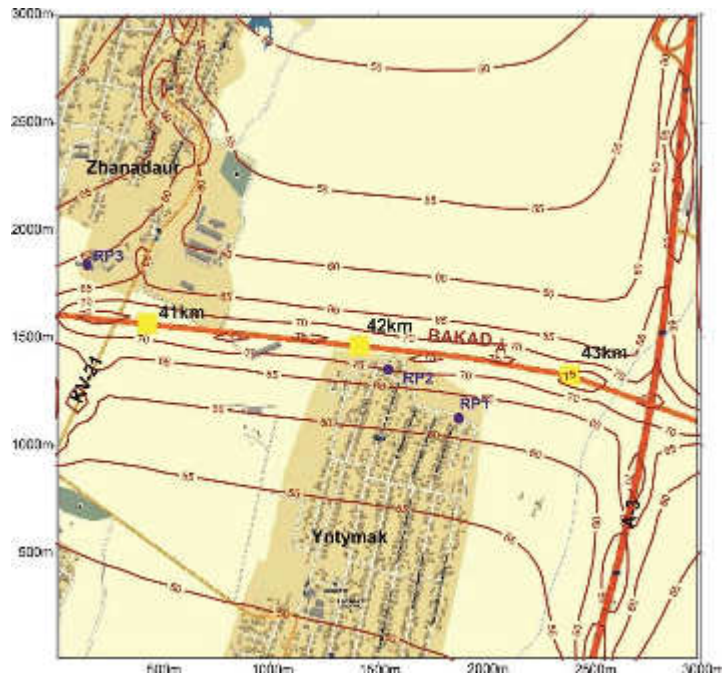


Figure 1.1-28` Equivalent sound levels at the nearest residential area during operation of the Section 5. Daytime estimates

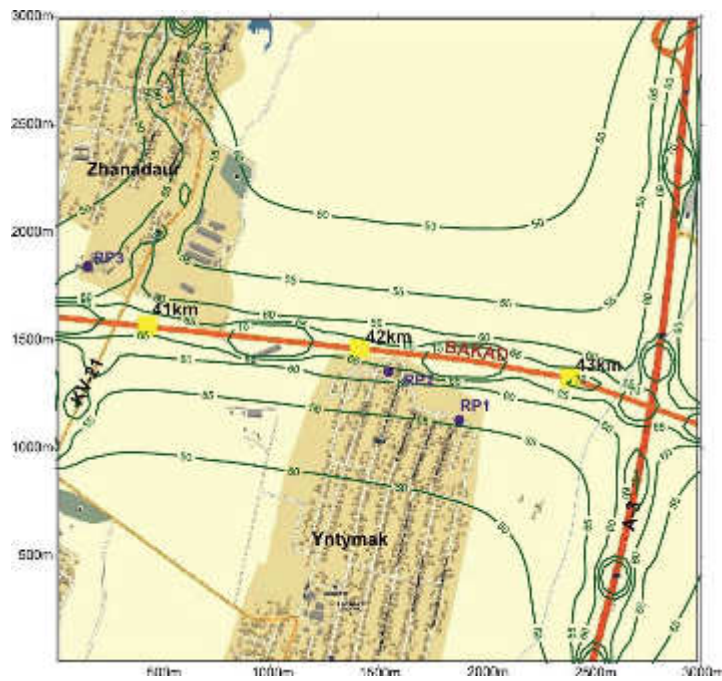
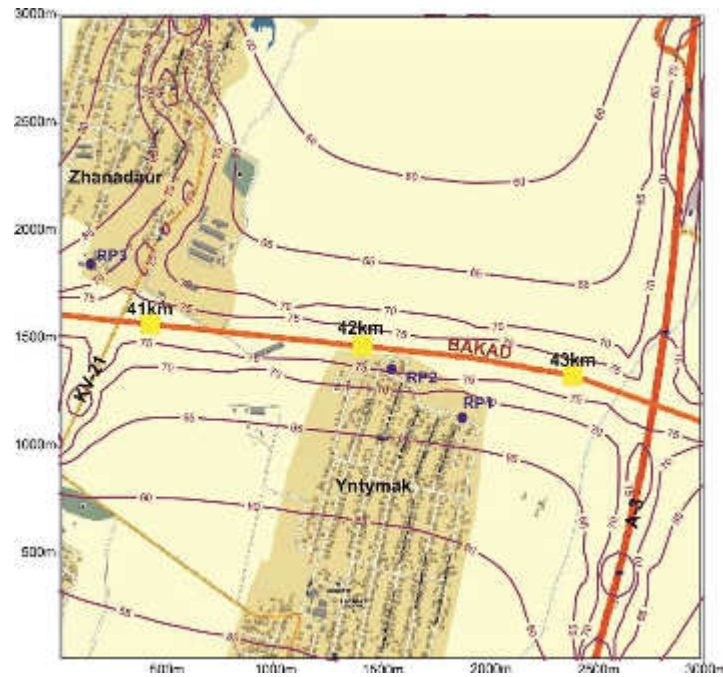


Figure 1.1-29 Equivalent sound levels at the nearest residential area during operation of the Section 5. Night-time estimates



**Figure 1.1-30** Maximum sound levels at the nearest residential area during operation of the Section 5

Baseline noise at RP1 was observed as 44 dB(A) for the equivalent sound level and 55/51 dB(A) for the day/night maximum sound level.

Modelling results show that within this section of BAKAD, residential areas will experience elevated sound levels. Equivalent sound levels resulting from road traffic will exceed the standard by 6-15 dB(A) during the day and by 10-18 dB(A) at night.

Threshold values of maximum sound levels during the day may be exceeded by 5 dB(A), and at night by 8-15 dB(A).

*Section 6 of BAKAD (45-51 km)*

The layout of the target section of BAKAD and the modelling are shown in Figure 1.1-31. Equivalent and maximum sound levels at the modelling points are presented in Table 1.1-31, and at the lands adjacent to the target section are shown in Figure 1.1-32 - Figure 1.1-34.



Figure 1.1-31 Layout of the Section 6 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-31 Equivalent and maximum sound levels at modelling points for the Section 6

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Otegen Batyr	59.6	53.2	65.1
RP2 Pokrovka	71.5	65	76.9
RP3 Pokrovka	67.5	62	73.5
RP4 Otegen Batyr	66.9	60.6	72.4
RP5 Zhana Kuat	57	50.6	62.4
RP6 Zhana Kuat	61.5	55	66.9
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-



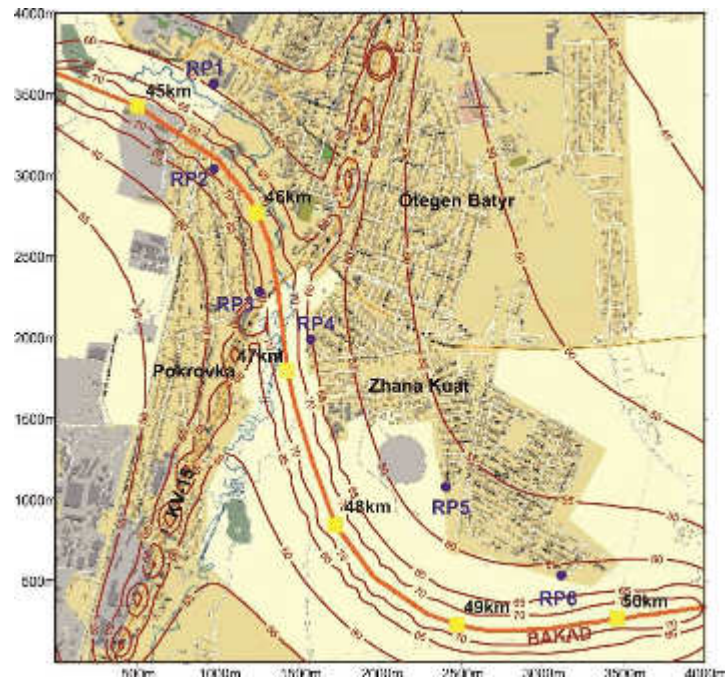


Figure 1.1-32 Equivalent sound levels at the nearest residential area during operation of the Section 6. Daytime estimates

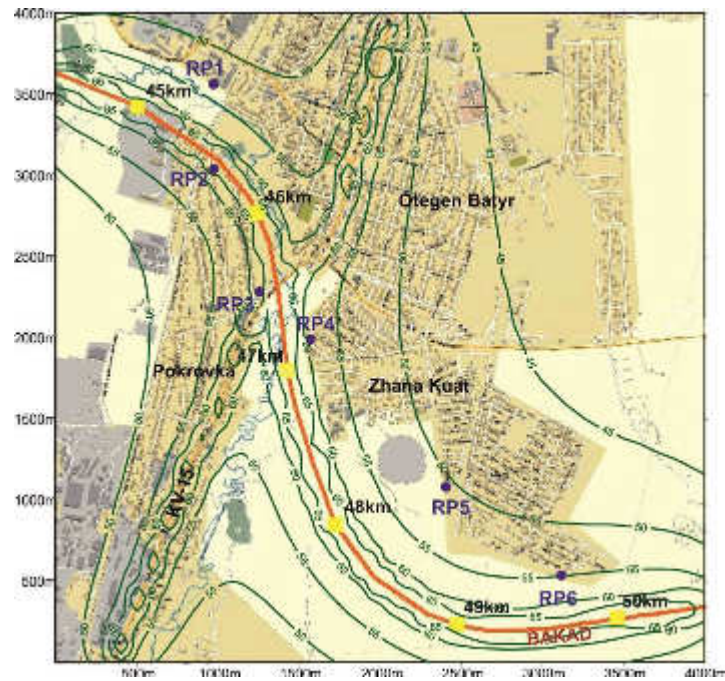
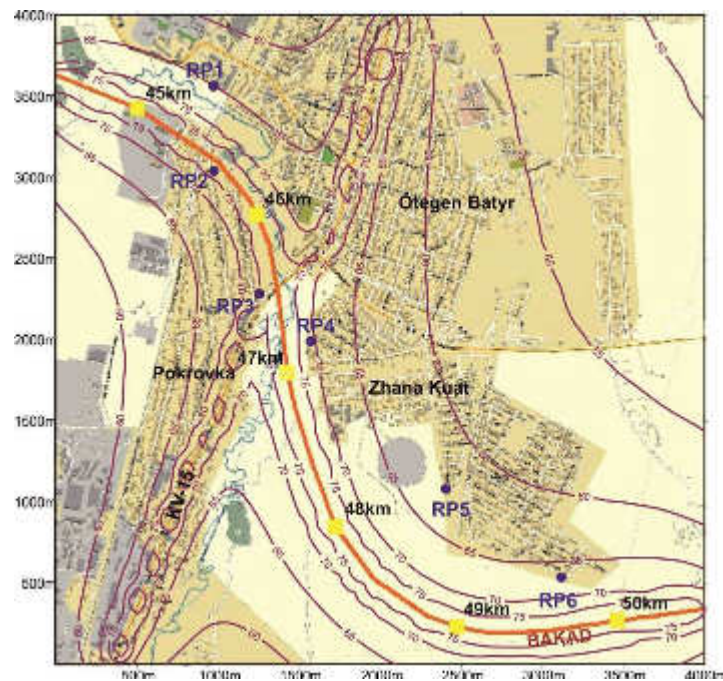


Figure 1.1-33 Equivalent sound levels at the nearest residential area during operation of the Section 6. Night-time estimates



**Figure 1.1-34** Maximum sound levels at the nearest residential area during operation of the Section 6

Baseline noise at RP3 was observed as 64/62 dB(A) for the day/night equivalent sound level and 82/72 dB(A) for the day/night maximum sound level.

Modelling results show that higher levels of noise load are predicted in the residential area near this section of BAKAD. Equivalent sound levels may exceed the standard by 2-17 dB(A) in daytime and by 6-21 dB(A) at night.

Maximum sound levels can exceed the standard by 7 dB(A) in the daytime and by 2-17 dB(A) at night.

*Section 7 of BAKAD (52-57 km)*

The layout of the target section of BAKAD and the modelling points are shown in *Figure 1.1-35*. Equivalent and maximum sound levels at the modelling points are presented in *Table 1.1-32*, and at the lands adjacent to the target section are shown in *Figure 1.1-36 - Figure 1.1-38*.



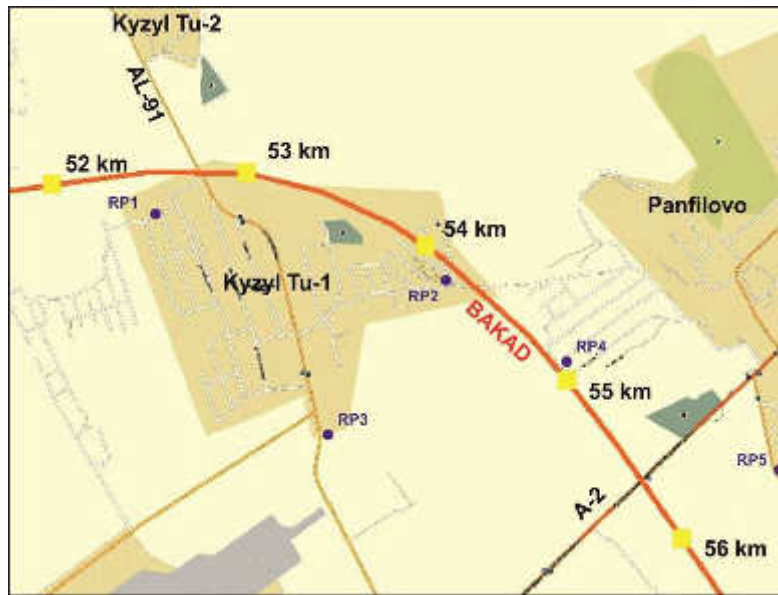


Figure 1.1-35 Layout of the Section 7 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-32 Equivalent and maximum sound levels at modelling points for the Section 7

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Kyzyl-Tu-1	63.5	57.1	69.4
RP2 Kyzyl-Tu-1	68.8	62.3	74.3
RP3 Kyzyl-Tu-1	62.4	58.9	68.3
RP4 Dachas	69.6	63.2	75.2
RP5 Panfilovo	54.4	49.6	62.1
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-

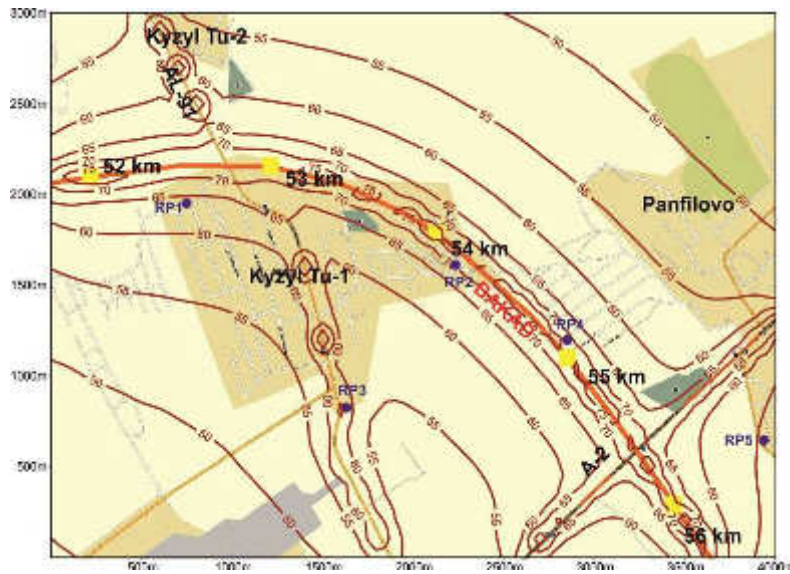


Figure 1.1-36 Equivalent sound levels at the nearest residential area during operation of the Section 7. Daytime estimates

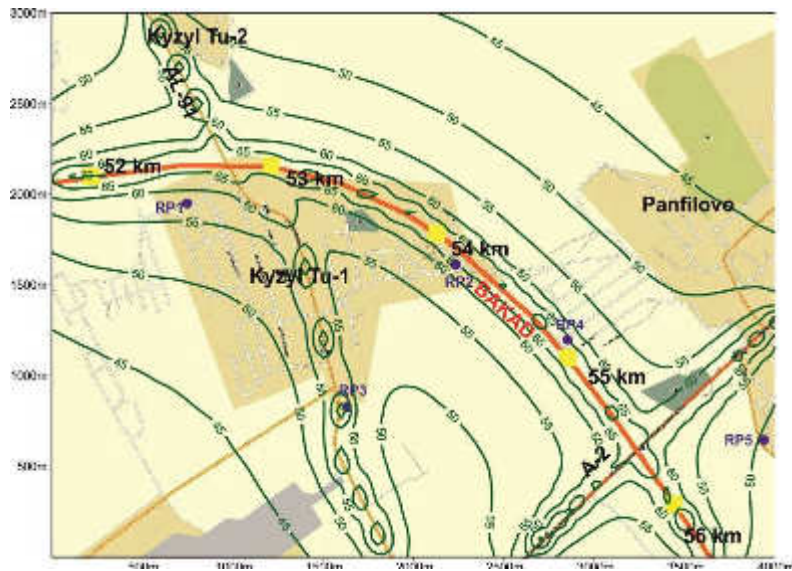
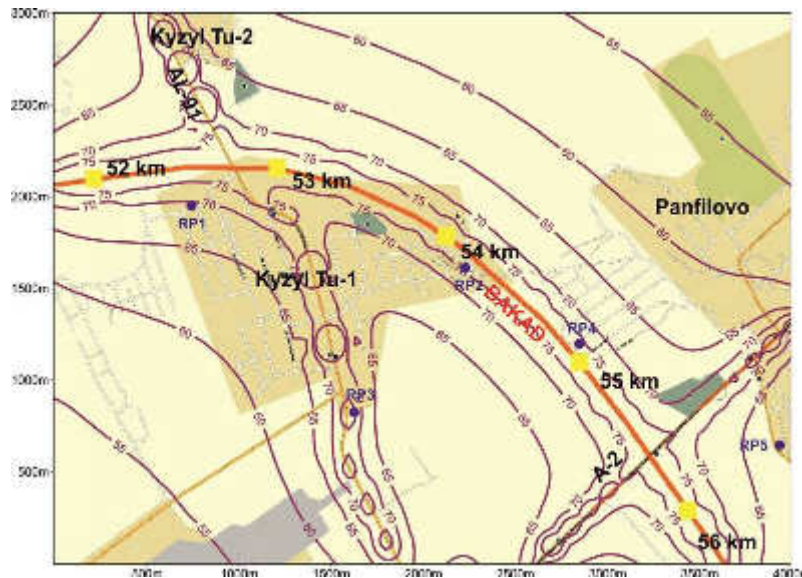


Figure 1.1-37 Equivalent sound levels at the nearest residential area during operation of the Section 7. Night-time estimates



**Figure 1.1-38** Maximum sound levels at the nearest residential area during operation of the Section 7

Baseline noise at RP3 was observed as 59/60 dB(A) for the day/night equivalent sound level and 72/69 dB(A) for the day/night maximum sound level. At RP5, the corresponding values were 69/65 and 85/78 dB(A).

Modelling results show that higher levels of noise load are predicted in the residential area near this section of BAKAD. Equivalent sound levels may exceed the standard by 15 dB(A) in daytime and by 5-18 dB(A) at night.

Threshold values for maximum sound levels can be exceeded by 5 dB(A) in the daytime and 2-15 dB(A) at night.

*Section 8 of BAKAD (58-61 km)*

The layout of the target section of BAKAD and the modelling points are shown in Figure 1.1-39. Equivalent and maximum sound levels at the modelling points are presented in Table 1.1-33, and at the lands adjacent to the target section are shown in Figure 1.1-40 - Figure 1.1-42.

