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HAILAR–MANCHULI SECTION OF SHUIFENHE-MANZHOULI HIGHWAY

ENVIRONMENTAL IMPACT ASSESSMENT

Submitted to

The World Bank

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CHAPTER 1 INTRODUCTION

1.1 Significance of the Project Construction and Origin of this EIA

The proposed project is one part of the plan of "Five North-South Lines and Seven West-East Lines" of China's state highways, as well as the important component of the first west-east line of Inner Mongolia's plan for "Three West-East Lines, Nine North-South Lines and Twelve Exits". It is also the main highway section going from the west to the east planned recently by the autonomous region, as the main framework of the highways in Inner Mongolia and the main passage connecting Hulunbeier League and other provinces and regions in the east of China.

After the construction in the Eighth Five-Year Plan Period and the Ninth Five-Year Plan Period and with the preparatory work of the project, most sections to the east of Hailar of Shuifenhe-Manzhouli Highway has been constructed or under construction, and other sections have moved into the stage of preliminary feasibility study. Currently, only the project of Hailar-Manzhouli section has not been set up for construction. The proposed project will be linked with Yakeshi-Hailar Highway (to be approved for construction) in the east, connected with Manzhouli Port in the west, and bond with Provincial Highways 201 and 202, etc., thus forming a highway network with State Highway 301 as the main axis and other state, provincial, county and township roads as branches, which can play important roles in economic construction along the highway lines.

According to China's environmental protection laws and regulations, EIAs should be performed for construction projects. Inner Mongolia Communication Department entrusted Chinese Research Academy of Environmental Sciences (CRAES) to formulated EIA for the proposed Hailar-Manzhouli Section of state highway Shuifenhe-Manzhouli Highway. After accepting the EIA task, CRAES seriously listened to the introduction to the proposed project by experts and the construction unit, studied the engineering and related data, performed on-site exploration, image pick-up and survey on the environmental sensitive areas along the proposed project line, and complied the *TOR of EIA for Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway*. The Appraisal Centre for Environmental Engineering (ACEE) of the State Environmental Protection Administration (SEPA) approved the TOR on October 14, 2002 (ACEE File [2002]243). According to the TOR and the approval letter on the TOR of the ACEE, CRAES further formulated this EIA report to submit to the responsible department for review.

1.2 Objectives of EIA

This EIA will be performed with the focus on Positive Line Scenario but also concern Alternative Scenarios. The objectives of the EIA include:

(1) Based on a survey of natural, social and ecological environment along the highway, identifying environmental sensitive sites, defining environmental protection targets, and performing assessment for current environmental quality along the line;
(2) Conducting projection and assessment on the impacts on the surrounding environment during the Construction Period and Operation Period of the proposed highway;
(3) Proposing environmental protection engineering measures for the unfavorable environmental impacts of the proposed highway, to minimize the unfavorable environmental impacts of the proposed projects and to realize the coordination of the highway construction and environmental protection;
(4) Elaborating the feasibility of the routing and construction of the proposed highway; and
(5) Providing basis for the environmental protection engineering design and the environmental management of this section of highway.

1.3 Regulatory Basis and Standards

1.3.1 National and local laws, regulations and documents

.1. *Law of Environmental Protection of the People's Republic of China*;
.2. *Law of Water Pollution Control of the People's Republic of China*;
.3. *Law of Air Pollution Control of the People's Republic of China*;
.4. *Law of Environmental Noise Pollution Control of the People's Republic of China*;
.5. *Law of Environmental Prevention and Control of Pollution by Solid Waste of the People's Republic of China*;
.6. *Law of Environmental Impact Assessment of the People's Republic of China*
.7. *Law of Water and Soil Conservation of the People's Republic of China*;
.8. *Law of Highways of the People's Republic of China*;
.9. *Law of Land Management of the People's Republic of China*;
.10. *Law of Grassland of the People's Republic of China*;
.11. *Law of Wild Animal Protection of the People's Republic of China*;
.12. *Law of Sand Prevention and Control of the People's Republic of China*;

.13. *Management Methods for Construction Project Environment Protection*, State Council Decree [1998] No. 253;

.14. *Ordinance on Wild Plant Conservation of the People's Republic of China*;

.15. *Ordinance on Natural Reserves of the People's Republic of China*;

.16. *Management Methods for Traffic Building Project Environment Protection*, Ministry of Communication Decree No. (90) 17;

.17. *Circulation on Strengthening Wetland Ecological Conservation,* SEPA Huanran File No. [1994] 184;

.18. *Some Opinions on Strengthening Ecological Protection,* SEPA Huanfa File No. [1997] 758;

.19. *Circulation on Management of Development Construction Projects Related to Natural Reserves*, SEPA Huanfa File No. [1999] 177.