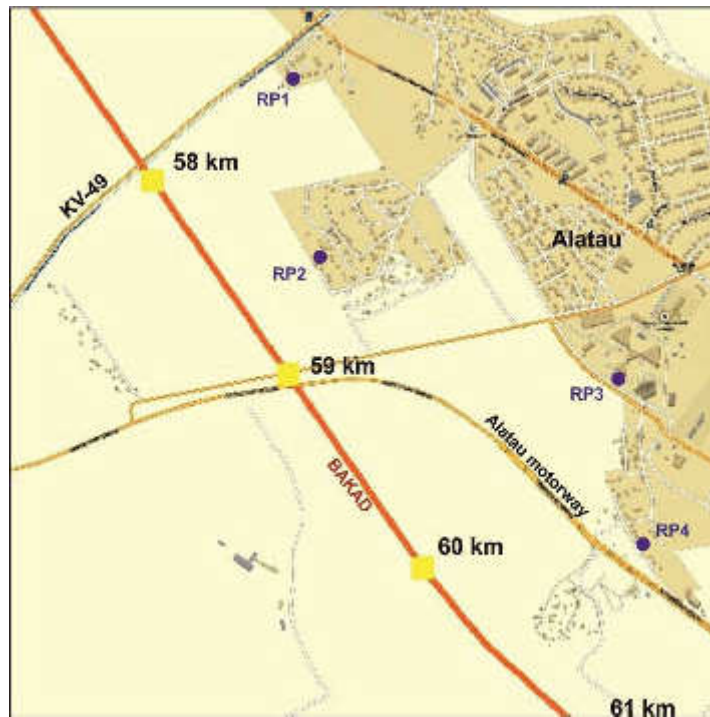


Figure 1.1-39 Layout of the Section 8 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-33 Equivalent and maximum sound levels at modelling points for the Section 8

Modelling points	L <sub>Aeq</sub> dB(A)		L <sub>Amax</sub> dB(A)
	Day	Night	
RP1 Alatau	54	50.7	66.9
RP2 Alatau	53.9	48.2	65.5
RP3 Alatau	47.4	42.9	59.3
RP4 Alatau	54.9	51.8	67.3
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-



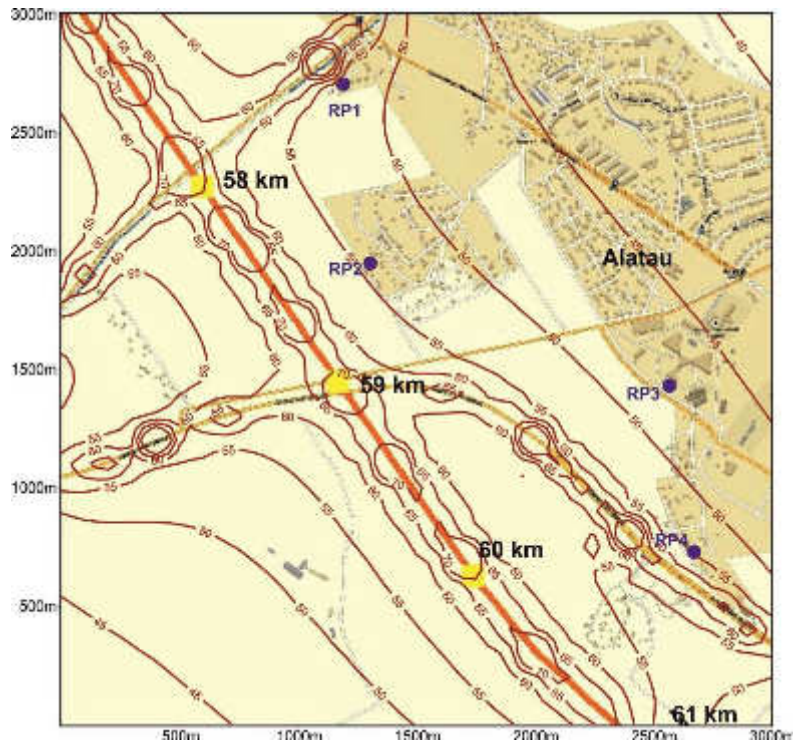


Figure 1.1-40 Equivalent sound levels at the nearest residential area during operation of the Section 8. Daytime estimates

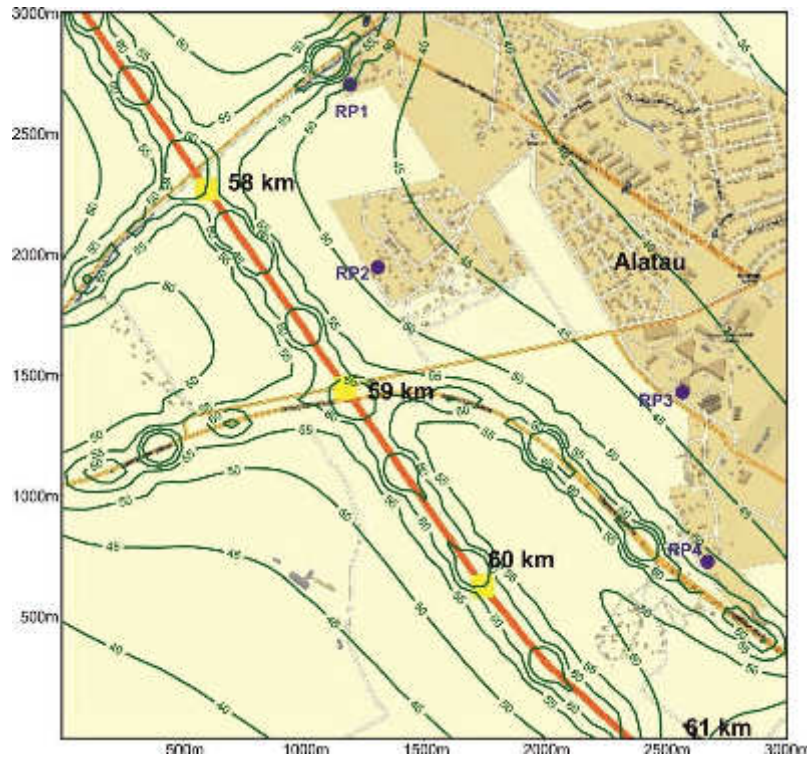
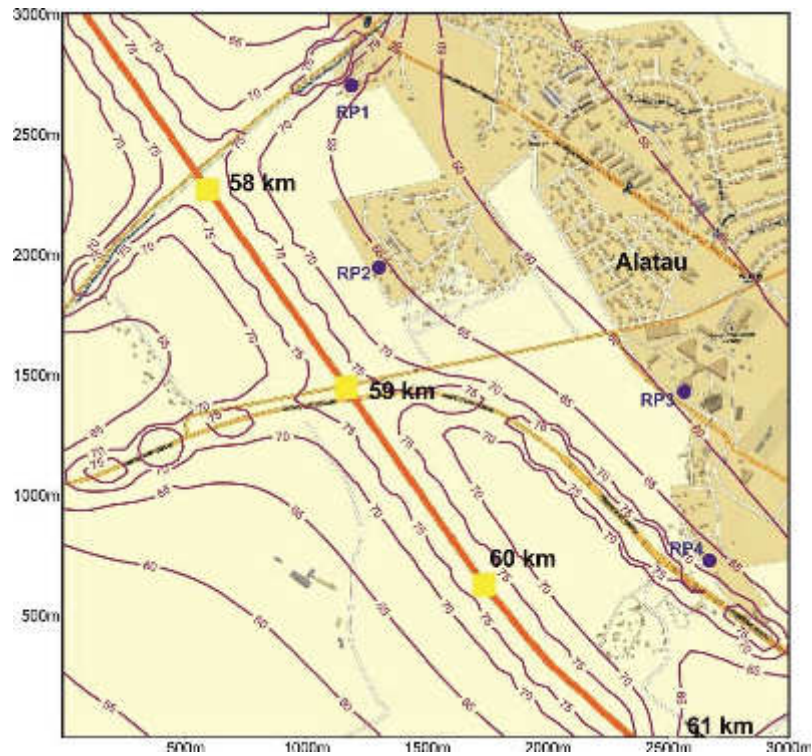


Figure 1.1-41 Equivalent sound levels at the nearest residential area during operation of the Section 8. Night-time estimates





**Figure 1.1-42** Maximum sound levels at the nearest residential area during operation of the Section 8

Modelling results show that in the residential area equivalent sound levels during the day will not exceed the standard, and at night, an exceedance of 8 dB(A) is possible.

Maximum sound levels may be exceeded at night by 7 dB(A).

*Section 9 of BAKAD (63-95 km)*

The layout of the target section of BAKAD and the modelling points are shown in *Figure 1.1-43*. Equivalent and maximum sound levels at the modelling points are presented in *Table 1.1-34*, and at the lands adjacent to the target section are shown in *Figure 1.1-44 - Figure 1.1-46*.

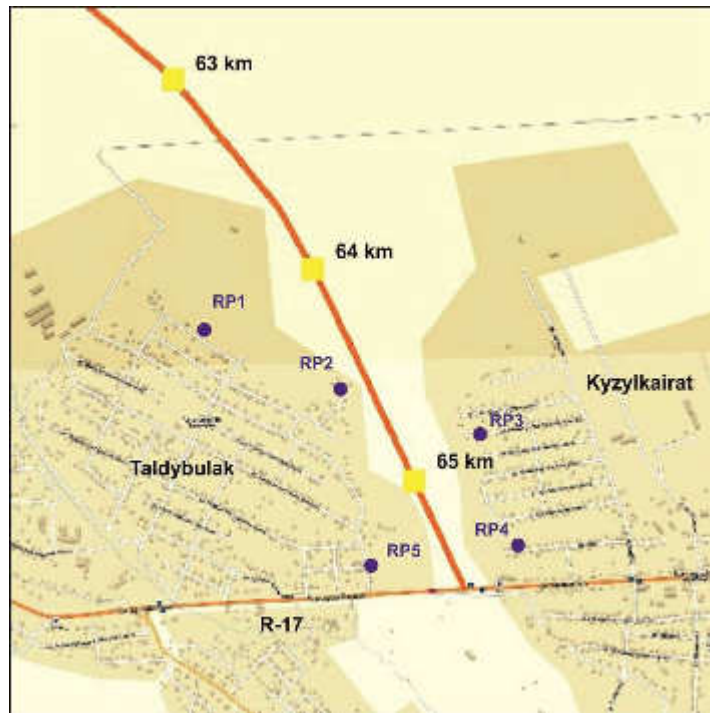


Figure 1.1-43 Layout of the Section 9 of BAKAD and modelling points for noise estimates for the operational stage

Table 1.1-34 Equivalent and maximum sound levels at modelling points for the Section 9

Modelling points	L <sub>Aeq</sub> , dB(A)		L <sub>Amax</sub> , dB(A)
	Day	Night	
RP1 Taldybulak	51.6	45.7	62.6
RP2 Taldybulak	60.7	54.4	72
RP3 Kyzyl-Kairat	55.5	49.7	66.5
RP4 Kyzyl-Kairat	58.2	54.5	68
RP5 Taldybulak	59.6	56.4	69
National standards	55	45	70 (day) / 60 (night)
IFC/WHO	55	45	-

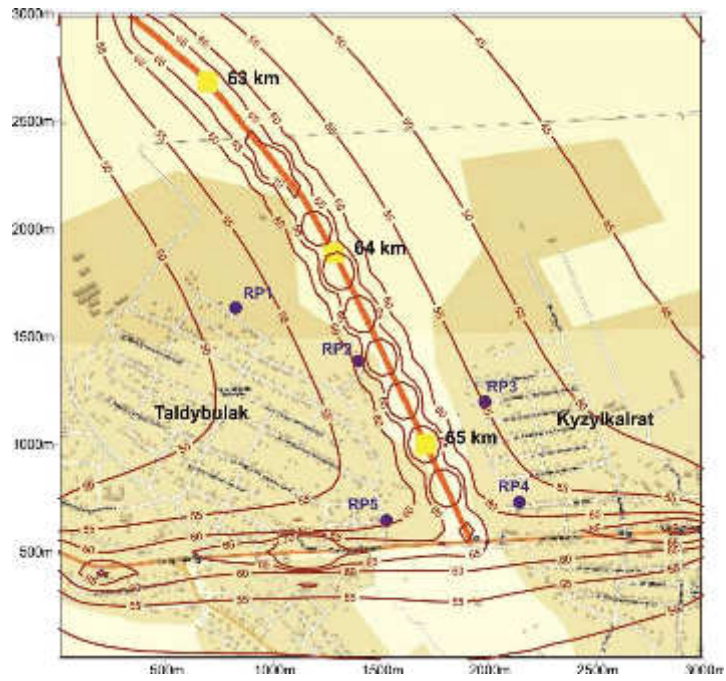


Figure 1.1-44 Equivalent sound levels at the nearest residential area during operation of the Section 9. Daytime estimates

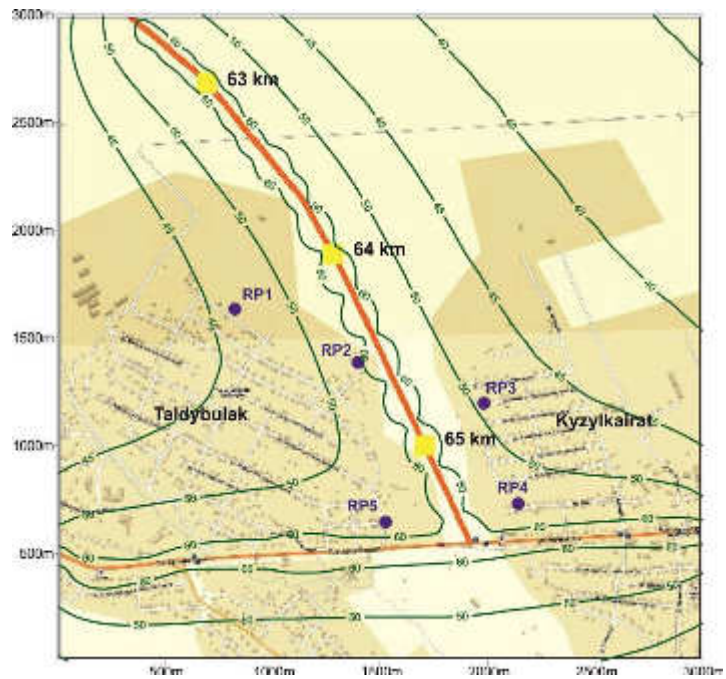
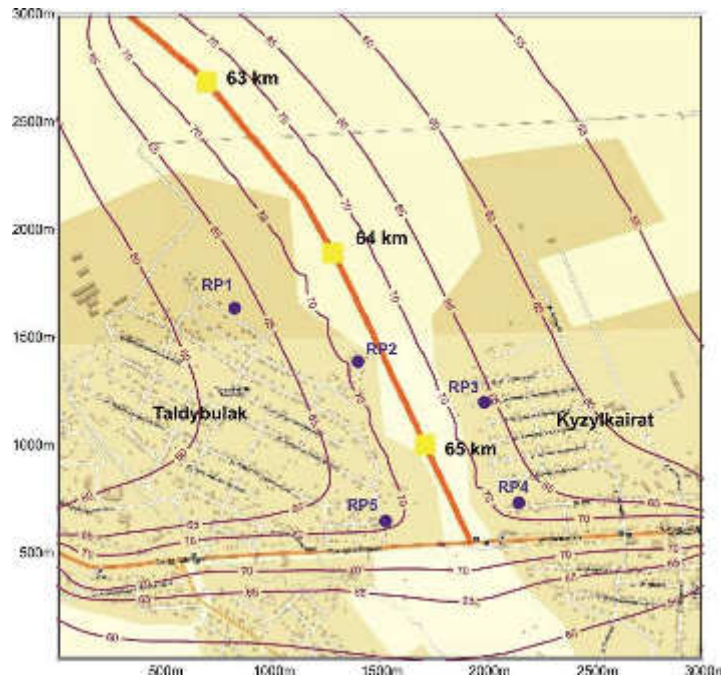


Figure 1.1-45 Equivalent sound levels at the nearest residential area during operation of the Section 9. Night-time estimates



**Figure 1.1-46** *Maximum sound levels at the nearest residential area during operation of the Section 9*

Baseline noise at RP4 was observed as 46/51 dB(A) for the day/night equivalent sound level and 53/59 dB(A) for the day/night maximum sound level.

Modelling results show that within the residential area the equivalent sound levels resulting from the traffic may exceed the standard by 6 dB(A) in daytime and by 11 dB(A) at night.

Threshold values for maximum sound levels can be exceeded by 2 dB(A) in the daytime, and by 3-12 dB(A) at night.

### **Impact Magnitude and Impact Significance**

Based on the review of baseline noise measurements and noise modelling results, the following conclusions were drawn in relation to noise levels at the receptors:

- Baseline noise measurements showed significant exceedances of the standards at most of the measurement points. Equivalent sound levels were observed exceeding the standard by 3-12 dB(A) during the day and by 2-19 dB(A) at night. Maximum sound level were observed exceeding the standard by 2-18 dB(A).
- Predicted noise levels (equivalent and maximum) generated by the traffic on BAKAD and the radial roads will significantly exceed sanitary standards both during the day and at night. The standards can be



exceeded by 10-20 dB(A) in the nearest (less than 100 m) residential areas, especially if they are exposed to the impact of several roads.

- Predicted noise levels are expected to decrease to the standard values and below in the areas located more than 500-600 m away from BAKAD.

The estimation of the *impact magnitude* during the operation of BAKAD is given in *Table 1.1-35*.

**Table 1.1-35 Assessment of the impact Magnitude**

Impact Magnitude criteria	Residential areas	
	Section 1 and Sections 3-9	Section 2
Scale	<i>Large</i> Daytime LAeq > 60 dB(A) Night time LAeq > 50 dB(A) (see <i>Error! Reference source not found.</i> )	<i>Medium</i> Night time LAeq > 45 dB(A) (see <i>Error! Reference source not found.</i> )
Frequency	<i>Continuous</i> Occurrence of the impact will depend on intensity of the traffic and BAKAD operation schedule (nonstop regime)	
Permanent	<i>Long-term</i> The impact will last throughout the operational stage	
Extent	<i>Local</i> The extent of the impact will be confined to the nearest residential areas	
<b>Impact Magnitude</b>	<b>Large</b>	

#### *Additional impact mitigation measures*

In order to reduce the noise impact of traffic on residential areas, noise screens can be installed along the road.

For illustrative purposes, below is an estimate of how a 3 metres high screen can reduce the noise load at the Sections 5 and 6 (41-44 km and 45-51 km respectively).

The comparison of the noise load before and after installation of the screen is shown in *Table 1.1-36*.

As the calculations show, the screen can reduce noise by 10-13 dB(A).

Although the screen would reduce the noise load, the permissible sound levels would still be exceeded.

A disadvantage of this method of noise reduction is that some of the residential areas along BAKAD will also be exposed to the noise from other the radial roads. The noise in these areas was already observed to be in excess of sanitary standards. Installing a screen in these areas would reduce the noise only slightly and would be economically impractical. For example, at RP3 located on the 45-51 km section of BAKAD, the noise will only decrease by 4-6 dB(A) as this point is within the area of influence of the KV15 road crossing BAKAD.



**Table 1.1-36 Sound levels at modelling points before and after installation of noise protection screens**

Modelling points	L <sub>Aeq</sub> dB(A)				L <sub>Amax</sub> dB(A)	
	Day		Night		Before installation	After installation
	Before installation	After installation	Before installation	After installation		
<i>41-44 km section of BAKAD</i>						
RP1	62.1	56.6	55.6	50.5	67.7	62.3
RP2	69.7	60	63.1	53.5	75.3	65.6
RP3	60.7	54.7	54.6	49.9	67.5	63.9
<i>45-51 km section of BAKAD</i>						
RP1	59.6	49.4	53.2	44.2	65.1	55.7
RP2	71.5	58.4	65	52.1	76.9	63.9
RP3	67.5	61.6	62	58.3	73.5	69.2
RP4	66.9	57.8	60.6	52.3	72.4	63.8
RP5	57	56.5	50.6	50.2	62.4	62
RP6	61.5	61.4	55	54.9	66.9	66.8

Preliminary estimations on the location and length of the noise screens were made, considering that the noise screens are to be installed in locations where residential areas will be located closer than 100 m to BAKAD and 300 m to the both directions along the road. The total length of the noise screen based on the estimation is provided in the table below (*Table 1.1-37*).

**Table 1.1-37 Estimated length of a noise screen**

#	Screen type	Screen location	Screen length
1	Two-sided	Kyrgayldy, section 8	2,314
2	Right-side	Ogonek GP, section 1	503
3	Left-side	Eltay, section 1	734
4	Left-side	Eltay, section 1	347
5	Two-sided	Gardener partnerships, section 1	518
6	Left-side	Isaevo, section 1	1,022
7	Right-side	Zhapek Batyra, section 2	565
8	Two-sided	Mukhametzhan Tuymebaev, section 2	961
9	Right-side	Yntymak, section 2	841
10	Two-sided	Pokrovka, section 3	1,502
11	Left-side	Kyzyl Tu, section 4	600
12	Right-side	Kyzyl Tu-1, section 4	860
13	Two-sided	Kyzyl Tu-1, section 4	1,085
14	Left-side	Panfilovo, section 4	650
15	Right-side	Taldybulak, section 9	740
16	Right-side	Taldybulak, section 9	652
17	Left-side	Kyzylkairat, section 9	557
18	Two-sided	Kyzylkairat, section 9	206
<b>Total</b>			<b>14,656</b>

Map showing the screens location is presented on the figure below (Figure 1.1-47).

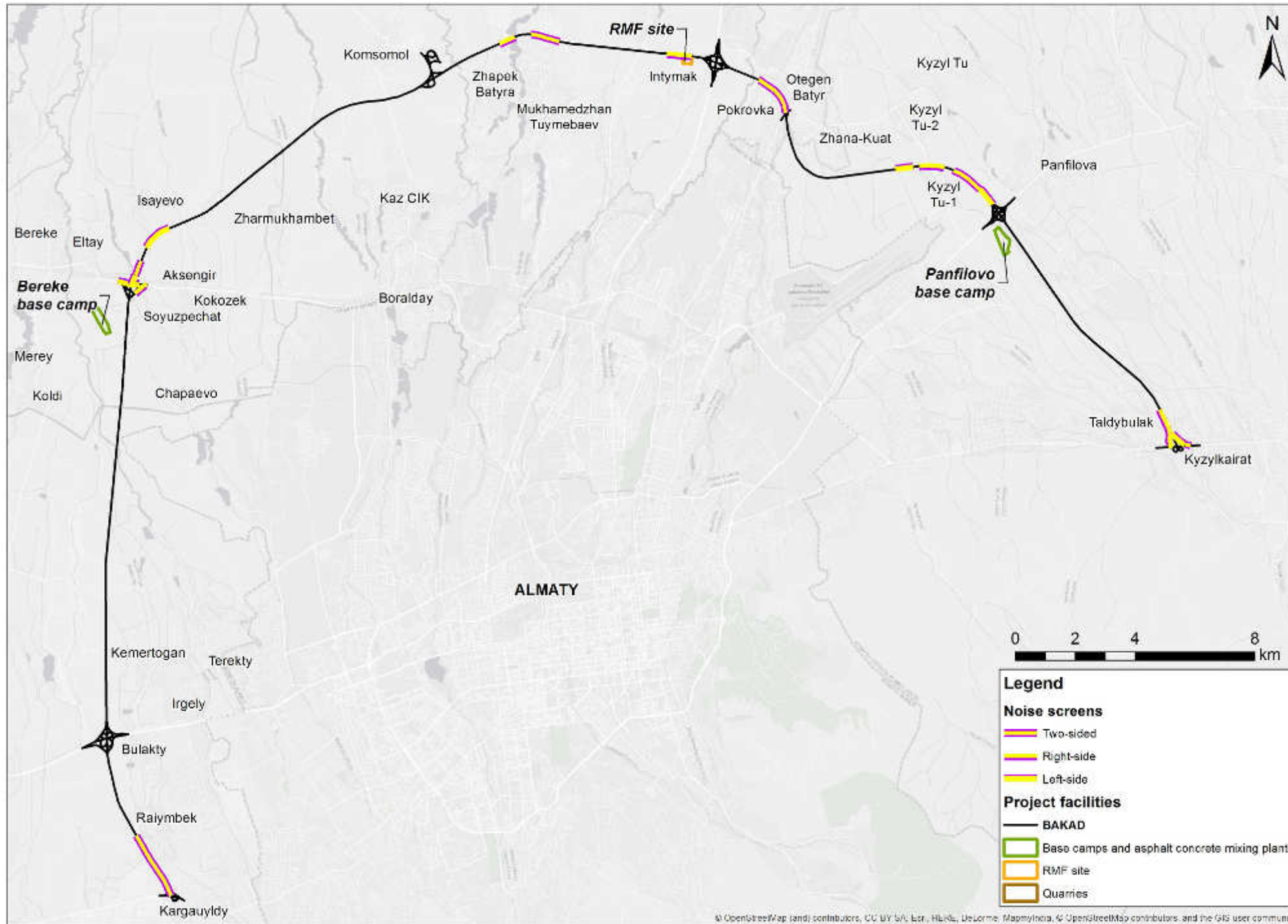


Figure 1.1-47 Preliminary locations of noise screens to be installed on BAKAD

Calculation of noise reduction and noise screen selection should be site-specific, taking into account the required degree of noise reduction, terrain features, height and location of residential buildings. It should also be noted that it would be a challenging, although a possible, task to reduce the noise by more than 15 dB(A) with a screen.

To comply with noise standards in the residential buildings nearest to the roads, soundproof windows are also recommended. They will reduce the indoor noise to permissible levels even with regular ventilation of living rooms, i.e. the windows should be equipped with ventilation devices with extra sound insulation. The windows can reduce noise by up to 30-35 dB(A) or more, which would ensure in many cases a permissible indoor acoustic regime even when external noise is high.

Table 1.1-38 below describes the *Impact Significance* taking into account embedded controls (i.e. mitigation measures provided for by the Project, see Section 1.1.4).

In spite of additional mitigation measures, the noise levels would still exceed the standards for outdoor noise level. The exception is indoor noise level in case of soundproof windows installation (Table 1.1-38).

**Table 1.1-38 Assessment of Impact Significance and Residual Impact**

Receptor	Impact Magnitude	Responsivity	Impact Significance
Locals in residential areas (the nearest settlements)	Large	Medium	Major
<b>Additional impact mitigation measures</b> <ul style="list-style-type: none"> <li>Noise screens installation along the road (noise level can be reduced by 10-13 dB(A))</li> <li>Soundproof windows installation (noise level can be reduced by 30-35 dB(A))</li> </ul>			
<b>Residual Impact</b>	<b>Major (outdoor noise level)</b>	<b>Small (indoor noise level)</b>	

As is evident from the table above, the applying of the proposed mitigation measures will result in major residual impacts. In this case, following the mitigation hierarchy approach, the Project should have considered alternative BAKAD routes. This could be considered the proper approach in line with the applicable international standards. However, as rerouting is not considered by the Project as an option, noise impact mitigation could be achieved by acquiring the land plots in the most affected area (e.g. 100 m from BAKAD) from their owners. Specific mitigation measures of this kind should be well agreed between the parties based on the proper stakeholder engagement actions by the Projects, and performed in accordance with relevant international standards (e.g. IFC Performance Standard 5). Also the Project has to consider engagement with local authorities in order to implement the proposed mitigation measures (i.e. installations of noise barriers and glazing) on the existing roads crossing BAKAD.

## Appendix 3: Socio-economic baseline



This Section presents information on the general socio-economic characteristics of the BAKAD Project area.

The BAKAD Project is situated in the Republic of Kazakhstan and passes through the Karasaysky, Iliysky and Talgarsky districts of Almaty Region. Quarries and transportation access routes are located in Enbekshikazakhsky and Zhambylsky districts of Almaty Region.

Sub-section 3.1 provides information on the current economic situation in Kazakhstan and in Almaty region, while other sub-sections contain detailed socio-economic description of the three districts and rural areas (okrug) where BAKAD main RoW and associated facilities will be located.

### 3.1 GENERAL CHARACTERISTICS OF THE SUBJECT AREA

#### 3.1.1 Current Economic Situation in Kazakhstan

Kazakhstan's economy has done relatively well in recent years, largely due to its large reserves of natural resources and the government pushing for diversified development. According to the RoK Committee on Statistics, the gross GNP per capita increased by 12.6 times within a 24 year period, from USD 696.2 in 1993 to USD 8,769.5 in 2017 (*Figure 3.1-1*). Decline in US dollars indicates a recession from 2013 to 2016, due to devaluation of the national currency.

GNP in Kazakhstani tenge (KZT) has been at a 26.4% growth rate, when adjusted for inflation<sup>1</sup>.

Kazakhstan has had reasonable economic development since its independence in 1991 and ranked 77<sup>th</sup> in the 2016 *Logistics Performance Index (LPI)* among 160 countries, having moved up by 11 positions from 2014<sup>2</sup>. The LPI score increased from 2.12 to 2.75 between 2007 and 2016<sup>3</sup>. The LPI is a benchmarking tool that identifies challenges and opportunities that a country faces in its performance on trade logistics.

Kazakhstan is vigorously improving its performance including all five key dimensions: efficiency of the clearance process, quality of trade and transport

<sup>1</sup> Estimates are based on the GDP at current prices adjusted for inflation (using the consumer price index, CPI) compared to 2010.

<sup>2</sup> <http://transport.mid.gov.kz/ru/news/za-poslednie-dva-goda-kazahstan-podnyalsya-na-11-pozicij-po-indeksu-effektivnosti-logistiki-lpi>

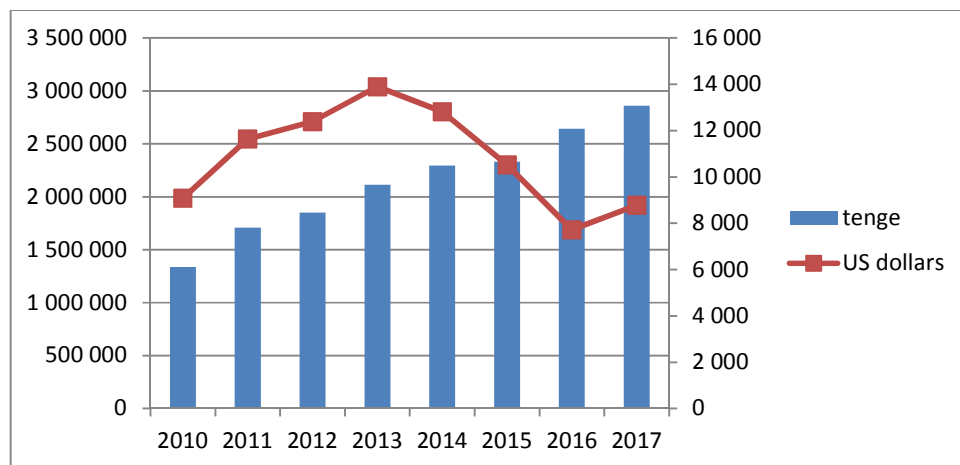
<sup>3</sup> <https://lpi.worldbank.org/international/global>

related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, timeliness of shipments in reaching destination within the scheduled or expected delivery time.

The BAKAD construction and commissioning in the Almaty Region (Oblast), one of the largest regions of Kazakhstan, is expected to contribute to a higher LPI.

Kazakhstan has a reasonably high ranking for its *Ease of doing business index*. This index reflects better, usually simpler, regulations for businesses and stronger protections of property rights. It takes into account factors such as the ease of starting and closing a business, getting credit, trading across borders, getting electricity, dealing with construction permit and investor protection. Kazakhstan moved from position 63 to position 36 in the rating of countries.

**Figure 3.1-1 GNP per capita in Kazhakstani tenge (KZT)**



Kazakhstan has a population density of approximately 7 people / km<sup>2</sup>, which is relatively low at the global scale. It is a vast area (2,724,900 km<sup>2</sup>) with a population of 18.2 million people<sup>4</sup>. The population has steadily grown by 1.4% to 1.5% per year over the past 8 years.

Kazakhstan's poverty rate (i.e the proportion of the population with average per capita income below the living wage) is reported at at 2.6 % in 2017, which is a reduction by 2.5 times during the past 8 years.

According to official statistics, unemployment rates seem stable, despite the country's economic slowdown. However, households with low income are vulnerable to growing prices, falling real wages and shrinking job opportunities.

<sup>4</sup> Thus, the population density is 6.7 people/sqkm.

**Table 3.1-1 Major socioeconomic development indices of the Republic of Kazakhstan in 2011 - 2017 demonstrate a sustainable growth of per capita income as well as falling poverty and unemployment rates<sup>5</sup>**

Indicator		2011	2012	2013	2014	2015	2016	2017
Population size, thousand people		16,440.5	16,673.9	16,910.2	17,160.9	17,415.7	17,669.9	17,918.2
Average nominal monthly wages	KZT	45,918	51,860	56,453	62,271	67,321	76,575	80,226
	USD	313.2	347.8	371.1	347.5	303.6	223.8	246.1
Proportion of the population with average per capita income below the living wage in per cent		5.5	3.8	2.9	2.8	2.7	2.6	2.6
Unemployment rate in per cent		5.4	5.3	5.2	5.0	5.1	5.0	4.9
Average nominal monthly wages per employee <sup>8</sup>	KZT	90,028	101,263	109,141	121,021	126,021	142,898	149,663
	USD	614	679	717	675	568	418	459

### 3.1.2 General socioeconomic characteristics of the Almaty Region

The Almaty Region, with an area of 223,500 km<sup>2</sup> is located in the south-west of Kazakhstan. It borders China in the east (border length 910.8 km), Kyrgyz Republic in the south (border length 542.8 km) and East Kazakhstan Region in the north. It adjoins the Lake Balkhash in the north-west and Jambyl Region in the west.

The Region comprises 17 districts and 3 cities of region subordination (Taldykorgan, Kapshagai and Tekeli)<sup>6</sup>, including Talgarsky, Iliysky and Karasasky districts, which the the proposed BAKAD route will intersect with.

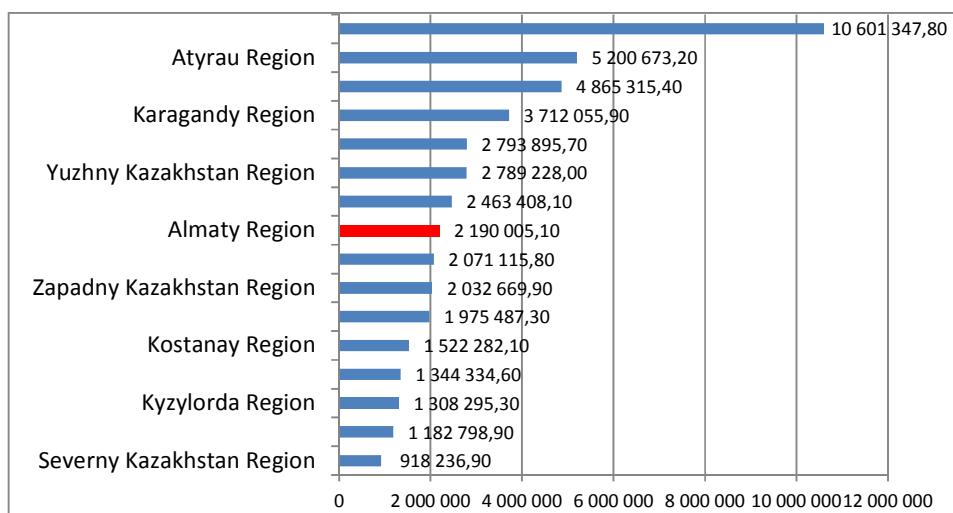
The population of Almaty is 2,023,000 people (2018), and represents 103 nationalities and ethnic groups. Of these people, 31.1% (607,000) reside within Talgarsky, Iliysky or Karasasky districts.

The gross regional product (GRP) of the Almaty Region (Figure 3.1-3) accounts for 4.7% of the country's GDP and has grown 2.18 times (KZT 997.7 billion to KZT 2,178.6 billion) 2010 and 2016. The region ranks 8<sup>th</sup> in terms of the GRP among other regions of Kazakhstan (Figure 3.1-3).

<sup>5</sup> [http://stat.gov.kz/faces/wcnav\\_externalId/homeDinamika.pokazateli;jsessionid=woqiWdmDLVFhHzJp3P1kX6izwElyv4RWAhhj9beVHvXiziPVMEK9!-2067519636!1194827341?lang=ru&\\_afLoop=4190507743308138](http://stat.gov.kz/faces/wcnav_externalId/homeDinamika.pokazateli;jsessionid=woqiWdmDLVFhHzJp3P1kX6izwElyv4RWAhhj9beVHvXiziPVMEK9!-2067519636!1194827341?lang=ru&_afLoop=4190507743308138)

<sup>6</sup> About the Region // <http://zhetyssu.gov.kz/ru/o-regione/>

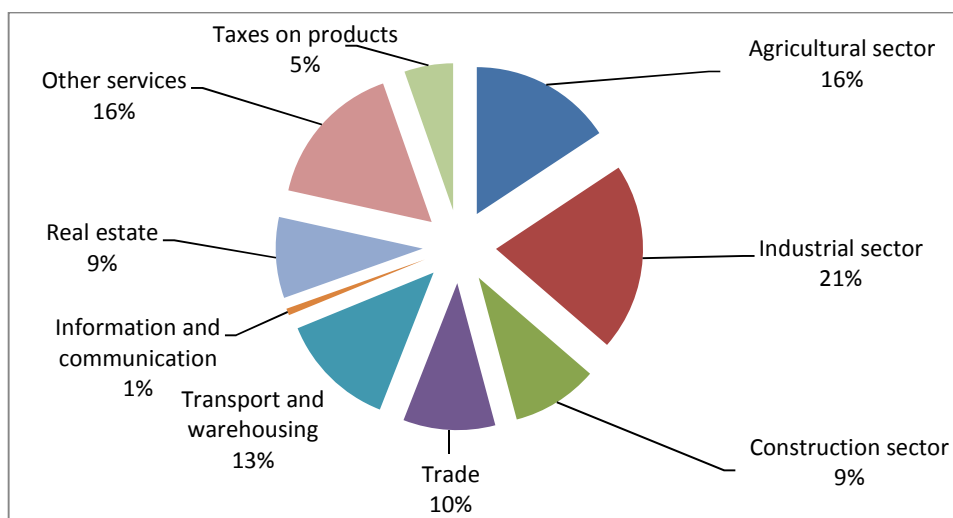
**Figure 3.1-2** *Almaty Region ranks 8<sup>th</sup> in terms of GRP among other regions of the country*



The Almaty region represents the country’s largest economic assets. It accounts for 16.2% of the country’s output in the agricultural sector, 7.3% in the construction sector, 7.3% in transport and warehousing and 3.7% in the industrial sector. In 2016, the GRP of Almaty Region reached KZT 2,190,005.1 million; 4.7% of the country’s GDP.

The industrial sector accounts for 21% of the region’s GRP, the share of agriculture, transport and warehousing as well as trade being 16%, 13% and 10% respectively.

**Figure 3.1-3** *Industry, agriculture, transport and warehousing accounted for the biggest share of the Almaty Region’s GRP in 2016*



### *Agriculture*

The agricultural sector in Almaty Region prevails over industrial sector. Food in the city of Almaty is predominantly supplied within the region. The

agricultural sector accounts for 17% of the Republic's total agricultural output<sup>7</sup>.

Almaty Region ranks first in the country for the production of sugar beet (9,000 ha), soybeans, potatoes, meat, eggs and wool. It produces 97% of all soybeans and 64% of all maize and sugar beet grown in Kazakhstan. Meat, milk and egg production accounts for 20%, 13% and 23% of the country's total output, respectively.

The Region has one of the largest stocks of cows, sheep and goats in the country. Sixty feedlots and fifty five milk farms of the Region are operational and demonstrate good economic results. The gross output of the agricultural sector in January to November 2017 amounted to KZT 611.3 billion, the index of physical volume of production being 102.5%. The sales volumes amounted to 296.6 thousand tonnes of cattle and poultry meat in live weight (107.9% compared to the same period of 2016), 681.6 thousand tonnes of milk (103.6%), 978 million eggs (100.8%) and 8.3 thousand tonnes of wool (101.9%). The livestock population amounted to 1,007.9 thousand heads of cattle (102.5% compared to the same period of 2016), 3,660 thousand sheep and goats (101%) and 298.3 thousand horses (101.7%). The poultry stock amounted to 9,234.6 thousand heads (106.4% compared to the same period of 2016).

The Almaty region is the second most important producer of grapes and vegetables. In 2017 the agricultural sector produced 774.3 thousand tonnes of grain crops, 512.5 thousand tonnes of grain maize, 48.9 thousand tonnes of rice, 331.5 thousand tonnes of sugar beet, 302.8 thousand tonnes of oil-bearing crops, 716.9 thousand tonnes of potatoes, 944.4 thousand tonnes of vegetables, 105 thousand tonnes of fruit and berries and 21.7 thousand tonnes of grapes<sup>8</sup>.

The region is also an important supplier of tobacco and beverage products. Production of beverages, foodstuff and tobacco products dominate the region's manufacturing sector accounting for 20%, 22%, and 17% of economic output, respectively.

Approximately one billion litres of juices and non-alcoholic beverages are produced each year.

Creation of an efficient transport infrastructure in the subject area is needed for the ongoing development of the agricultural sector. Farming enterprises are extensively dependant on the reliable traffic infrastructure, which is necessary for quick delivery of agricultural products to end users and acquisition of industrial commodities. The proposed BAKAD construction will improve productivity, reduce losses in transit and production costs.

<sup>7</sup> <http://alplan.gov.kz/soc-ekonomicheskij-pasport/>

<sup>8</sup> <http://zhetyssu.gov.kz/ru/content/23informatsiya-ob-itogakh-sotsialno-ekonomicheskogo-razvitiya-almatinskoy-oblasti-za-yanvar-sentyabr-2.html>



### *Manufacturing*

Mining/quarrying and manufacturing account for 2.2% and 82.9% of the Region's total output. They provided 14.3 billion KZT and 534.7 billion KZT worth of products for the reporting period respectively.

Processing industry accounts for 82.9% of the Region's total output; power, gas, steam supply and air conditioning 13.9%; mining and quarrying 2.2%; water supply, sewage and waste distribution 1%.

Over 1,800 enterprises are operational in Almaty Region. Twenty of them manufacture one third of the Region's industrial output.

Six pharmaceutical plants are currently operational in the Region.

Almaty Region is the only Republic's manufacturer of malt, electric accumulators, gypsum boards, reinforced concrete and metal pylons for high voltage power lines, fire hydrants, silicon and syntepon. About 70 types of major construction materials and structural units are manufactured in the Region.

### *New industrial developments*

Currently, six industrial zones are being developed in the Almaty Region: Taldykorgan and Arna in Kapshagai, Boraldai and Bereke in Iliysky District, Kazbek Bek in Jambyl District and Kairat in Talgarsky District. Enterprises manufacturing innovative, hi tech and organic products will be built in these industrial zones. Two large-scale projects with a total investment of KZT 46 billion will be implemented in the Taldykorgan Industrial Zone (a meat processing plant jointly with Chinese partners and a baby food plant). These projects will create 560 new jobs. A new industrial zone Bereke is under development in Gate City, a satellite city of Almaty. Five investment projects totalling KZT 90 billion and securing about 2,000 new jobs are being launched here with participation of trans-national companies. The infrastructure facilities of the Kairat Industrial Zone comprising 17 operational enterprises are already under construction.

### *Tourism*

Characterised by vast natural landscapes, areas of natural and cultural value, and recreation sites, the Almaty region has high potential for tourism development and growth. Noteworthy features include landscapes of the Trans-Ile Alatau and Dzungarian Alatau; lakes Alakol and Balkhash; the Kapshagai Water Reservoir; mountain lakes; the Ile River and other numerous mountain and lowland streams; deposits of mineral water and peloids; natural monuments; unique flora and fauna; historical heritage sites (burial mounds) and petroglyphs; museums and theatres; mausoleums, mazars and modern architecture.

The close proximity of the Almaty Region to China and the Kyrgyz Republic facilitates further development of transit potential and construction of transit corridors (including the Kazakhstani section of the Silk Road) and infrastructure of cross-border trade centres.

## 3.2 TALGARSKY DISTRICT

### 3.2.1 Demography

Talgarsky District, has an area of 3,600 km<sup>2</sup> and is located in the southern part of Almaty Region in the submountainous area of the Trans-Ile Alatau. Talgar, the district's administrative centre, is located 274 km from the regional centre of Taldykorgan and 25 km from the capital city of Almaty.

The population of the Talgarsky District is 192,700 people, with a density of 53.5 people per km<sup>2</sup>. The district is unevenly populated, with the majority of people residing in the suburban area of Almaty.

The district comprises 10 rural okrugs, in addition to the City of Talgar. The BAKAD will cross four okrugs of the Talgarsky District (*Table 3.2-1*).

**Table 3.2-1 Settlements located near proposed BAKAD route in Talgarsky District**

Rural Okrug	Settlements
Guldala Rural Okrug	<ul style="list-style-type: none"> <li>Zhana Kuat</li> </ul>
Panfilovo Rural Okrug	<ul style="list-style-type: none"> <li>Panfilovo,</li> <li>Kyzyl Tu 4 (a settlement uniting Kyzyl Tu 1, Kyzyl Tu 2 and Kyzyl Tu 3)</li> </ul>
Belbulak Rural Okrug	<ul style="list-style-type: none"> <li>Taldybulak</li> </ul>
Alatau Rural Okrug	<ul style="list-style-type: none"> <li>Kyzyl Kairat</li> </ul>

#### *Population and ethnic composition of rural okrugs within the BAKAD Area of Influence*

There are 46 settlements in the Talgarsky District (2018). Within the population, 77% (148,400 people) live in a rural area and 23 % (44,300 people) live in an urban area.