1.3.2 Related technical specifications and project materials

.1. *Technical Specifications for Environmental Impact Assessment*, SEPA, HJ/T2.1~2.3-93□HJ/T2.4-1995□HJ/T19-1997;

.2. *Technical Specifications for Environmental Impact Assessment – Non-Pollution Ecological Impacts*, SEPA, HJ/T19-1997;

.3. *Temporary Specifications on EIA for Highway Construction Projects*, Ministry of Communications, JTJ 005-96;

.4. *Chinese List of Priority Conservation Wild Animal Species*;

.5. *Chinese List of Priority Conservation Wild Plant Species.*

1.3.3 Others

.1. *Trust Deed on EIA of Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway*;

.2. *Feasibility Report on Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway,* Chinese Highway Engineering Consultation and Supervision Company, October 2001;

.3. *Preliminary Design on Engineering of Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway,* Chinese Highway Engineering Consultation and Supervision Company;

.4. *Construction Plan of Hulunbeier Ecological Demonstration Area*;

.5. *Evaluation Opinion on TOR of EIA for Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway,* ACEE File [2002]243;

.6. *Approval Letter on Standards Adopted for EIA for Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway*, Hulunbeier EPB File No. [2003] 18.

1.4 Assessment Standards

According to *Approval Letter on Standards Adopted for EIA for Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway* provided by Hulunbeier EPB (See Annex 2), the following standards and criteria will be implemented by this EIA.

1.4.1 Water environment

The Class III standard of *Surface Water Environmental Quality Standards* (GB3838-2002) is applied for surface water quality along the project line. The Class 2 standard of *Farmland Irrigation Water Quality Standards* (GB5084-1992) is applied for wastewater discharge in the construction sites and service areas. The detailed standard values are shown in Table 1-1.

Table 1-1 Water Quality Assessment Standard (Excerpt)

Type	Assessment standard	PH	COD_{Cr} (mg/L)	SS (mg/L)	Oil (mg/L)
Surface water quality	GB3838-2002, Class III	6□9	□20	-	□0.05
Service area discharge wastewater	GB5084-1992, Class 2	5.5-8.5	□300	□200	□10

1.4.2 Air environment

For ambient air quality, Class 2 standard of *Ambient Air Quality Standards* (GB3095-1996) applies. The values of NO_2 in the table have been updated based on SEPA Huanfa File No. [2001] 1. Class 2 standard of *Air Pollutants Comprehensive Emission Standards* (GB16297-1996) is applied for bitumen smoke. The detailed standard values are shown in Table 1-2 and Table 1-3.

Table 1-2 Air Environment Assessment Standard (Excerpt) Unit: mg/m^3

Pollutant		TSP	NO_2
GB3095-1996, Level 2 limits	Daily average	0.30	0.12
	1 h average	-	0.24

Table 1-3 Bitumen Smoke (New Source) Discharge Standard (Excerpt) Unit: mg/m^3

Pollutant	Production process	Maximum	Fugitive emission

		allowable emission rate	concentration limit
Bitumen smoke	Bitumen smoke smelting and mixing	40-75	Obvious fugitive emission not allowed

1.4.3 Noise

The *Noise Limit for Construction Site* (GB12523-90) is applicable in the Construction Period. The noise assessment for residences will implement *Circulation on Related Issues of Environmental Noise in EIA for Highway and Railway (Including Light Railway) Projects.* The noise assessment for hospitals in the Operation Period refers to Class 1 standard of *Standards on Ambient Noise in Urban Areas (*GB3096-93), as required by the World Bank.