More than 20 nationalities and ethnic groups reside in the district, including Kazakhs (58.2%), Russians (22.5%) and Uyghurs (10.4%)<sup>9</sup>.

<sup>9</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District

**Table 3.2-2 Population and ethnic composition of rural okrugs within the BAKAD Area of Influence as of the early 2018**

Rural Okrug	Settlements	Population	Ethnic composition
Guldala <sup>10</sup>	<ul style="list-style-type: none"> <li>• Guldala</li> <li>• Kolkhozshy</li> <li>• <i>Almerek</i></li> <li>• Kairat</li> <li>• Kishi Baiserke</li> <li>• <i>Zhana Kuat</i></li> </ul>	11,306	<ul style="list-style-type: none"> <li>• Kazakhs (38.5%)</li> <li>• Russians (26.5%)</li> <li>• Uyghurs (23.6%)</li> <li>• Others (11.4%)</li> </ul>
Panfilovo <sup>11</sup>	<ul style="list-style-type: none"> <li>• <i>Panfilovo</i></li> <li>• Arkabai</li> <li>• Kamenskoye Plato</li> <li>• Karabulak</li> <li>• <i>Kyzyl Tu 4</i></li> <li>• Tonkeris</li> <li>• Tuzusai</li> </ul>	24,400	<ul style="list-style-type: none"> <li>• Kazakhs (42.5%)</li> <li>• Russians (32.3%)</li> <li>• Kurds (1.53%)</li> <li>• Greeks (1.9%)</li> <li>• Azerbaijanis (1.94%)</li> <li>• Uyghurs (6.88%)</li> <li>• Turks(2.15%)</li> <li>• Others (10.8%)</li> </ul>
Belbulak <sup>12</sup>	<ul style="list-style-type: none"> <li>• Belbulak</li> <li>• <i>Taldybulak</i></li> <li>• Birlik</li> </ul>	18,500	<ul style="list-style-type: none"> <li>• Kazakhs (73%)</li> <li>• Russians (13.3%)</li> <li>• Others (13.7%)</li> </ul>
Alatau <sup>13</sup>	<ul style="list-style-type: none"> <li>• <i>Kyzyl Kairat</i></li> <li>• Amangeldi</li> <li>• Almalyk</li> <li>• Baibulak</li> <li>• Chimbulak</li> <li>• Altyndan</li> <li>• Ryskulov</li> <li>• Bereke</li> <li>• Orman</li> </ul>	16,210	<ul style="list-style-type: none"> <li>• Kazakhs (38.5%)</li> <li>• Russians (21.5%)</li> <li>• Uyghurs (27.8%)</li> <li>• Others (12.2%)</li> </ul>

\* Settlements located within 1 km of the proposed BAKAD route are highlighted in *italics*

Oralmans are ethnic Kazakhs who immigrated to Kazakhstan from the neighbouring countries (Uzbekistan, China, Turkmenistan, Russia, Kyrgyzstan) and a number of other Asian countries (Mongolia, Iran, Afghanistan, Pakistan, etc.).

According to the Head of the Department of Employment and Social Programmes, Oralmans are numerous in the District, especially in Kainar Rural Okrug and Nura. They immigrated from Mongolia, Iran and China. Oralmans are regarded as adventurous and hard-working people with high standard of living. They often have own business, engage in trade, farming or furniture production.

<sup>10</sup> 2017 Socioeconomic Passport (Datasheet) of Guldala Rural Okrug of Talgarsky District

<sup>11</sup> 2017 Socioeconomic Passport (Datasheet) of Panfilovo Rural Okrug of Talgarsky District

<sup>12</sup> 2017 Socioeconomic Passport (Datasheet) of Belbulak Rural Okrug of Talgarsky District

<sup>13</sup> 2017 Socioeconomic Passport (Datasheet) of Alatau Rural Okrug of Talgarsky District

### Population trends

The population of Talgarsky District has increased from 186,500 to 192,700 between 2015 and 2018<sup>14</sup> largely due to internal migration. The figures are indicative of a reducing rate of natural increase with slightly falling birth rates. Declining birth rates is a general trend in the Republic of Kazakhstan. It followed a lengthy upward trend, which continued within 10 years.

**Table 3.2-3** *Natural and migration changes in the population in 2015 - 2017<sup>15</sup>*

Indices	2015	2016	2017
Birth rate	4,759	5,143	5,070
Mortality	1,268	1,380	1,384
<b>Rate of natural increase</b>	<b>3,491</b>	<b>3,763</b>	<b>3,686</b>
Arrived	5,260	No data <sup>16</sup>	11,701
Left	6,121	No data	11,132
<b>Migratory increase</b>	<b>-861</b>	<b>No data</b>	<b>569</b>

In 2015 – 2016, the boundaries of the Almaty city were revised and several settlements of Talgarsky District were annexed to the City of Almaty (for instance, Almerrek). At the same time, in 2017 several settlements with no legal status were annexed to Talgar (in particular, Zhana Kuat).

### Vulnerable groups of population

According to the Department of Employment and Social Programmes of Talgarsky District, as of 1 January 2018, 101 persons are registered as children with disabilities and 93 persons as single elderly people and invalids requiring home care<sup>17</sup>.

According to specialists of the above Department, there were about 400 families with low income in the District at the time of the survey, which are rendered various social services. According to the Head of the Department, these families are financially deprived but *'the head of the family also has a job, they get jobs in private businesses, they are sometimes retrained or members of the family undergo youth practical training'*<sup>18</sup>.

<sup>14</sup> Information of the Department of Statistics of the Akimat of Talgarsky District

<sup>15</sup> Information of the Department of Statistics of the Akimat of Talgarsky District

<sup>16</sup> Information of the Department of Statistics of the Akimat of Talgarsky District (2016 data is not made available)

<sup>17</sup> Official website of the Akimat of Talgarsky District of Almaty Region at <https://www.akimat-talgar.gov.kz/news/show/id/713>

<sup>18</sup> From the in-depth interview with the Head of the Department of Employment and Social Programmes of Talgarsky District

### 3.2.2

#### *Local economy*

The economy of Talgarsky District is agro-industrial.

The industrial output of Talgarsky District has grown during the past ten years. In 2017, it amounted to KZT 30.5 billion (against KZT 14 billion in 2008). The output of the manufacturing sector amounted to KZT 25.1 billion (against KZT 12.3 billion in 2008). The gross output of the agricultural sector reached KZT 46.8 billion (against 16 billion in 2008)<sup>19</sup>.

#### *Agriculture*

The District accounts for 7.2% of the gross output of the agricultural sector of Almaty Region. The District's agriculture comprises animal husbandry (40.5%), crop production (59.4%) and agricultural services (0.1%). In 2017, the gross output amounted to KZT 46.8 billion, the index of physical volume of production being 103.1% (see *Figure 3.2-1*)<sup>20</sup>.

**Figure 3.2-1** *Agricultural output in 2015 - 2017*



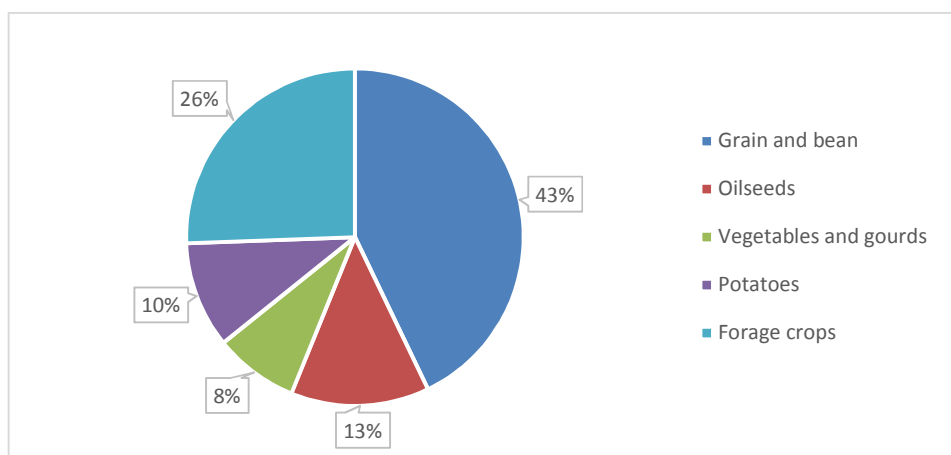
Crop production. Crop production accounts for the largest share of the total agricultural output. *Figure 3.2-2* below shows the cropping structure.

<sup>19</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District of Almaty Region

<sup>20</sup> According to the Department of Agriculture of the Akimat of Talgarsky District



**Figure 3.2-2 Cropping structure in 2017**



Fruit farming and greenhouse business are well-established in the District.

Animal husbandry. In 2017, the production of animal husbandry products increased as compared to 2016: meat by 4.2% (total output 16,500 tonnes), milk by 0.2% (total output 73,100 tonnes), eggs - by 4.7% (total output 21,600 pcs) and wool by 0.1% (total output 335.1 tonnes)<sup>21</sup>.

The population of livestock and poultry have been sustainably growing during the past three years except for the pig stock which population has dropped by more than one half in 2017 compared to 2016.

**Table 3.2-4 Livestock and poultry populations in 2015 - 2017.**

Indices	2017	2016	2015
Cattle	36,252	36,000	35,499
including cows	17,968	17,079	16,179
Sheep and goats	107,501	107,246	107,122
Pigs	18,162	45,100	45,088
Horses	7,025	6,993	6,438
Camels	316	316	272
Poultry	171,509	126,917	105,500

Large agricultural producers. The District’s largest agricultural producers are TOO Baiserke Agro, TOO Green Eco, TOO AsylKus Agro, Arman family farm, TOO Baimene, Too Fresh Fruit Kazakhstan, Isayev family farm and TOO Massari.

TOO Baiserke Agro is one of the first robotic dairy farms with 360 heads of cattle. The core of the stock are Holstein milking cows. Heifers are bred

<sup>21</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District of Almaty Region

separately. The average daily milk yield is 30 litres per head. The annual production output of TOO Baiserke Agro is over 1,800 tonnes of milk and 1,250 tonnes of meat. The company has 3,600 ha of croplands with 500 ha of the acreage already equipped with subsurface drip irrigation system<sup>22</sup>.

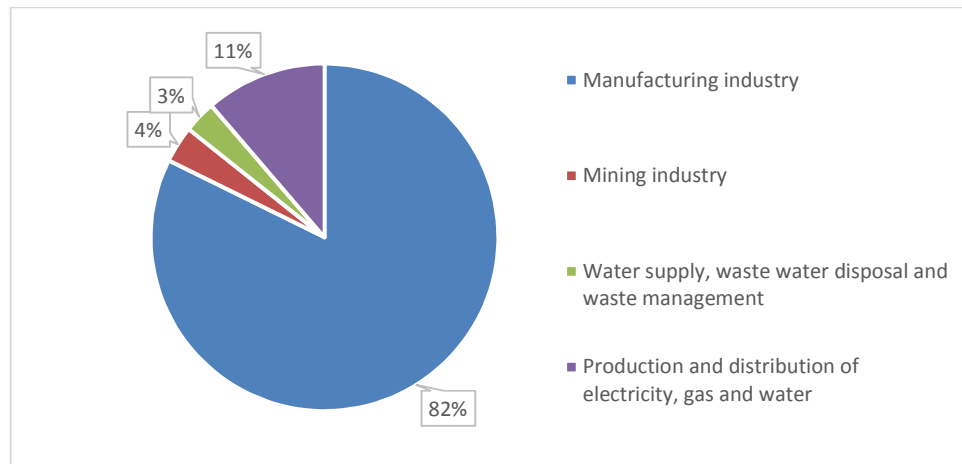
*TOO Green Eco.* A large greenhouse complex for pot plant growing, the only such facility in Kazakhstan. The complex has an area of 1.3 ha which allows producing 61 tonnes of vegetable greens every month.

*TOO Amiran.* A large dairy plant supplied with milk by own milk farm with 750 heads of cattle and the annual milk production of 6,937.5 tonnes.

### Industry

In 2017, the industrial output was KZT 30.5 billion (index of physical volume of production 109.3%) including the output of the manufacturing sector of KZT 25.1 billion (82.3%). The core of the District's industrial sector is formed by enterprises extracting sand and gravel, producing concrete, alcohol, ready-made fodder, outer clothing, paper products as well as companies generating electric power.

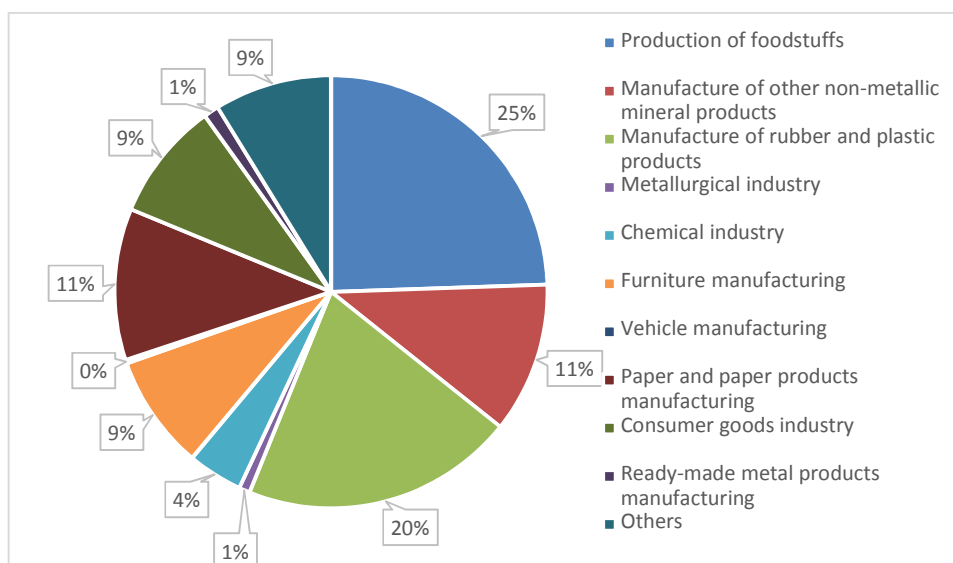
**Figure 3.2-3 Structure of the industrial sector in 2017.**



In 2017, the largest output in the manufacturing sector was provided by the production of foodstuff (24.5%), rubber and plastic products (20.4%), paper and paper products (11.3%) and mineral products (11.2%).

<sup>22</sup> <http://www.dairynews.ru/company/bayerke-agro-too/>

**Figure 3.2-4 Structure of the manufacturing sector in 2017**



Practically most of the District's industrial enterprises are concentrated in Talgar as well as industrial businesses in Panfilovo and Besagash rural okrugs (primarily due to their vicinity to Almaty).

**Table 3.2-5 Industrial output in municipalities of Talgarsky District in 2015 - 2017.**

Municipalities of Talgarsky District	Output at current prices, million KZT			Ratio to the total output, %		
	2015	2016	2017	2015	2016	2017
Alatau	439.8	931.2	1039	1.8	2	3.4
Belbulak	600	851	985	2.5	2.5	3.2
Beskainar	256.5	336.2	450	1	1.1	1.5
Besagash	3,367.6	2,550	2,598	13.7	11.5	8.5
Guldala	3,400	1,890	1,940	13.8	8.5	6.4
Kainar	512.7	1,650	1,850	2.1	2.5	6.1
Kendala	1,825	1,997	2,100	7.4	9.1	6.9
Nura	754.3	795	855	3.1	3.5	2.8
Panfilovo	689.5	1,970	2,130	2.8	7.7	7
Tuzdybastau	810	1,106	1,451	3.3	4	4.7
City of Talgar	11,912.7	13,387.7	15,087	48.5	47.6	49.5
<b>Total</b>	<b>24,568.1</b>	<b>27,464.1</b>	<b>30,485</b>	<b>100</b>	<b>100</b>	<b>100</b>

#### *Small and medium-size businesses*

As of early 2018, the number of operational small and medium-sized businesses was 9,580. In 2017, they provided 15.1 billion KZT worth of

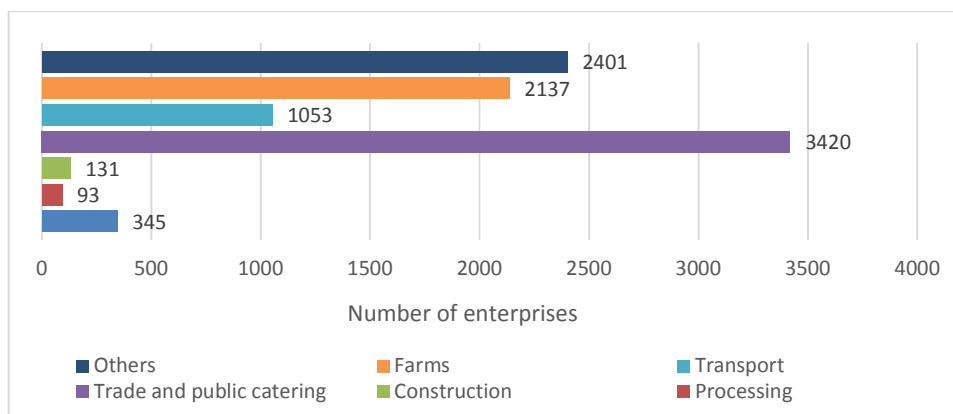
manufactured products and rendered services. Small business sector employs 26.4 thousand people, 27% of the economically active population<sup>23</sup>.

**Table 3.2-6 Characteristics of small and medium-size businesses of Talgarsky District<sup>24</sup>**

Indices	Unit	2016	2017
Number of registered small and medium-size businesses		13,628	13,359
Including operational businesses		8,747	9,580
Number of employees	people	26,220	26,370
Sales revenue	million KZT	14,411.8	15,132.4
Budget receipts	million KZT	7,294.0	10,913.7

Small and medium-sized businesses are mainly trade and public catering businesses (35.7%), family farms (22.3%) and businesses rendering transport services (13.1%). Family farms provide most of the jobs in the small business sector (43.8%), the share of small trade and public catering businesses being 23.3% (see Figure 3.2-5 below).

**Figure 3.2-5 Number of small and medium-size businesses in Talgarsky District by category in 2017**



Small business sector is most rapidly growing in Talgar as well as in Panfilovo and Tuzdybastau rural okrugs. These account for 56.4%, 10.8% and 7.8% of the total number of operational businesses respectively. The biggest budget receipts are provided by small and medium-sized businesses of Talgar (37.5% of the total revenue from the small business sector) as well as Panfilovo (14.2%), Besagash (10.2%) and Guldala (8.4%) rural okrugs.

<sup>23</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District of Almaty Region

<sup>24</sup> According to the Department of Entrepreneurship of the Akimat of Talgarsky District

### *Service sector*

As a rule, service sector is comprised by small and medium-size businesses. 80.5% of the District's operational businesses are in the service sector, of them 13.3% are in construction, 24.2% in trade, 2.5% in public catering, 15.0% are transport companies and telecommunication agencies and 3.1% are hotels and restaurants. Service sector employs 77.1% of all people working in small businesses. According to official statistics, service sector accounts for 40.5% of the total output of small businesses.

There are 6,238 individual entrepreneurs (73.0%), of them 96.8% are in the service sector, including 49.2% in trade, 3.1% in public catering, 15.1% in transport and telecommunications and 32.5% in other businesses.

There are 739 trade facilities, 9 large marketplaces and 12 trading houses in the District. In 2017, the retail trade turnover amounted to KZT 49.4 billion (compared to the total industrial output of KZT 46 billion).

### **3.2.3**      *Ecosystem services*

The socio-economic survey conducted in 2018 has not identified any individuals engaged in hunting, fishing or gathering of herbs and mushrooms or other ecosystem services within the BAKAD Area of Influence.

### **3.2.4**      *Labour market and household incomes*

In 2017, the number of employed population was 93,600 with 1,582 new jobs created in all sectors of economy and 3,072 people getting full-time jobs. The jobless rate dropped to 4.3%.

Various social services were rendered to 144,500 low-income citizens. 44,700 of them received targeted social support and benefits for children under 18 in the amount of KZT 864.3 million. The number of able-bodied persons among the recipients of such support and benefits dropped from 29.8% to 29.0%.

According to the Head of the Department of Employment and Social Programmes of Talgarsky District no less than 10 to 15% of the District's population work in Almaty: *'they go to the flea market, work in regional hospitals, large shopping centres, recreation facilities, a lot of them are in the service sector, education, many of them are teaching, many work in health care (outpatient clinics, hospitals, private healthcare facilities.... even in transport services, they work in a taxi depot or as private cabmen'*<sup>25</sup>.

About one third of the people placed in a job by the Job Centre are young people under 29. They are either re-trained or undergo youth practical

<sup>25</sup> From the in-depth interview with the Head of the Department of Employment and Social Programmes of Talgarsky District



training, which gives them 6 months work experience and makes it easier for them to find a job without assistance<sup>26</sup>.

### 3.2.5 *Public health and healthcare infrastructure*

#### *Public health*

In 2017, the birth rate was 21.9. It has dropped by 10.1% within a year, which reflects the general trend in the country. In 2017, the birth rate in the Republic of Kazakhstan was 21.65 due to demographic recession of the nineties. The natural population increase has also fallen due to dropping birth rate at unchanging mortality.

According to information provided by Talgar Central District Hospital, 2017 witnessed falling incidence of cancer and infectious diseases, circulatory diseases and syphilis as compared to 2016<sup>27</sup>. However, the incidence of tuberculosis and brucellosis has risen.

**Table 3.2-7 *Demography, incidence rates and mortality in 2016-2017***<sup>28</sup>

Rates per 100,000 people	2017	2016
Birth rate	21.9	24.6
Mortality	7.3	7.3
Natural population increase	14.7	17.3
Infant mortality	7.0	6.4
Maternal mortality		--
Cancer morbidity	130.2	140.5
Tuberculosis morbidity	73.5	70.7
Infectious morbidity (viral hepatitis)	28.0	39.3
Incidence of circulatory diseases	170.3	288.3
Brucellosis	2.5	2.0
Syphilis morbidity	30.5	41.4
Cancer mortality	0.5	0.4
Tuberculosis mortality	0.4	0.11
Mortality due to circulatory diseases	1.6	1.2

<sup>26</sup> From the in-depth interview with the Head of the Department of Employment and Social Programmes of Talgarsky District

<sup>27</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District

<sup>28</sup> <http://talgar-aoa.kz/index.php/ru/%D0%B3%D0%BE%D0%B4%D0%BE%D0%B2%D0%BE%D0%B9-%D0%BE%D1%82%D1%87%D0%B5%D1%82>

*'Circulatory diseases, infarctions, strokes are number one here as everywhere. In recent years, these diseases more often involve able-bodied people, primarily men: they are more often exposed to injuries and have a more light-minded attitude to their health. We don't have some special diseases. All is as everywhere: look at statistics, we have the same. At the moment, cancer morbidity, tuberculosis morbidity, primary disablement are growing, young people become invalids more often'.*

(From the interview with Deputy Director of the central district hospital).

In 2017, 12,300 children out of the total number of 46,500 underwent preventive medical examination. The number of children with disabilities in the same year amounted to 825.

#### *Healthcare infrastructure*

The public healthcare in Talgarsky District is provided by the central district hospital (210 beds), an outpatient polyclinic (350 visits per shift), two rural hospitals (35 beds each), twelve rural ambulatory care clinics, eleven rural health posts (referred to as 'medical and obstetrical stations') and nine health care access points. The District's medical staff is comprised by 289 doctors and 961 nurses (see *Table 3.2-8*).

**Table 3.2-8 Public healthcare infrastructure**

Indices		2017	2018 (January to May)
Number of hospital beds	Total	245	245
	Per 10,000 people	12.3	12,3
Number of outpatient polyclinics		1	1
Capacity of outpatient polyclinics, thousand visits per shift		1,590	795
Visits per shift per 10,000 people		81	39
Number of rural health posts and rural ambulatory care clinics		23	23
Number of doctors per 10,000 inhabitants		28.9	29.0
Number of nurses per 10,000 inhabitants		96.1	96.5
Staffing level (doctors), %		14.4	14.7
Staffing level (nurses), %		48.1	48.1

Emergency aid in Talgarsky District is provided by 16 ambulance crews. Each of them has an ambulance car. The number of ambulance trips within 5 months of 2018 was 42,100 with an average attendance time of 15 minutes.

*'There is a health facility in each settlement, but these facilities are different depending on the population size: sometimes it is a health care access point,*

*sometimes a rural health post, sometimes a rural ambulatory care clinic and sometimes a rural hospital. People have a facility to resort to on the spot, but in case of emergency aid, if there is some injury or a specialized treatment is required, they have to come to us'.*

(From the interview with Deputy Director of the central district hospital).

The nearest health facilities located close to the proposed BAKAD route are rural ambulatory care clinics in Kyzyl Kairat, Belbulak, Taldybulak, Guldala, Kyzyl Tu, the rural hospital in Panfilovo (20 beds) and the central district hospital in Talgar (210 beds). The number of doctors and nurses in the above settlements is 290 and 965 respectively.

There is only one hospital with a trauma centre in the District. According to Deputy Director of Talgar Central District Hospital, the presence of a large highway will require the establishment of a traumatology department:

*'When large highways are nearby, health facilities must always have larger traumatology departments. We don't have this. We have just several beds for trauma patients in our Surgery Department'.*

(From the interview with Deputy Director of the central district hospital).

### 3.2.6 *Social infrastructure*

#### *Education*

According to the Talgarsky District Akimat, there are 43 operational comprehensive secondary schools in Talgarsky District attended by 38,200 schoolchildren. Three new schools were open in recent years (in Yenbekshi, Yelaman and Kishi Baiserke) and capacities of two existing schools were enlarged (in Belbulak and Aktas).

There are 107 operational preschool educational institutions (including 6 publicly funded), 34 small day-care centres and 67 private kindergartens. Preschool institutions are available for 96.6% of children in the age of 3 to 6<sup>29</sup>.

There are 14 schools (including a private one) in rural okrugs located near the proposed BAKAD route. These schools are attended by 12,800 schoolchildren<sup>30</sup>. Twenty-four publicly funded kindergartens and thirteen private small day-care centres are attended by 2,126 children.

Three schools of Panfilovo Rural Okrug are in settlements located close to the proposed BAKAD route: two schools in Panfilovo (located in the inner part of the village and are not affected by the Project implementation activities) and

<sup>29</sup> Official website of the Akimat of Almaty Region at <http://www.zhetysu.gov.kz>

<sup>30</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District

one school in Kyzyl Tu. The Project provides for construction of a viaduct to preserve the existing transport links. According to the Akim (Head) of Panfilovo Rural Okrug, at the time of preparation of the Report the local community arranged transportation of children to school from different parts of Kyzyl Tu by private vehicles<sup>31</sup>.

The school of Taldybulak is located in the inner part of the settlement and children can walk to school. Sometimes parents bring their children to school by car as it takes about 40 minutes to reach school from the outskirts of the settlement on foot. There is no lighting<sup>32</sup>.

The school of Kyzyl Kairat is also located in the inner part of the settlement. Children walk to school. Some of them have to cross the road. The Project-related public concerns are associated with safety of children as they will have to cross the proposed interchange during construction and after commissioning<sup>33</sup>.

### *Sports*

As of July 2018, there were 228 operational sports and fitness facilities in the District, including 3 stadiums, 9 swimming pools, 61 gymnasiums, 546 sports grounds, 49 football pitches, 5 tennis courts, 1 roofed ice palace and 4 pistes. At the moment, the District's operational sports facilities are the Ak Bulak sports and fitness centre, the district youth sports school, the Kivilyov special cycle racing school for young Olympic reserve, the training centre of the central army sports club, the Tabagan sports and fitness centre and the Alatau biathlon stadium.

The district youth sports school is attended by 1,356 children engaged in 15 sports. The Kivilyov special cycle racing school for young Olympic reserve numbers 573 sportsmen. The training centre of the central army sports club has 393 sportsmen engaged in football and athletics. At the time of preparation of the Report, 28% of the District's population were engaged in sports and fitness activities<sup>34</sup>.

There are 88 sports and fitness facilities in settlements adjacent to BAKAD (see *Figure 3.2-6*).

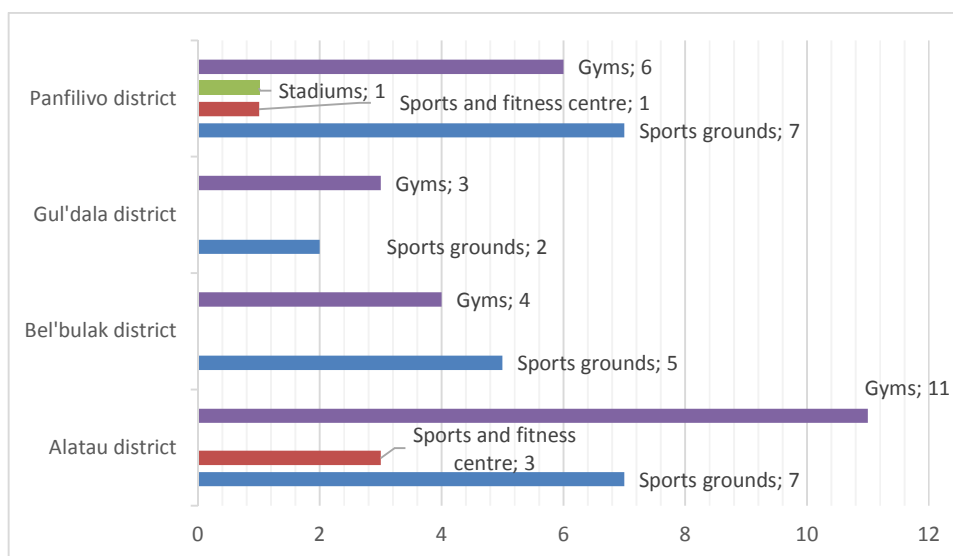
<sup>31</sup> Transcript of the interview with the Akim (Head) of Panfilovo Rural Okrug of Talgarsky District.

<sup>32</sup> From interviews with households in Taldybulak

<sup>33</sup> From interviews with households in Taldybulak.

<sup>34</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District

Figure 3.2-6 Sports and fitness facilities within the SAoI



The largest operational sports facility within the BAKAD Area of Influence is the training centre of the central army sports club of the RoK Ministry of Defence located at 32, Timiryazeva St., Panfilovo, Panfilovo Rural Okrug. According to the Department of Sports of Talgarsky District, the training centre is in good condition.

### Culture

There is an operational district community centre with affiliates in Tuzdybastau, Nura and Kyzyl Kairat and one amusement park in Talgar.

There are five cultural facilities in settlements located within the BAKAD Area of Influence: the community centre in Alatau Rural Okrug (in Kyzyl Kairat), which is in good condition according to the Akimat of Talgarsky District), and five libraries (in Kyzyl Kairat, Gul'dala, Belbulak and two in Panfilovo)<sup>35</sup>. The community centre in Kyzyl Kairat was built in 2013. It has six employees and is located at 37b Malkeyeva St., Kyzyl Kairat, Talgarsky District.

### Trade infrastructure

Four settlements of Talgarsky District are located within the BAKAD Area of Influence. All large villages have small convenience shops (shopping floor space up to 100-150 m<sup>2</sup>) with traditional over-the-counter trade selling a limited assortment of foodstuffs and household goods. Convenience shops stock a range of everyday items consisting of daily necessities, such as bread

<sup>35</sup> 2017 Socioeconomic Passport (Datasheet) of Talgarsky District



and pastries, groats, dairy products, vegetables, oil and butter, confectionery, beverages, etc.

There are larger shops with broader selection of items and specialty stores (e.g. selling construction materials) in Kyzyl Kairat and Panfilovo. A filling station in Kyzyl Kairat located at the Almaty-Talgar road is an important retail facility for the local community. No shops are located in gardening partnerships or they are at a distance therefrom.

### 3.2.7 *Housing stock and public utilities*

The entire housing stock of Talgarsky District is 3,870 m<sup>2</sup> with 73.2% thereof in rural areas. The total number of houses is 31,011. Only 10.9% of them are blocks of flats. In 2016, fifteen houses with 69 residents and a total area of 900 m<sup>2</sup> were in disrepair. Water is supplied practically to the entire population of the District. However, hot water supply is available only to 10% of the Region's housing stock<sup>36</sup>. Electricity is delivered to 43 settlements of the District and gas is supplied to 48.7% of the households<sup>37</sup>.

Kyzyl Kairat, Taldybulak, Panfilovo, Kyzyl Tu, Zhana Kuat and two gardening partnerships are located along the proposed BAKAD route.

*Panfilovo and Kyzyl Tu.* There are 3,018 houses in Panfilovo with 10,843 residents. The majority of them are small private houses and only 81 are blocks of flats. Their condition varies: there are new and old buildings. Ramshackle buildings are only a few. There are 1,217 houses in Kyzyl Tu. All of them are private with water supply from two wells. The community is serviced by two public utility companies: Talgar Sukory and TOO Moldir<sup>38</sup>. Garbage is collected and brought to a landfill in Yenbekshikazak District by private companies once a week.

*Zhana Kuat* is a growing rural community. Houses are relatively new (built not earlier than 10 years ago). Public utilities are managed by the developer, which used to build the settlement. Households have gas, power and water supply. According to the locals, sometimes they experience interruption of water supply.

<sup>36</sup> Socioeconomic Development of Almaty Region in 2016

<sup>37</sup> 2017 Socioeconomic Passport (Datashet) of Talgarsky District

<sup>38</sup> Source: Interview with the Akim of Panfilovo Rural Okrug

### 3.2.8 *Transport and communications*

The length of motorways in Talgarsky District is 1,921.55 km. The roads of national, regional and district significance are 71 km, 402 km and 1,448.55 km long respectively.

The length of motorways in rural okrugs crossed by the proposed BAKAD route is 309.69 km. All of them are Category IV roads. According to the Akimat of Talgarsky District, their condition is satisfactory.

**Table 3.2-9** *List of motorways in Talgarsky District within the SAoI*

Motorway	Length, km	Category	Condition
<b>Alatau Rural Okrug</b>	<b>69.31</b>		
Almalyk	6.81	IV	Satisfactory
Altyn Dan	0.60	IV	Satisfactory
Amangeldy	5.26	IV	Satisfactory
Baibulak	3.97	IV	Satisfactory
Bereke	2.68	IV	Satisfactory
Kyzyl Kairat	30.33	IV	Satisfactory
Orman	0.73	IV	Satisfactory
Ryskulova	15.81	IV	Satisfactory
Chimbulak	3.12	IV	Satisfactory
<b>Belbulak Rural Okrug</b>	<b>85.78</b>		
Belbulak	48.02	IV	Satisfactory
Birlik	16.16	IV	Satisfactory
Taldybulak	21.60	IV	Satisfactory
<b>Guldala Rural Okrug</b>	<b>43.62</b>		
Guldala	33.89	IV	Satisfactory
Kishi Baiserke	9.74	IV	Satisfactory
<b>Panfilovo Rural Okrug</b>	<b>110.98</b>		
Arekabai	4.03	IV	Satisfactory
Karabulak	17.41	IV	Satisfactory
Kyzyl Tu	26.12	IV	Satisfactory
Tonkeris	8.95	IV	Satisfactory
Tuzusai	0.93	IV	Satisfactory
Panfilovo	53.82	IV	Satisfactory

Socioeconomic surveys conducted in 2018 indicate that the BAKAD Area of Influence encompasses a large number of dirt roads used by local communities.

There is no bus service inside settlements adjacent to BAKAD. Bus service is available only between settlements. However, the locals prefer hitchhiking or a taxi. There are busy motorways of national significance passing near the settlements: the Almaty-Talgar and the Almaty-Khorgos roads.

**Table 3.2-10** *Bus routes within the SAoI*

Bus route	Interval	Charge
Route No. 2, Avtobaza microdistrict - Baibulak	35 minutes	KZT 50
Route No. 215, Talgar – Bereke - Orman	1 hour 30 minutes	KZT 50 - 100

### 3.2.9 *Cultural heritage*

There are 24 sites of historical and cultural heritage in Talgarsky District<sup>39</sup>. The most important site of national significance is Talgar, site of a medieval town located in the southern part of the present-day Talgar (outside the BAKAD Area of Influence).

### 3.2.10 *Public organisations*

According to the Akimat of Talgarsky District, there are seven active public organisations in settlements located near the proposed BAKAD route. The majority of them promote sport, physical activity and healthy lifestyle.

**Table 3.2-11** *Public organisations in settlements located within the Project Area of Influence*

Organisation	Settlement	Kind of activity
Zhynmin Schin Civic Association	Kyzyl Kairat	Activities of other public organisations not included in other groups
Ak Zhol-M Public Foundation	Kyzyl Kairat	Physical rehabilitation
Angel Obereg Public Foundation	Panfilovo	Other health protection activities
Public foundation for construction of a mosque in Panfilovo	Panfilovo	Construction of a mosque in Panfilovo

<sup>39</sup> <http://www.akimat-talgar.gov.kz/p/cultureinfo>

Organisation	Settlement	Kind of activity
Biathlon Federation of Almaty Region, civic association	Panfilovo	Promotion of biathlon in Kazakhstan
Kazakhstani Association of Preschool Educational Institutions, a branch of the Association of Entrepreneurs and Legal Persons in the City of Almaty and Almaty Region	Guldala	Kazakhstani Association of Preschool Educational Institutions, the Association of Entrepreneurs and Legal Persons
Eleftheria, Society of the Greeks of Almaty Region, civic association	Panfilovo	Activities of other public organisations not included in other groups
Almaty Regional Lugging Federation, civic association	Panfilovo	Promotion of lugging

### 3.3 ILYISKY DISTRICT

#### 3.3.1 Demography

The Iliysky District is located in the south-western part of Almaty Region and borders on Balkhash District in the north-east, Karasai and Jambyl districts in the west, the City of Almaty in the south-east and Talgarsky District in the east. It occupies an area of 7,800 km<sup>2</sup>.

Otegen Batyr, the District's administrative centre, is located 3 km away from Almaty. Connection with the District's administrative centre and the City of Almaty is secured by highways of republican and regional significance.

The District comprises 10 rural okrugs and 31 settlements. Four settlements will be within the BAKAD construction area (Table 3.2-1).

**Table 3.3-1 Settlements located near proposed BAKAD route in Iliysky District**

Rural Okrug	Settlements
Energetichesky Rural Okrug	Otegen Batyr, Pokrovka
Baiserke Rural Okrug	Yntymak, Zhanadaur, Koyankus
Kaztsik Rural Okrug	Kaztsik and Komsomol
Aschibulak Rural Okrug	Zhapek Batyr, Tole Bi, Kokkainar and Mukhametzhana Tuimebayeva

#### *Population and ethnic composition of rural okrugs within the BAKAD Area of Influence*

The population of Iliysky District has grown considerably within 2017 and reached 203,200 compared to 190,600 in 2015 (Table 3.3-2).

**Table 3.3-2 Number of population in settlements**

Rural Okrugs	Settlement	Population			Number of households
		2015	2016	2017	2017
<i>Iliysky District</i>	<i>Total in district</i>	<i>18,9900</i>	<i>190,429</i>	<i>192,710</i>	<i>-</i>
Energetichesky	<b>Total in RO</b>	<b>31,100</b>	<b>31,080</b>	<b>28,925</b>	<b>2,657</b>
	Otegen Batyr	23,560	23,497	21,380	1,300
	Pokrovka	7,060	7,045	7,004	1,151
Baiserke	<b>Total in RO</b>	<b>29,900</b>	<b>30,017</b>	<b>32,586</b>	<b>5,386</b>
	Yntymak	4,198	4,230	4,650	834
	Kokozek	592	601	710	208
	Zhanadaur	2,604	2,630	3,030	786
	<b>Total in RO</b>	<b>14,900</b>	<b>14,926</b>	<b>16,305</b>	<b>1,830</b>



Kaztsik	Kaztsik	12,235	12,225	13,225	1,324
	Komsomol	2,665	2701	3,080	506
Aschibulak	<b>Total in RO</b>	<b>24,800</b>	<b>24,998</b>	<b>29,199</b>	<b>5,056</b>
	M.Tuymebaev	12,385	12,259	15,207	2,307
	Tole Bi	893	997	1147	280
	Zhapek Batyr	8,204	8,316	8,916	1,259
	Kokaynar	3,320	3,426	2,929	1,210

More than 49 nationalities and ethnic groups live in the District, including the Kazakhs (70.2%), Russians (19.6%) and others (10.2%) (Azerbaijanis 1.4%, Kurds 1.9%, Uyghurs 1.4%, Turks 1.3%, Germans 0.7%, Koreans 0.7%, Ukrainians 0.5%, Tatars 0.6%).

#### *Natural and migration changes in the population*

2017 witnessed a growing rate of natural increase in Iliysky District population (4,884 against 3,880 in 2016). However, the population growth of 25.5 per 1,000 people is lower than in the previous year (20.7). In 2017, the District had a positive net migration of 6,486 people.

**Table 3.34** *Natural and migration changes in the population in 2015 - 2017<sup>40</sup>*

Indices	2015	2016	2017
Birth rate	5,577	5,559	6,127
Mortality	1,335	1,679	1,243
<b>Rate of natural increase</b>	4,242	3,880	4,884
Arrived	4,044	4,506	19,574
Left	5,306	7,156	13,088
<b>Migratory increase</b>	-1,262	-2,650	6,486

Thus, the District's population has grown due to the natural population increase of 4,900 and positive net migration of 6,400 (see also *Table 3.2-6*).

**Table 3.3-6** *Migration characteristics of Iliysky settlements in 2015-2017*

Rural Okrugs	Settlement	Arrived in total			Left in total		
		2015	2015	2016	2015	2015	2016
Iliysky District	<b>Total in district</b>	<b>21,200</b>	<b>23,500</b>	<b>96,300</b>	<b>27,800</b>	<b>37,300</b>	<b>64,400</b>
Energetichesky	<b>Total in RO</b>	<b>866</b>	<b>575</b>	<b>2,459</b>	<b>318</b>	<b>1,253</b>	<b>5,509</b>
	Otegen Batyr	678	704	2,175	133	312	4,986
	Pokrovka	87	35	210	145	8	301

<sup>40</sup> Information of the Department of Statistics of the Akimat of Iliysky District

Rural Okrug	Settlement	Arrived in total			Left in total		
		2015	2015	2016	2015	2015	2016
Baiserke	<b>Total in RO</b>	<b>493</b>	<b>571</b>	<b>3,288</b>	<b>1,802</b>	<b>1,120</b>	<b>1,357</b>
	Yntymak	136	108	425	39	27	158
	Kokozek	12	23	113	43	10	35
	Zhanadaur	210	76	392	30	16	118
Kaztsik	<b>Total in RO</b>	<b>331</b>	<b>370</b>	<b>1,418</b>	<b>312</b>	<b>564</b>	<b>486</b>
	Kaztsyk	205	201	1,275	247	61	506
	Komsomol	126	92	364	65	12	75
Aschibulak	<b>Total in RO</b>	<b>701</b>	<b>211</b>	<b>3,554</b>	<b>866</b>	<b>1,379</b>	<b>880</b>
	M.Tuymebaev	437	320	3,272	415	69	827
	Tole Bi	16	38	140	14	12	18
	Zhapek BAtyr	105	332	737	257	62	827
	Kokkaynar	143	119	533	180	38	374

*Age and sex structure of the population*

Men account for 48.9% of the entire District's population and women for 51.1% (Figure 3.3-1).

**Figure 3.3-1** *Age and sex structure of the population in 2015 - 2017*



### Vulnerable populations

Vulnerable populations are 30,924 people out of the District's population of 203,200. The number of such people increased compared to 2015 due to the population growth (Table 3.3-3).

**Table 3.3-3 Vulnerable populations in 2015 - 2017**

Vulnerable populations by category	2015	2016	2017
II World War veterans and participants	35	29	26
Group 1 and 2 invalids	3,020	3,093	3,056
Pensioners	17,273	18,230	19,335
Members of multi-child families	3,768	4,112	4,583
Members of low income families	3,518	3,479	3,924
Total	24,896	12,536	30,924

### 3.3.2 Local economy

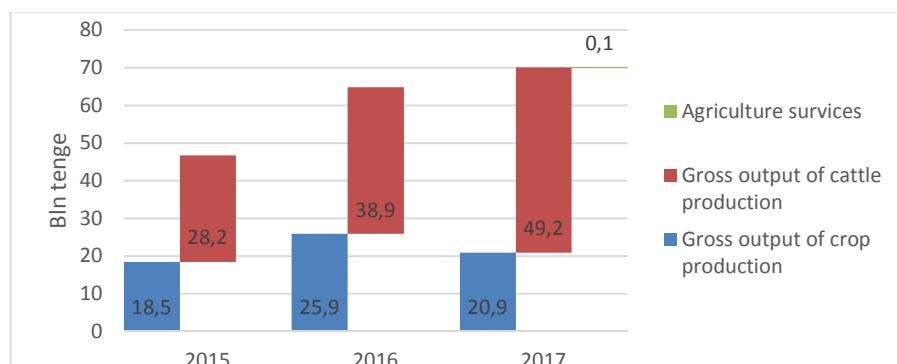
Industrial sector in the Iliysky District prevails over agricultural sector. One of the major drivers of economy is the District's vicinity to Almaty.

In 2017, the industrial and agricultural output amounted to KZT 250.6 billion and KZT 70.3 billion respectively. The District accounts for 33.4% of the Region's production of commodities.

#### Agriculture

About 30 types of crops are produced in the District. The subject area is the Region's leader in the production of meat, milk, eggs, grain maize, safflower, soybeans, potatoes, vegetables, melons and water melons (see Figure 3.3-2)<sup>41</sup>.

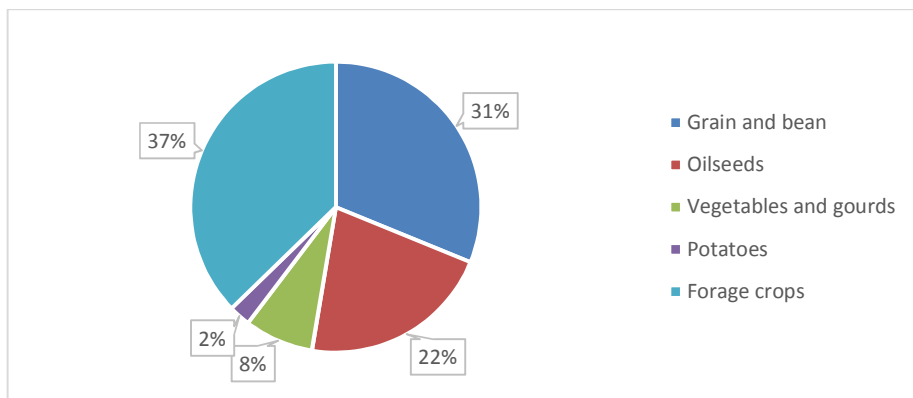
**Figure 3.3-2 Agricultural output in 2015 - 2017**



<sup>41</sup> According to the Department of Agriculture of the Akimat of Iliysky District

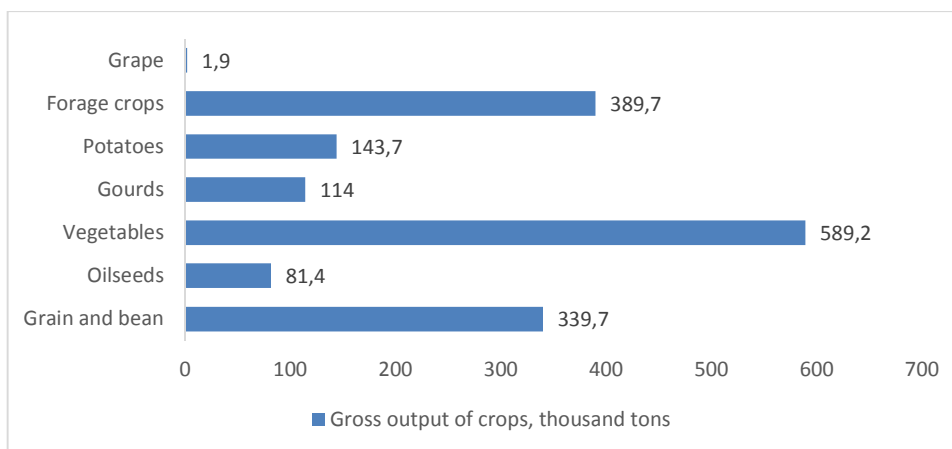
Crop production. In 2017, the area of croplands has increased by 588 ha and reached 68,825 ha. *Figure 3.3-3* below shows the cropping structure.

**Figure 3.3-3 Cropping structure in 2017**



Production of vegetables, fodder, grain and leguminous crops is the District's specialty (see *Figure 3.3-4*).

**Figure 3.3-4 Gross output of crops in 2017**



Animal husbandry. In 2017, the production of animal husbandry products increased as compared to 2016: meat by 111.9% (gross output 95,500 tonnes), milk by 100% (gross output 54,600 tonnes), eggs by 87.4% (gross output 238,200 pcs) and wool by 100.6% (gross output 401 tonnes).

Pedigree stock accounts for 30 to 40% of the total livestock population.

**Table 3.3-4 Livestock and poultry populations in 2015 - 2017**

Indices		2015	2016	2017
Cattle	Total	41,125	41,150	37,627
	<i>including pedigree stock</i>	9,936	9,936	16,250
	Including cows	Total	19,866	18,678
	<i>including pedigree stock</i>	6,199	6,088	6,088
Horses	Total	5,080	5,117	5,200
	<i>including pedigree stock</i>	1,408	1,421	1,630
Sheep and goats	Total	118,230	115,784	111,773
	<i>including pedigree stock</i>	51,880	51,880	54,450
Pigs	Total	39,049	34,871	34,340

### *Industry*

The District's industrial sector accounts for 34% of the Region's production of commodities.

In 2017, the total volume of sales in industrial sector amounted to KZT 250.6 billion, the index of physical volume of production being 98.8%.

Manufacturing accounted for 92% of the total volume of sales. Mining and quarrying, power, gas and water supply, effluents disposal account for the rest of 8%.

**Table 3.3-5 Volume of sales in industrial sector by economic activity**

Indices	2015	2016	2017
Index of physical volume of production in per cent against the previous year	91.6	102.6	98.8
Total volume of sales in industrial sector, KZT	189,930.9	215,610.2	25,0581.8
including			
Mining and quarrying	1,159.8	2,700	3,800
Manufacturing	175,784	198,732.7	231,306.8
Power, gas and steam supply; air conditioning	12,414	13,500	14,700
Water supply, effluents disposal, waste management	572.7	677.5	775.0



The largest enterprises of the District are detailed in below (Table 3.3-6).

**Table 3.3-6 Major industrial development indices<sup>42</sup>**

Enterprise	Settlement	Volume of sales, million KZT	Investments, million KZT
TOO Philip Morris Kazakhstan	Otegen Batyr	61,362.5	2,650.8
TOO JTI Kazakhstan	Baiserke	44,871	3,652.8
AO Galanz Bottlers	Baiserke	11,336	36.1
The First Brewery LLP	Mukhametzhana Tuimebayeva	4,786.6	290.9
TOO Bericap Kazakhstan	Otegen Batyr	3,942.3	36
TOO Raimbek Agro	Otegen Batyr	8,847.9	61.5

Rural okrugs with the largest volume of sales in industrial sector are Energetichesky (36.7%) and Baiserke (30.2%). See Table 3.3-7 for details.

**Table 3.3-7 Major industrial development indices**

Rural okrug	Volume of sales (commodities and services) at prices of the respective year, million KZT			Proportion of the total volume of sales, %		
	2015	2016	2017	2015	2016	2017
<b>District's total including households</b>	<b>174,645.1</b>	<b>215,610.2</b>	<b>250,581.8</b>	<b>100</b>	<b>100</b>	<b>100</b>
<i>including</i>						
Energetichesky	47,125.1	48,512.30	91,791.6	26.9	22.5	<b>36.7</b>
Aschibulak	8,458.1	15,563.20	24,666.2	4.8	7.2	9.8
Kaztsik	31,458.1	35,478.5	17,947.1	18	16.4	7.2
Baiserke	20,147.9	41,951.1	75,646.2	11.5	19.4	<b>30.2</b>

2017 witnessed a significant growth in the volume of sales in industrial sector of Energetichesky and Baiserke rural okrugs.

Since the beginning of 2017, twenty-one industrial facilities offering 412 new jobs were commissioned in the District. Sixteen operational industrial assets were expanded creating 198 new jobs. The industrial agenda of the District is formulated by 32 large and medium-sized enterprises.

Enterprises with the largest headcount in Iliysky District are:

- TOO JTI;
- TOO FMK;

<sup>42</sup> 2017 Socioeconomic Passport (Datasheet) of Iliysky District

- AO Galanz Bottlers;
- TOO Aluminium of Kazakhstan; and
- TOO MEA Properties.

Large industrial enterprises are located mainly in Baiserke and Energetichesky rural okrugs.

**Table 3.3-8 Major industrial enterprises in the subject areas**

Enterprise	Settlement	Produced commodities	Headcount
AO Galanz Bottlers	Baiserke	Beverages	553
TOO Pervomaiksiye Delikatesy	Koyankus	Sausage	106
TOO Raimbek Agro	Otegen Batyr	Milk	276
TOO Mediatex-N	Baiserke	Headgear	114
TOO Aluminium of Kazakhstan	Mukhametzhana Tuimebayeva	Metal products	515
TOO MEA Properties	Kaztsik	Glass	515
TOO FMK	Otegen Batyr	Cigarettes	565
TOO JTI	Yntymak	Cigarettes	650
TOO Promet	Pokrovka	Metal products	133
Subsidiary of AO UPTOK	Pokrovka	Spare parts	197
TOO Bericap Kazakhstan	Otegen Batyr	Plastic bottle caps	122
TOO Amcor Tobacco Packaging Kazakhstan	Otegen Batyr	Packaging for cigarettes and rolling paper	60
TOO Abdi Ibrahim Global Pharm	Mukhametzhana Tuimebayeva	Pharmaceuticals	221
TOPO Bent	Kaztsik	Railroad ties	190
TOO Sonnik	Baiserke	Metal pipes	106
The First Brewery LLP	Mukhametzhana Tuimebayeva	Beer	367
TOO AVZ	Koyankus	Electric fans	98
AO Remstroytekhnik	Kaztsik	Precast concrete	248
TOO Dolce-Pharm	Yntymak	Medical products	247

#### *Small and medium-size businesses*

The small business sector is comprised by 1,755 small businesses, 1,325 family farms and 6,246 individual entrepreneurs.

They provided 156.3 billion KZT worth of manufactured products and rendered services.

During 2010 – 2017, they were granted 123 credits in the total amount of KZT 39 billion as part of the 2020 Business Roadmap Programme. 111 credits were granted as subsidies and guarantees and 12 credits for the development of the infrastructure.

The largest number of operational businesses is in Boraldai (432), Energetichesky Rural Okrug (799) and Baiserke Rural Okrug (209). See *Table 3.3-9* for details.

**Table 3.3-9** *Key small business development indicators (legal persons)*

Rural Okrugs	Number of operational businesses		Budget receipts from small businesses (legal persons), million KZT	
	as of 01.01.2017	as of 01.01.2018	as of 01.01.2017	as of 01.01.2018
Energetichesky	781	799	2,459.7	2,298.6
Aschibulak	50	82	1,215.6	1,140.5
Kaztsik	36	41	615.4	730.6
Baiserke	190	209	2,415.9	2,590.9
District's total	1,755	1,824	12,298.5	11,866

In 2017, the total number of operational small and medium-size businesses increased by 30%, reaching 9,394. Small and medium-size businesses employ more than 30,000 people (see *Table 3.3-10*).

**Table 3.3-10** *Key development indicators of small and medium-size enterprises*

Indicators	2016	2017
Number of operational small and medium-size enterprises	7,205	9,394
Total headcount	28,193	30,005
Volume of sales, million KZT	13,7246.4	156,312.3
Budget receipts from small businesses (legal persons), million KZT	12,298.5	15,902.7

### *Service sector and trade*

The proportion of food commodities and non-foods in retail trade is 28.6% and 71.4% respectively<sup>43</sup>. The retail turnover is KZT 55.1 billion (109.3% compared to 2016).

**Table 3.3-11 Retail trade structure in 2017.**

	Total, million KZT	Including			
		Food commodities		Nonfoods	
		million KZT	Proportion in per cent	million KZT	Proportion in per cent
Almaty Region	434,403	151,483	34.9	282,920	65.1
Iliysky District	55,146	15,770	28.6	39,376	71.4

In 2017, sixty new trade and service enterprises were established in the District, including 35 shops, 12 cafes and 13 service businesses. They created 344 new jobs<sup>44</sup>.

The trade sector is comprised by 774 businesses with the total headcount of 2,163. The service sector created 1,126 new jobs and the catering sector provided 681 jobs (see Table 3.3-12).

**Table 3.3-12 Service sector businesses**

Sectors	Number of businesses			Headcount		
	2015	2016	2017	2015	2016	2017
Total	1,169	1,224	1,284	3,284	3,626	3,970
Trade	706	741	774	1,864	2,023	2,163
Service	333	349	367	805	1,011	1,126
Catering	130	134	143	615	649	681

### **3.3.3 Ecosystem services**

The socio-economic survey conducted in 2018 has not identified any individuals engaged in hunting, fishing or gathering of herbs and mushrooms or other ecosystem services within the BAKAD Area of Influence.

### **3.3.4 Labour market and household incomes**

As of 2017, the economically active population of Iliysky District was 98,800. During 2015 – 2017, this figure has slightly increased.

<sup>43</sup> Source: Sales of Commodities in Almaty Region, January – December 2017. Official Statistics, [www.egov.kz](http://www.egov.kz)

<sup>44</sup> 2017 Socioeconomic Passport (Datasheet) of Iliysky District

The number of people employed in the local economy in 2017 was 94,400. The employment rate remains unchanged at the level of about 95% over the past few years. The small business sector accounts for 26.5% of the total employment. The self-employment rate is 22%.

Unemployment in Iliysky District remains unchanged at the level of 4.3% (4,268 unemployed in 2017, an increase of 168 compared to 2016). See *Table 3.3-13* for details.

**Table 3.3-13 Economically active population**

Indices	2015	2016	2017
Economically active population	98,500	96,700	98,800
Participation rate, %	85.6	85.4	74.5
People employed in the economy, including:	94,200	92,600	94,400
Small and medium-sized businesses	25,200	24,100	25,100
Self-employed	21,500	19,400	20,800
Employment rate, %	95.6	95.7	95.5
Number of unemployed	4,200	4,100	4,268
Unemployment rate, %	4.3	4.2	4.3

In 2017, all sectors of the local economy provided 2,504 new full-time jobs, including 1,887 jobs in large, medium-sized and small businesses (75%), 319 jobs in social services (13%) and 298 jobs in individual entrepreneurship and family farms (12%).

2,913 people were placed in jobs by departments of employment and social programmes. Besides, 500 people were sent to public works and 490 people underwent professional training.

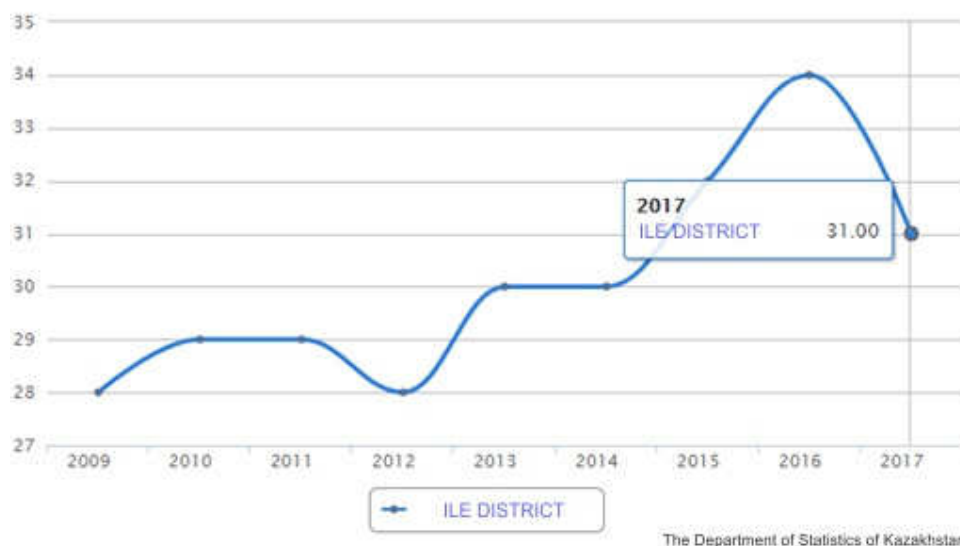
In 2017, there were 98 low-income people receiving targeted social support. In 2016 and 2015 this figure was 137 and 172 respectively.

### 3.3.5 *Public health and healthcare infrastructure*

#### *Public health*

The past few years witnessed the growing birth rate in Iliysky District. In 2017, it was 31 per 1,000 population, which is above the Region's and country's level (24.98 and 21.64 respectively). See *Figure 3.3-5* for details.

Figure 3.3-5 Birth rate in Iliysky District<sup>45</sup>



Since 2012, the rate of mortality due to major causes has been sustainably dropping down to 138.

Table 3.3-14 Number of persons with disabilities

	2015	2016	2017
Persons with disabilities	1,175	1,086	1,166
including children	690	692	759

#### Healthcare infrastructure

There are 32 healthcare facilities in Iliysky District, including six hospitals, eleven healthcare access points and fourteen rural ambulatory care clinics.

The following healthcare facilities are located in Otegen Batyr, the District's administrative centre:

- Central District Clinic of Iliysky District;
- Tuberculosis Hospital of Iliysky District;
- Almaty Regional Children's Clinical Hospital; and
- Almaty Regional Centre for Prevention and Control of AIDS.

Table 3.3-15 Healthcare facilities by rural okrug

Rural okrug	Hospitals	Healthcare access points	Health posts	Others
District's total	6	11	14	1
Energetichesky	2	-	1	1

<sup>45</sup> <https://taldau.stat.gov.kz/ru/>



Rural okrug	Hospitals	Healthcare access points	Health posts	Others
Aschibulak	-	2	3	-
Kaztsik	-	1	1	-
Baiserke	-	3	4	-

The hospital-bed population ratio per 10,000 population in Iliysky District is 26.2% (533 beds). Healthcare facilities employ 432 doctors, the density of doctors per 10,000 population being 21.3. The nursing staff population ratio per 10,000 population is 51.1%, the total number of nurses being 1,038 (see Table 3.3-16).

**Table 3.3-16 Key healthcare infrastructure indicators in 2017**

Rural okrug	Hospital beds	Hospital-bed population ratio per 10,000 population	Number of doctors (excluding dentists)	Density of doctors per 10,000 population	Number of nurses	Nursing staff population ratio per 10,000 population
<i>District's total</i>	533	26.2	432	21.3	1,038	51.1
Energetichesky	403	139.3	265	91.6	501	173.2
Aschibulak	-	-	27	9.2	84	28.8
Kaztsik	-	-	9	5.5	25	15.3
Baiserke	-	-	21	6.4	93	28.5

There are 14 pharmacies, 2 medical laboratories, 6 private multidisciplinary medical centres and 4 dental clinics in the District.

**Table 3.3-17 Healthcare facilities by settlement**

Settlement	Pharmacies	Medical laboratories, diagnostic laboratories	Private multidisciplinary medical centres, consulting rooms of medical specialists (ultrasonographer, gynaecologist, etc.)	Dental clinics
Otegen Batyr	14	2	6	4
Pokrovka	1	-	-	1
Zhapek batyr	5	-	-	3
Tuimenbai	5	1	1	1
Yntymak	1	-	-	-
Chapayevo	5	-	1	1

Twelve healthcare facilities were built during the past 10 years (a rural health post in Baiserke; a medical and obstetrical station in Zhana Daur; a children's hospital for 200 beds with an outpatient polyclinic for 450 visits per shift in Otegen Batyr; ambulatory care clinics in Yntymak, Kaztsik, Pokrovka, Yekpendy, Kosozen, Zhapek Batyr, Koyankus; a medical station in Ali and a medical and obstetrical station in Zhaugashty).

#### *Emergency medical services*

There are 15 ambulance crews and 12 ambulance cars in Iliysky District. No ambulance cars are stationed in Aschibulak Rural Okrug. The number of ambulance trips within 6 months is over 47,000. More ambulance trips are made in areas with more population, i. e. in Energetichesky, Baiserke and Aschibulak rural okrugs.

Ambulance crews make 16.4 trips per day on average. The average attendance time is 10 to 15 minutes in Energetichesky Rural Okrug, 5 to 20 minutes in other rural okrugs and 20 to 40 minutes in Baiserke Rural Okrug.

### 3.3.6 *Social infrastructure*

#### *Education*

##### Preschool facilities

In 2017, the number of preschool children in Iliysky District increased to 29,739. As of 2017, 102 preschool institutions were operational in the District providing 8,578 places in kindergartens and 295 places in small day-care centres.

**Table 3.3-18** *Preschool educational institutions*

Indices		2015	2016	2017	
Number of children	Total	68,689	70,589	78,917	
	Preschool children				
		under 5	26,316	23,732	29,739
	School children (attending schools and vocational education institutions)	from 6 to 10	20,693	24,938	26,272
		from 11 to 14	15,291	14,913	16,291
over 15		6,389	7,006	6,615	
Number of preschool facilities	Total	68	89	102	
	Kindergartens	Number of places	6,425	7,560	8,578
	Small day-care centres	Number of places	522	462	295

*\* Information is provided by local executive authorities*

Twenty-two private kindergartens offering 1,900 places were established in the District in 2017. There is no shortage of schools. Children are provided with kindergarten places to 96.6%.

### Schools

Forty-nine schools attended by 48,132 schoolchildren are operational in the District as of 2017 - 2018 (see *Table 3.3-19*).

Seven new schools with 5,100 school places were commissioned in 2017. Two secondary schools of Otegen Batyr were refurbished.

Part of schools in Zhapek Batyr, Mukhametzhana Tuimebayeva, Yntymak and Tole Bi are operational on a three-shift basis.

**Table 3.3-19** *Preschool education institutions of rural okrugs*

Rural Okrug	Preschool facilities				Schools	
	Kindergartens		Small day-care centres			
	public / private	Number of children	public / private	Number of children	public / private	Number of children
Total	8/90	1,850/7023	2/2	125/170	47/2	44,901/231
Energetichesky	1/18	180/1381	0/2	0/170	4/1	7,046/153
Aschibulak	1/10	140/780	0/0	0/0	8/0	8,822/0
Kaztsik	0/7	0/570	0/0	0/0	3/0	3,290/0
Baiserke	1/21	180/1158	/0	0/0	10/0	7,869/0

Children living in remote settlements and gardening partnerships are brought to schools located within the proposed BAKAD construction area in Mukhametzhana Tuimebayeva, Zhapek Batyr, Kokkainar, Komsomol and Otegen Batyr by school buses.

**Table 3.3-20** *School education institutions of rural okrugs*

Rural okrug	Settlement	Number of schools in total	Secondary schools	Primaty schools	Number of children
Iliysky district	<b>In total</b>	48	48	-	45,141
Energetichesky	<b>Total in RO</b>	5	5	-	7199
	Otegen Batyr	5	5	-	7199
	Pokrovka	-	-	-	-
Baiserke	<b>Total in RO</b>	10	10	-	7869
	Yntymak	1	1	-	711
	Kokozek	1	1	-	323

Rural okrug	Settlement	Number of schools in total	Secondary schools	Primaty schools	Number of children
	Zhanadaur	1	1	-	768
Kazsik	<b>Total in RO</b>	3	3	-	3290
	Kazsik	2	2	-	2201
	Komsomol	1	1	-	1089
Aschibulak	<b>Total in RO</b>	8	8	-	8822
	M.Tuymebaev	3	3	-	4025
	Tole Bi	1	1	-	247
	Zhapek Batyr	2	2	-	2512
	Kokaynar	2	2	-	2038

### Colleges

There are three colleges in the District. Two of them are in Otegen Batyr, namely the College of Economics and Law and the Progress Polytechnic College. The number of students is about 300.

### *Sports facilities*

There are 1 stadium, 1 roofed sports centre, 62 gymnasiums and 4 open-air swimming pools in the District. Besides, there are 14 indoor firing ranges, 1 open-air shooting range, 224 flatbed recreational sports facilities and 14 sports grounds.

A youth sports school is operational in the District where 1,481 young sportsmen engage in 14 sports. Other sports organisations of the District are Ile-Saulet football club, Ile handball club and Alpiyskaya Rosa tourist club in Chapayevo.

### *Culture*

There are 4 community centres and 12 libraries for 164 reader places in rural areas of the District. The libraries number 16,975 readers.

### 3.3.7 *Public utilities*

#### *Housing stock*

In 2017<sup>46</sup>, the entire District's housing stock was 2.45 million m<sup>2</sup>, i. e. 20.9 m<sup>2</sup> per inhabitant, which is above the Region's average (18.5 m<sup>2</sup>).

**Table 3.3-21 Commissioning of residential houses in Iliysky District**

Rural Okrugs	2015	2016	2017
Energetichesky, m <sup>2</sup>	8,694	9,375	16,243
Aschibulak, m <sup>2</sup>	17,540	17,994	11,955
Kaztsik, m <sup>2</sup>	6,050	6,277	8,718
Baiserke, m <sup>2</sup>	23,167	23,721	19,905
<b>Total, m<sup>2</sup></b>	<b>81,890</b>	<b>84,160</b>	<b>86,231</b>

#### *Water supply*

Water is supplied centrally practically to the entire population of the District. Standpipes are used by 1.5% of the population. Centralised hot water supply is available only to 11.7% of residential houses (2016 data)<sup>47</sup>

Over 40 km of water supply network were re-laid and four new water intakes were constructed in new-built quarters in Kaztsik, Chapayevo, Boraldai and Koyankus as part of the Regional Development Programme. Water supply systems in Kuigan and Yntymak underwent scheduled maintenance<sup>48</sup> (see Table 3.3-22).

**Table 3.3-22 Water supply indices**

Indices	2015	2016	2017
Length of intra-settlement water supply network, km	600.1	600.1	705.2
Population provided with centralized water supply	190,397	191,627	203,003
including users of standpipes	34,451	23,595	3,009
including people having water supply at home	155,946	168,032	199,994
Number of clean water reservoirs	21	21	21
including operational reservoirs	14	14	14
Number of water towers or elevated reservoirs	56	58	74
including operational facilities	51	52	69

<sup>46</sup> According to local authorities (District's Akimat)

<sup>47</sup> On Housing Stock of Almaty Region in 2016. Statistical Book. Department of Statistics of Almaty Region.

<sup>48</sup> 2017 Socioeconomic Passport (Datasheet) of Iliysky District

Indices	2015	2016	2017
Number of standpipes	736	604	319
including operational standpipes	309	275	92

### *Power supply*

The length of intra-settlement power lines has grown compared to the previous year and amounts to over 1,560.6 km. As of 2016, the wear rate of the power lines and transformer substations is 72% and 76% respectively. The number of transformer substations reached 364.

### *Gas supply*

As of 2017, nine of ten rural okrugs of the District are provided with centralized gas supply (23 of 31 settlements are connected to the gas supply grid).

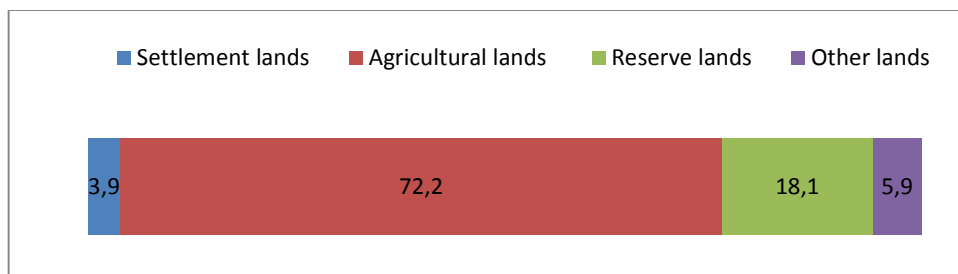
### *Central heating and sewage system*

Central heating is available to 12.8% of the District's housing stock. 48% of residential houses are connected to the sewage system.

### 3.3.8 *Land use*

Agricultural lands account for 72.2% of the District's territory (562,817 ha). Major part of them are pastures (85%). Arable lands account for 13.6% and other lands (fallow lands, etc.) for 1.3%. The area of croplands is 68,825 ha, which is 8.8% of agricultural lands.

**Figure 3.3-6** *Land use structure*



The District's land resources are detailed in the *Table 3.3-23* below.



**Table 3.3-23 Land resources**

Iliysky District				2015	2016	2017	
<b>Total area, ha</b>				<b>779,683</b>	<b>779,683</b>	<b>779,683</b>	
Lands of rural settlements, ha				30,228	30,228	30,228	
Agricultural lands, ha	Total			565,292	565,292	562,817	
	including	Pastures	Total	77,089	77,089	76,821	
			Average quality index	No data	No data	850	
			including irrigated lands	26,571	26,571	26,514	
		Haylands			0	0	0
		Pastures	Total	479,561	479,561	478,934	
			including	Natural pastures	466,124	466,124	465,637
				Croplands of (sown) forage crops	13,437	13,437	13,297
		Others (fallow lands, etc.)			8,642	8,642	7,062
		Reserve lands and lands of Special Land Fund ha	Total			145,069	145,069
including	Arable lands		Total	0	0	0	
			Average quality index	0	0	0	
	Haylands			1,105	1,105	1,105	
	Pastures			39,497	39,497	33,918	
	Others (fallow lands, etc.)			104,467	104,467	105,734	
Other lands (industrial lands, specially protected natural areas, forest and water lands as well as lands of urban settlements), ha				39,094	39,094	45,882	
Total area of croplands, ha				No data	68,237	68,825	

### 3.3.9 Cultural heritage

The *Almerek Baba Mausoleum* is a cultural heritage site located in Iliysky District in the valley of the Malaya Almatinka River near a proposed interchange at the intersection of BAKAD and the Ile Route motorway.

The burial site of Almerek Baba with a mausoleum built upon his grave is one of the holy places of Iliysky District.

At the time of preparation of the Report, the site is visited by numerous local residents. There is a spring with a spring-fed creek flowing nearby, which is also considered holy. The locals use its water for drinking and ablution.

There are 34 registered religious buildings and structures in Iliysky District, including:

- 24 Islamic;
- 9 Orthodox; and

- 2 Protestant.

### 3.3.10 *Public organisations*

There are 10 NGOs in the District: NGOs DPK "Bolashak", "Arnaz", "the football Federation of Ile area", "World", "the Council of the Afghans", "Alpine rose", "Zhas Tolkyn", "Zhas Tylek", "veterans ' Council", "Zhiger".

NOO DPK "Bolashak" has built 11 children's teenage clubs at rural okrugs with the involvement of 4,200 children.

"The football Federation of Ile area" unites 42 football teams, 80 youth clubs in rural districts. Over 6000 thousand people are engaged in football.

The public Association "Zhas Tulek" involves 1,100 young people and conducts public patriotic education among young people, holds round tables and meetings.

"Zhas Tolkyn" together with the district library holds reading conferences, exhibitions of novelties of fiction for young people of the region: "Kazakhstan 2030", "Great sons of the people", "21st century - century of Kazakhstan", field meetings together with the Almaty regional center for prevention and fight against AIDS with pupils of 8-11 classes of secondary schools of Iliysky District.

"Mir" organizes participation in the projects of the "Fund of the first President of Kazakhstan", the organization of cultural and mass recreation for orphans, children of large and poor families and with disabilities in the Park "World Fantasy Aya".

"Giger." As a result of the activities of the organization in the company "KNAUF" studied 10 people with disabilities took a specialization certificate Builder, in College "Progress" of 30 people with disabilities were studying on courses of seamstresses and received the certificate.

The Association «Alpine rose» attracts young people to tourism.

"District Council of veterans" involves 13,200 veterans of the World War II, rear and labor. The main activity – support in solving social problems of veterans.

## 3.4 *KARASAYSKY DISTRICT*

### 3.4.1 *Administrative structure*

Karasaysky District is located to the south-west of Almaty. Its part facing the piedmont area of Zailiysky Alatau overlaps a portion of Ili-Alatau National Park. The district's area is 2,000 km<sup>2</sup>. The administrative centre is the town of Kaskelen.

The district is made up of one municipal okrug, 10 rural okrugs, and 46 populated areas. Three rural okrugs are located within the Project Area:

**Raiymbeksky Rural Okrug.** The administrative centre is the village of Raiymbek. The okrug includes 6 populated areas: Raiymbek, Abay, Bulakty, Dolan, Kyrgauldy, and Kumtogan.

**Irgeliysky Rural Okrug.** The administrative centre is the village of Irgeli. The okrug includes 3 populated areas (Irgeli, Koksay, and Kemertogan) and 18 gardening partnerships: Argymak, Agropromovets, Gorizont Ispytatel, Dramteatr, Druzhba, Kaynar, Krasnye Maki, Lastochka, Rassvet, Meliorator, Mashinostroitel, Mayak, Orbita, Uchitel, Tsvetuschy Sad, Energoispytatel, Mayak Verkhny, Kyzyk, and Borik Say.

BAKAD RoW will be located near the village of Kemertogan, collective farms in the Irgeliysky okrug, and several gardening partnerships (Rassvet, Orbita, Uchitel, and Energoispytatel).

**Yeltaisky Rural Okrug.** The administrative centre is the village of Bereke. The okrug includes 9 populated areas (Bereke, Yeltay, Isayevo, Zharmukhambet, Kokozeck, Koktogan, Karatobe, Aksenger, and Semdesyat Pervy Razyezd) and 3 gardening partnerships (Pridorozhnoye, Ogonyok, and Soyuzpechat).

BAKAD is located in the vicinity of the following populated areas:

- Raiymbeksky Rural Okrug: Kyrgauldy, Raiymbek, gardening partnerships;
- Irgeliysky Rural Okrug: Kemertogan, gardening partnerships;
- Yeltaisky Rural Okrug: Isayevo, Aksengir, gardening partnerships.

#### *Size of population and ethnic composition of rural okrugs within the Project's Area of Influence*

As the Almaty City expanded, it has been gradually acquiring lands formerly owned by Karasaysky District. In 2014, over 16,000 hectares were transferred from the district to the city, which had a certain impact on local demographics, as the district's population lost 73,000 people in favour of Almaty's population.

From the ethnic perspective, Kazakhs prevail (75%), followed by Russians (13%), Turks and Azerbaijani (7%), and Kurds (slightly over 1%). Several ethnicities (Uygurs, Tatars, Koreans, Germans, Ukrainians and others) cumulatively make up less than 1% of total population.

**Table 3.4-1 Gender and age structure of population in Karasaysky District's populated areas located in the Project Area of Influence, 2016**

Populated area	Total population	Gender	Population by gender	Age breakdown			
				<16	16-29	30-57/62 (f/m)	>58/63 (f/m)
Isayevo	1594	Males	766	220	215	289	42
		Females	828	218	228	297	85
Aksengir	675	Males	359	103	101	135	20
		Females	316	83	87	113	33
Kemertogan	2648	Males	1260	361	354	475	70
		Females	1388	365	383	498	142
Raiymbek	6037	Males	2892	830	812	1091	159
		Females	3145	827	867	1129	322
Kyrgauldy	7158	Males	3536	1014	993	1334	195
		Females	3622	952	999	1300	371

*Natural and migratory movement of population*

By January 1<sup>st</sup>, 2018, the district's population included about 210,000 rural residents (86%) and 65,000 urban residents (14%). Similar to Iliysky District, Karasaysky District shows the highest population growth in the Almaty Oblast (4.8% vs the regional average of 1.7%). Annual birth rate is around 8 thousand people; annual morbidity rate is 1.3 thousand people, making up the population increase of around 6-7 thousand people annually.

Migrants predominantly arrive in the district from other areas of Kazakhstan (20,880 people came in 2016, and 16,218 people left Karasaysky District) and CIS countries (739 people came in 2016).

**Table 3.4-2 Number of population in BAKAD's SAOI settlements**

Rural Okrug	Settlement	Birth rate per na 1000 citizens			Death rate per na 1000 citizens		
		2015	2016	2017	2015	2016	2017
Karasaysky district	<b>Total in district</b>	28.7	29.63	30.07	5.6	5.4	5.1
Raimbeksy RO	<b>Total in RO</b>	29.9	30.4	30.8	5.6	5.2	5.0
	Raiymbek	40.0	42.1	41.8	6.0	5.8	5.6
	Kyrgauldy	30.1	30.6	30.2	4.9	4.9	4.8
	Bulakty	27.0	30.0	29.8	5.8	5.6	5.2
Eltaisky RO	<b>Total in RO</b>	27.6	27.7	27.6	5.9	5.6	5.3

Rural Okrug	Settlement	Birth rate per na 1000 citizens			Death rate per na 1000 citizens		
		2015	2016	2017	2015	2016	2017
	Isaevo	n/d	n/d	n/d	6.8	6.6	6.4
	Aksengir	15.4	15.9	15.9	3.2	3.0	3.2
Irgely RO	<b>Total in RO</b>	30.2	32.4	32.4	4.9	4.6	4.4
	Kemertogan	48.8	49.8	49.7	1.8	1.5	1.8

### 3.4.2 *Local economy*

Industry plays the main part in the economic structure (209 bln KZT), trade comes second (103 bln KZT) and agriculture is the third (45 bln KZT). In money terms, industry and trade have been growing 17-20% in recent years and agriculture – approximately 11% annually.

**Table 3.4-3** *Economic indicators of Karasaysky District, mln KZT*

Indicator	2015	2016	2017
Industry, mln	164,893.6	186,699.1	209,056.2
Agriculture, mln	33,421.0	437,935.5	45,218.5
Investments, mln	91,416.4	103,238.8	112,033.6
Construction, mln	21,976.9	22,902.0	31,668.5
Retail, mln	72,072.7	88,229.3	102,920.2

#### *Industry*

There are over 180 production facilities in the district with 75% of goods supplied from 20 major and 94 medium-size facilities. An industrial share of the district amounts to 28%.

The main issues of the industrial sector are the following: an insufficient number of process equipment, obsolete core production assets and a shortage of electricity.

#### *Agriculture*

Karasaysky District is an agricultural and industrial area. As it is in proximity to the Almaty City there is a developed agricultural production: vegeculture, meat-and-dairy cattle farming as well as egg production.

In 2017, the agricultural gross output in Karasaysky District amounted to 45,218.5 mln KZT, including a livestock sector – 24,806.0 mln KZT or 54.8% of

the total volume, crop production – 20,372.5 mln KZT (45%), with a share of services accounting for 0.1% which is 40.0 mln KZT in money terms.

Compared to 2015-2017 the agricultural production has been growing by 4,326.8 mln KZT. The growth is caused by an expanded cattle farming by 4,977.2 mln KZT, whereas vegeculture has dropped a little compared to 2015 and reduced by 672.3 mln KZT in 2017.

**Table 3.4-4 Gross agricultural production in Karasaysky District, 2015-2017**

	Total, mln KZT	including:		
		livestock	crop production	Services rendered to the agriculture
2015	40,891.7	48.5	51.5	0.04
2016	43,118.9	53.7	46.0	0.3
2017	45,218.5	54.8	45.0	0.2

### Crop production

There are 4 seed farms in the district producing elite seeds of crop, vegetables, potatos and oil plants. The district specialises in vegetable farming. There are 14 storage areas for potato, fruits and vegetables and 19 greenhouses with a square area of 13.0 ha. There are 932 ha with trees and bushes bearing fruits and berries<sup>49</sup>.

The total irrigation network length in the district is 0.426 thousand km, with 16.9 thousand ha of land connected to the network.

### Structure of cultivated areas

Following the 2017 results the cultivated area of Karasaysky District amounted to 29,062 ha.

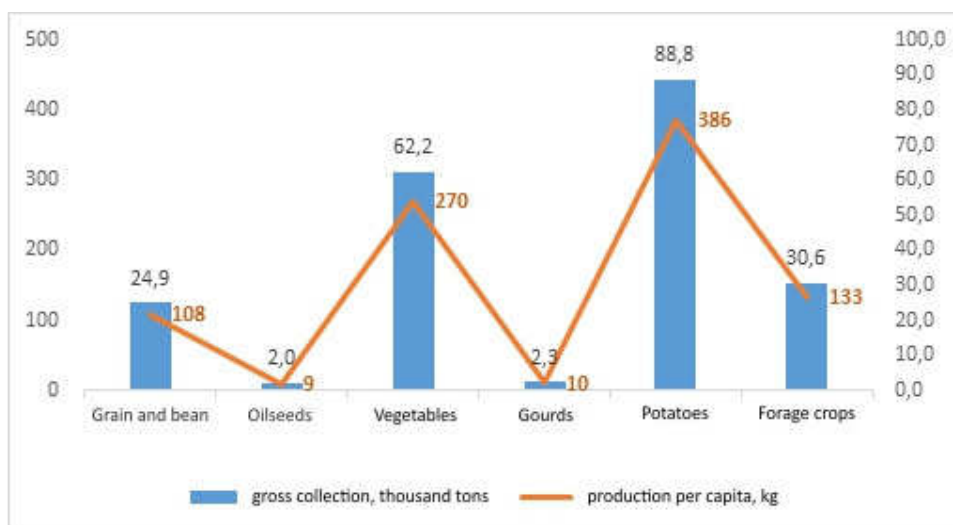
Forage (38.6%), cereal and leguminous (36.2%). crop take up a considerable share. One of the massive crops is potato (13.5%), vegetables and oil plants occupy at least 10% of the total crop structure.

In 2017, 88.8 thousand tons of potato were harvested, which was 386 kg per capita. 62.2 thousand tons of vegetables were harvested, which was 270 kg per capita.

<sup>49</sup> <http://karasay.zhetisu.gov.kz/pages/175/>



Figure 3.4-1 Crop harvesting in Karasaysky District, 2017



In 2015-2017, there were positive harvesting growth rates in vegetable, especially cereals, oil-plants and vegetables, except for forage crops (this position reduced by 11.2%).

### Livestock

The livestock in Karasaysky District is represented by dairy breeding, fine-fleece sheep breeding, yielding horse breeding, pig breeding and poultry breeding. In the district there are 7 breeding farms. Three of them are dairies, 2 breed horses and 2 breed sheep.

As of January 1<sup>st</sup>, 2018 the cattle stock in all farm categories of Karasaysky District amounted to 35,312, sheep and goats – 36,900, horses – 5,146, pigs – 1,669, poultry – 1,260,801.

The number of pigs in Karasaysky District was growing by 31.5% in 2015-2017 and poultry was decreasing by 26.4%.

Table 3.4-5 Livestock in Karasaysky District, 2017

Period	Cattle	Sheep and goats	Horses	Pigs	Poultry
2017	35,312	36,900	5,146	1,669	1,260,801
2016	35,204	36,900	5,092	1,669	1,260,799
2015	35,082	36,910	5,090	1,269	1,714,166

There are 5 livestock breeding farms in the district, 2 of them breed cattle, 2-sheep and 1 – horses; the percentage of thoroughbred animals to the total livestock in terms of cattle is– 15.8%, sheep – 19.1%, horses – 15.0%.

In 2017, the livestock production in the district per capita amounted to 1,212.3 of eggs; 358.4 kg of milk; and 70.7 kg of meat. In 2015-2017, milk production was increasing by 4.8%, and meat production was reducing by 5%.

#### Agricultural producers of the district

According to the Agricultural Department of Karasaysky District there are 2 state-owned farms in the district, 27 production co-operatives, 101 limited liability partnerships and 3,669 farm households. There are 20,500 people working in the agricultural sector.

More than 44 production facilities processed agricultural products in the district. The largest ones being: TOO AgroImpeksAlatau, TOO Alel Agro, TOO Alsad Kazakhstan, TOO KazAgroFerma, AgroFermaKeruen, Zhetysu agricultural production co-operative, TOO Sultan Agro, TOO DunieAgro, TOO AvroraAgro, PK Musaev, PK Madmar, TOO AgroImpeksAlatau and PK Zhailybaeva.

#### *Small and medium-size businesses*

Based on the 2017 results there were 12,642 small and medium size enterprises acting in the district. The gross output of the enterprises amounted to 14,756.9 mln KZT. Production of small enterprises was the highest amounting to 58% of the total output with self-employed persons amounting to 33.9% in the total production and farm households producing 8.1% on average.

At the same time it has to be noted that self-employed persons, despite a bit lower output, both in total and per capita, account for the highest employment.

**Table 3.4-6** *Main development indicators in relation to small and medium enterprises in Karasaysky District in 2017<sup>50</sup>*

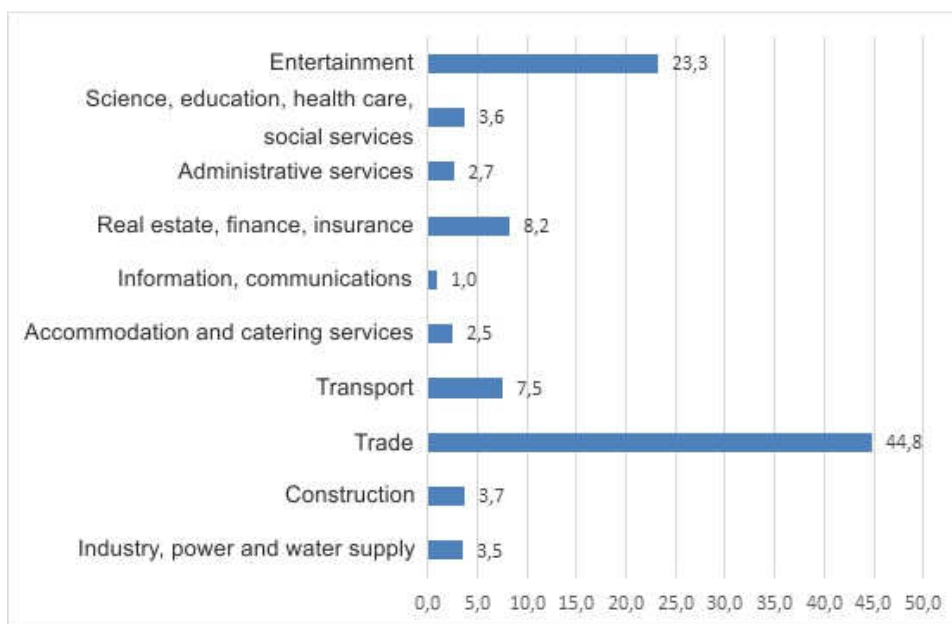
	Number of acting small and medium enterprises	Number of employees	Output, mln KZT
Total	12,642	59,074	14,756.9
Of them			
<i>Legal entities</i>	2,639	19,694	8.6
<i>self-employed (not legal entities)</i>	7,462	25,528	5.0
<i>Farm households</i>	2,541	13,852	1.1

<sup>50</sup> According to the Entrepreneurship Department of Karasaysky District

Approximately 31% of women manage small and medium enterprises, and they account for 42% of self-employed. But as a representative of akimat (the local administration) of Yeltaisky Agricultural District has noted, oftentimes an enterprise was registered in the name of a woman, but the activity was controlled by men, thus, presumably, the number of businesswomen was much smaller in reality.

Small and medium enterprises of the district are most widely represented in such economic sectors as trade and services.

**Figure 3.4-2** *Small and medium enterprises, %*



*Source: Statistics of productions, as of January 1, 2018*

According to the akimat of Karasaysky District, priority investments are in construction, transport and warehousing, real estate, industry, education, art, entertainment and leisure, as well as wholesale and retail. Respectively, it can be assumed that these business areas are considered to be a priority and most beneficial to the district economy.

#### *Service sector and trade*

Retail in 2017 amounted to 102.9 bln KZT and grew by 16.7% or 14.7 bln KZT against 2016. The volume index amounted to 107.1%. A retail share of the district in the regional volume is 23.7%.

As of January 1, 2018 according to statistics of Karasaysky District there were 1,003 trading and service companies, including 646 shops (among others, 7 malls and 10 markets), 179 food services and 178 consumer services (hotels,

auto services, hairdressers', tailor and shoemaker's shops, bath houses, dry cleaners', laundries, etc.)

### 3.4.3 *Ecosystem services*

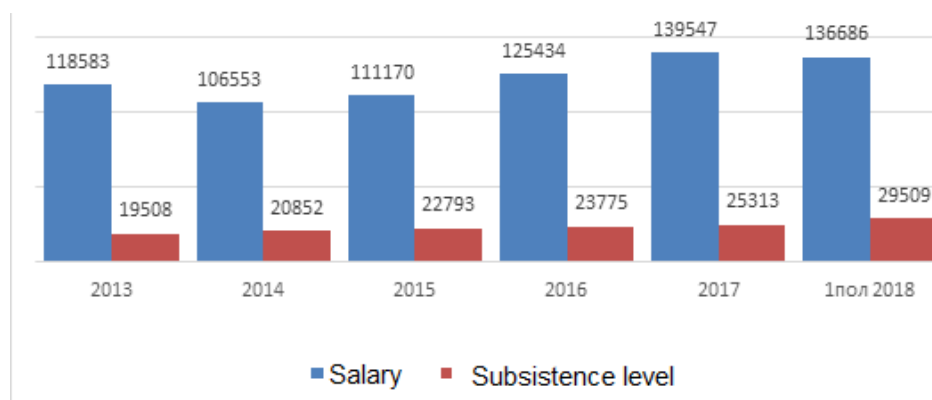
The socio-economic survey conducted in 2018 has not identified any individuals engaged in hunting, fishing or gathering of herbs and mushrooms or other ecosystem services within the BAKAD Area of Influence.

### 3.4.4 *Labour market and household income*

According to the Passport of Karasaysky District<sup>51</sup> in Q4 2017 the headcount of employees in large and medium enterprises of Karasaysky District was 21,800 people, which decreased by 4% from 2016 with a salary of 140,831 KZT; in 2017, the salary averaged to 136,686 KZT.

The average salary in Karasaysky District (136,000 KZT) was above the average regional salary (109,000 KZT) in H2 2018; the salary was 4.6 times higher than the subsistence level.

**Figure 3.4-3** *Salary and subsistence level dynamics in Karasaysky District*



*Social and economic development in Karasaysky District by month, in January –June 2018.*  
<http://karasay.zhetisu.gov.kz/pages/240/>

*Social and economic passport of Karasaysky District for 2016.*  
<http://karasay.zhetisu.gov.kz/pages/175/>

Official unemployment rate in Karasaysky District is 4.5%. Over 4,000 people apply to the employment office, 78% of them have found jobs, some are given public jobs (550 people), sent to practical trainings (57 people) and professional workshops (173 people) and granted loans. There are vacancy

<sup>51</sup> <http://karasay.zhetisu.gov.kz/pages/175/>

fairs. In 2016, there were 4,161 people protected against the unemployment. Nevertheless, the most vulnerable groups among the unemployed are women – the unemployment rate among them reaches 5.8% - whereas among the youth it is 3.4%<sup>52</sup>.

Vulnerable groups receive assistance as follows:

- Over 946 children received a state allowance (up to 2,000 KZT per month per child);
- 1 family with 6 members received state targeted aid (1,300 KZT per month per person);
- 101 families with children received social assistance (approximately 2,800 KZT per month per physically challenged);
- Social aid to 139 tuberculosis patients (2,200 KZT per month); and
- 324 veterans and emergency responders (from 25,000 to 70,000 KZT).

Physically challenged people are among the vulnerable groups; many of them are assisted, in particular, they are provided with hygiene products (327 people), prosthetic and orthopaedic appliances (156 people), wheel chairs (35 people), 162 physically challenged have helpers (162 people).

There are 2 rehabilitation wards attended by over 140 handicapped children and 2 social assistance departments. The percentage of those covered by special services reached 97.8%. In 2015, there were 5,116 physically challenged people, i.e. 2.8% of the population.<sup>53</sup>

### 3.4.5 *Public health and infrastructure*

There are 43 health agencies in the district, the district hospital in Kaskelen (for 290 patients), 2 rural hospitals for 15 and 40 patients, 17 outpatient clinics, 8 first-aid stations in villages and 8 dispensaries. Medical service density is 17 doctors per 10,000 of the population. Annually a doctor pays approximately 7 visits to 1 person. Life expectancy grows – 69.9 in 2014, tuberculosis incidence decreases to 61.9; blood circulation morbidity reduces to 109.6; infant mortality drops to 6.7; maternal mortality was not recorded.

Main issues are – a lack of polyclinics, inpatients, premises, a shortage of doctors, aging of medical personnel, low salaries, in particular, in rural areas.

Infant mortality in Karasaysky District is higher than the regional average and stood at 9.24 per 1,000 people in 2017, whereas the regional average is 7.66<sup>54</sup>.

<sup>52</sup> <http://karasay.zhetisu.gov.kz/pages/221/>

<sup>53</sup> <http://karasay.zhetisu.gov.kz/pages/221/>

<sup>54</sup> A social and economic development in the Almaty Oblast, a concise statistical bulletin, January 2018, Almaty 2018

A high percent of the population dies of tumours (11.9% of all deaths), and of blood circulation diseases (19.9%), whereas the regional average is 9.2 and 19.2, respectively.

**Table 3.4-7** *Morbidity rate, 2017*

	Blood circulation	Neoplasm	Infections	Tuberculosis	Injuries	Other
<b>Almaty Oblast</b>	19.2	9.2	1.0	0.2	11.2	59.4
<b>Karasaysky District</b>	19.9	11.9	1.4	0.2	10.7	56.1

*A social and economic development in the Almaty Oblast, a concise statistical bulletin, January 2018, Almaty 2018*

### 3.4.6 *Social infrastructure*

#### *Education*

##### Pre-school education

There are 75 kindergartens in Karasaysky District including 10 state-owned and 65 private facilities. There are also 28 pre-school mini centres. The total number of students is 5967. The pre-school facilities cover 92.2% of all pre-school children in the district.

The rural okrugs within the Project Area have 34 pre-school institutions, including 29 kindergartens and 5 mini centres.

Raiymbesky rural okrug: 17 pre-school institutions including 2 state-owned kindergartens (Raiymbek and Kyrgauldy), 11 private kindergartens, and 4 pre-school centres. In total, they are attended by 950 children.

Raiymbek: 4 kindergartens accommodating 200 children.

Kyrgauldy: 3 kindergartens accommodating 395 children.

Bulakty: 2 kindergartens accommodating 70 children

Zhanaturmys: 1 kindergarten accommodating 40 children.

Abay: 3 kindergartens accommodating 95 children.

*Yeltaysky rural okrug*: 9 pre-school institutions (all private kindergartens). In total, they are attended by 385 children.

Irgeli: 7 kindergartens accommodating 245 children.

Kemertogan: 1 kindergarten accommodating 110 children.

Koksay: 1 kindergarten accommodating 30 children.



## School education

According to the akimat, there are 53 schools in the district, including 50 secondary schools and 3 primary schools. In total, they are attended by 25,252 students, up 4,583 children from last academic year. Also, as part of a programme to phase out 3-shift schools, seven new schools were built and one addition to an existing school was commissioned in 2017, creating 6,300 additional spaces.

15 schools in the district arrange free transportation for 4,510 students including 3,376 students from 48 gardening partnerships and 1,134 students from populated areas. For medical reasons, 164 students receive home schooling.

In total 41 schools offer hot meals for 49,911 students.

**Table 3.4-8** *Number of schools and students in rural okrugs within the Project Area as of 2017<sup>55</sup>*

	Total number of schools	Secondary schools	Primary schools	Total number of students
Yeltaysky rural okrug	7	6	1	4,152
Irgelinsky rural okrug	3	3	-	4,908
<i>Irgeli</i>		1		
<i>Koksay</i>		1		
<i>Kemertogan</i>		1		
Raiymbeksky rural okrug	8	6	2	6,730
<i>Kyrgauldy</i>		2		
<i>Raiymbek</i>		1		
<i>Abay</i>		2		
<i>Zhanaturmys</i>		1		
<i>Bulakty</i>			1	
<i>Dolan</i>			1	

## Sports

There are 194 sports facilities in the district including 2 sports centres, 1 stadium, 62 gyms, 114 sports fields, and 15 play fields.

There are also 2 race courses (Nurdaulet to the west of Kaskalen, and Aksay in the Raiymbeksky okrug by the Almaty-Kaskelen motorway).

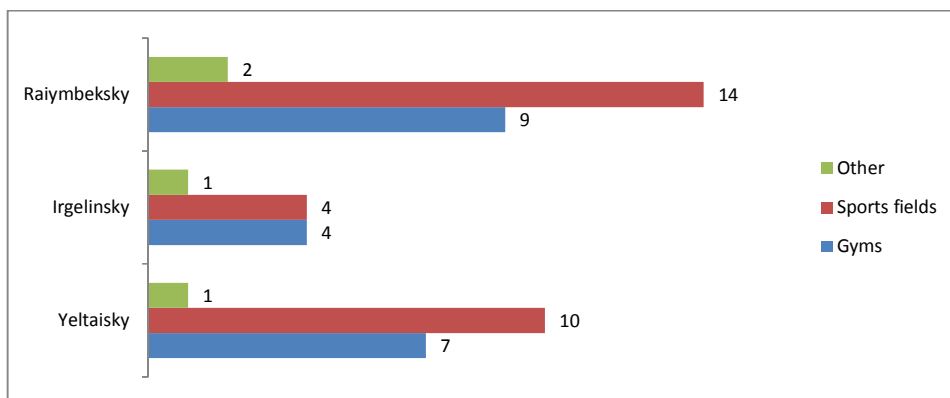
There is a physical culture school for children and teenagers in the district. It is attended by 1,400 students. In 2016, a football field was commissioned in the

<sup>55</sup> Based on the passports of rural okrugs

village of Bereke in the Yeltaisky rural okrug: this project was supported by Zhiger-M and Kyokushin Karate federations of disabled athletes, the Zhas Kyran and Parasat football schools.

Populated areas bordering the Project Area have 52 sports facilities including 20 gyms, 28 sports fields, and 4 other sports facilities.

**Figure 3.4-4 Sports facilities in Karasaysky District as of 2017**



However, there are several issues with the availability of the sports facilities:

- Absence of sports and recreational centres in villages;
- Undeveloped chain of clubs for teenagers and basic sports grounds and play fields in vilalges;
- Lack of sports clubs for disabled persons;
- Lack of equipment in existing facilities.

### Culture

There are 22 cultural facilities in the district including 2 museums (a local history museum in Kaskalen and the Anaga Kurmet museum in Kyrgauldy at the 26th km of the Almaty-Zhandosovo motorway), 11 libraries, 34 historical and cultural monuments, and 13 archaeological monuments.

Populated areas bordering the Project Area have 5 cultural facilities:

- Irgelinsky okrug: 1 club and 1 library in Irgeli;
- Raiymbeksky okrug: 1 library in Raiymbek and 1 musreum in Kyrgauldy;
- Yeltaisky okrug: none until 2017, when a rural community centre was purchased in Bereke.

### Trade infrastructure

There are 5 populated areas and gardening partnerships in Karasaysky District within the Project Area. All villages have small stores with food and non-food products, where customers can buy goods over the counter. The size of stores varies from 50 to 100 m2. Products for sale include convenience

goods purchased daily, such as bakery, meat, groats, dairy, vegetables, vegetable oils, confectionery, beverages etc.

There are 53 stores and 2 markets in Irgelinsky rural okrug. Yeltaisky okrug has 77 outlets. There are practically no stores in gardening partnerships.

As Almaty is located nearby and can be easily accessed by taxi or by bus, individuals and organisations often make large purchases in shopping malls and markets in Almaty thanks to lower prices and a wider range.

### 3.4.7 *Utilities and communal infrastructure*

According to the passport of the district, all populated areas are supplied with gas, although only 95% of residents are provided with this service. In populated areas within the Project Area, gasification rate ranges from 42% to 73% and is highest in Isayevo.

Power transmission grids suffer from poor technical condition (up to 70% wear rate and 16.1% line losses).

Around 80% of populated areas use water abstraction wells, while 20% utilise surface sources.

Water supply lines are 30-35 years old or past their useful life; the wear rate is 50%, and around 250 km of pipes require heavy repairs. Pipeline losses are 20%.

There are 47 populated areas in the district inhabited by over 264 thousand people. 46 of 47 communities (97.9%) have centralised water supply.

Sewerage pipelines are 40-45 years old or past their useful life. Wear rate is 75%. Centralised sewerage is available in Kaskelen, Shamalgan, Almalybak, Zhalpaksay, and Irgeli.

Most of the water supply facilities (water intakes, pipelines, treatment facilities, towers, tanks) are in poor condition due to lengthy usage and lack of maintenance. Water supply systems require construction or reconstruction in 20 populated areas.

There is an official landfill for solid domestic waste in the village of Aytey (Ayteysky rural okrug, near the northern section of the Almaty-Bishkek motorway), 21 km from Almaty and 6 km from Kaskelen. The landfill spreads over 147 ha and has been operated by TOO KazWasteConversion since 2014 under a 49-year lease agreement. Each day, the landfill receives around 1000-1200 tonnes of solid domestic waste. The waste collection fee is 200 KZT per person.

Visits to populated areas showed that littering in villages is an issue. Unauthorised waste dumps were observed in ravines on the outskirts of villages, which are a source of environmental pollution.

### 3.4.8 *Transport and communications*

46 of 47 populated areas are covered by regular transportation routes. There are 29 bus routes to connect the areas with Almaty.

In 2016, passenger traffic gained 15.7% year-on-year to around 3 billion passenger-kilometres; the cargo traffic gained 2.4% to 1.3 billion tonne-kilometres.

In 2017, passenger traffic gained 1.3% year-on-year to around 2.98 billion passenger-kilometres; the cargo traffic gained 0.1% to 1.37 billion tonne-kilometres.

The district is crossed by transit railway lines: Novosibirsk-Tashkent, Bishkek-Novokuznetsk, Almaty-Simferopol, Almaty-Moscow, Almaty-Astana<sup>56</sup>. In 47 populated areas, Shamalgan station and three passing loop stations belong to the Almatinskaya Railroad.

In general, condition of roads in Karasaysky District is better than the regional average: almost 40% of roads are in good condition, 47% are satisfactory, and 13% of roads are in poor condition.

The main issue is related to the condition of roads in villages. Only Abay, Kyrgauldy and Zhanaturmys have hard-surfaced roads (their share is 33-50%); such roads are almost absent in other villages including in Raiymbek (where their share is just 17%).

The transport problem is acute in Kemertogan and Isayevo (where over 90% of roads are in poor condition), Raiymbek and Yeltai (80-90% of roads are in poor condition). Kemertogan and Aksengir do not have hard-surfaced roads.

### 3.4.9 *Safety*

The number of victims of natural and technogenic disasters has been growing in recent years. Negative factors include floods (there are 12 areas with a risk to residential houses, roads, bridges, industrial and social facilities), fires (70% of villages have no fire protection). There are 253 fire hydrants in the district, of which 12 are faulty. Industrial facilities have 212 hydrants in total, of which 16 are faulty. In Kaskalen, 27 out of 65 hydrants are faulty. There are no fire hydrants in the Yeltaisky rural okrug.

Mudflows pose a threat to over 2,000 facilities and 12,000 residents; landslides pose a threat to 15 facilities and 58 residents.

Based on official statistics, 2583 crimes were committed in the district in 2017 including 358 serious and especially serious crimes. This is 11.8% down from

<sup>56</sup> Social and economic passport of Karasaysky District for 2016, <http://karasay.zhetisu.gov.kz/pages/175/>

2016, although the share of especially serious crimes has gone up, and the number of serious crimes remains at almost the same level.

According to the district police department, the prevailing types of crime are thefts and disorderly conduct. Offenders are represented by people living in Karasaysky District and other parts of Kazakhstan (East Kazakhstan Oblast, Zhambylskaya Oblast, South Kazakhstan Oblast), as well as nationals from other countries like Uzbekistan and Kyrgyzstan. The police authorities believe that the static level of thefts is caused by the fact that the district borders Altyn-Orda, a large wholesale market.

#### **3.4.10**      *Cultural heritage*

Most prominent natural and cultural heritage sites in Karasaysky District include the Ile-Alatausky State Natural park, the Aksayskoe and Kaskelenskoye Gorges, the monument to the Battle of Anrakay, the red deer farm, the trout farm and others.

Kaskelenskoye Gorge is located in the western chain of wooded ridges of Zailiyskoye Alatau. The eastern slope of the gorge houses a limestone quarry and a small limestone plant.

The monument to the Battle of Anrakay is located at the 35<sup>th</sup> km mark of the Almaty-Bishkek motorway.