Table 1-4 Noise Limit for Construction Site (Excerpt) Unit: dB (A)

Construction stage	Main noise sources	Noise limit	
		Daytime	Night
Earth and stone	Earth mover, excavator, mechanical loader, etc.	75	55
Piling	Various types of pile engines	85	Construction prohibited
Structure	Concrete mixer, vibrator, electric saws, etc.	70	55
Fitment	Crane, elevator, etc.	65	55

Table 1-5 Noise Environment Assessment Standard
Limit in the Operation Period Unit: dB (A)

Classification	Assessment standard	Daytime	Night
Residences	GB3096-93, Class 4	70	55
Hospitals	GB3096-93, Class 1	55	45

1.5 EIA Grades, Scopes, Focuses and Factors

1.5.1 EIA grades

According to the environmental characteristics along the highway line, the TOR of EIA and the Approval Letter on the TOR, the assessment grades are determined, as shown in Table 1-6.

Table 1-6 EIA Grades

No.	Environmental element	EIA grade	Environmental characteristics along the line	Main basis for EIA grade

1	Water environment (surface water)	3	The main rivers the line crosses are the Morigele River, the Hailar River and Xinkai River.	Table 2 on work grading of surface water EIA, HJ/T2.3-93
2	Air environment	3	The areas along the line are slight hilly, with annual average wind speed of 4.4m/s. The air diffusion condition is relatively good, and the village density is not high	EIA work grading (4.1) and Table 2, HJ/T2.2-93
3	Noise	2	There are some but small-scale sensitive sites, such as villages, towns and hospitals.	Article 4.2.2.1 in noise EIA work grading principles, HJ/T2.4-1995
4	Ecological environment	1	The highway goes through grasslands and wetlands.	Article 4, expert opinions at TOR evaluation meeting (Annex 1)

1.5.2 Assessment scopes

According to the stipulation in the TOR, the EIA scopes for the proposed project are shown in Table 1-7.

Table 1-7 EIA Scopes

No.	Environmental element	Assessment scope
1	Social environment	Areas directly impacted by the project Areas directly impacted by the project: key areas along the highway line
2	Surface water environment	Within 100 m upstream and 1km downstream of river bridges
3	Air environment	Within 200 m along the central line of the highway
4	Noise	Within 200 m along the central line of the highway
5	Ecological environment	The side slopes and farmlands, grasslands and wetlands within 300m along the highway; within 100m around borrowing and waste earth yards
6	Others	Service areas: Wastewater discharge

1.5.3 EIA focuses

According to the TOR and the approval document of TOR, the EIA of this proposed project include the following contents:

(1) Social environment: socioeconomic benefits of the project, land acquisition, residence removal or resettlement, etc.;

(2) Water environment: impact on surface water during the Construction and Operation Periods; sewage discharge from service areas; disposal of sewage

and garage from construction camps; disposal of construction wastes;

(3) Air environment: protective measures for fugitive dusts and bitumen dust during the Construction Period, vehicle tail gas during the Operation Periods;

(4) Noise environment: construction noise, highway traffic noise;

(5) Ecological environment: landscape, animals, plants, soil, and water and soil conservation along the line;

(6) Public consultation: comments and suggestions of the public on the proposed project;

(7) Comparative analysis of alternatives for parts of the line.

The focuses will be ecological EIA during the Construction Period, and ecological and noise EIA during the Operation Period.

1.5.4 EIA factors

The main EIA factors are shown in Table 1-8.

Table 1-8 EIA Factors

No.	Environmental elements	Main assessment factors
1	Water environment	pH, SS, COD_{Cr}, oil
2	Air environment	NO_2, TSP
3	Noise environment	Noise in the Construction and Operation Periods
4	Ecological environment	Landscape, animals, plants, soil

1.6 EIA methods

According to the specialities of the proposed project, this EIA adopts the principle of representing the line with typical sections, combined with representing the section by typical point, to feedback the entire highway line. The methods of monitoring, investigation, calculation and analysis will be used for current status assessment and the model computation and analogue analysis methods applied for projection assessment. The noise and air environment assessment will be based on quantitative analysis using simulation models. The Estimation Method will be used for water and soil erosion in the eco-environment. Qualitative and semi-quantitative statistical methods will be applied for impact assessment of social environment, surface water

environment and ecological environment, with qualitative assessment as the main method.

1.7 EIA Projection Time Intervals

The EIA is conducted for the Construction Period and the Operation Period. According to the Feasibility Report, the EIA for the Operation Period is divided into initial year (2008), medium term (2015) and long term (2030). The Construction Period lasts for 3 years (2005-2007).

1.8 EIA Procedure

The assessment procedure is illustrated in Figure 1-1.

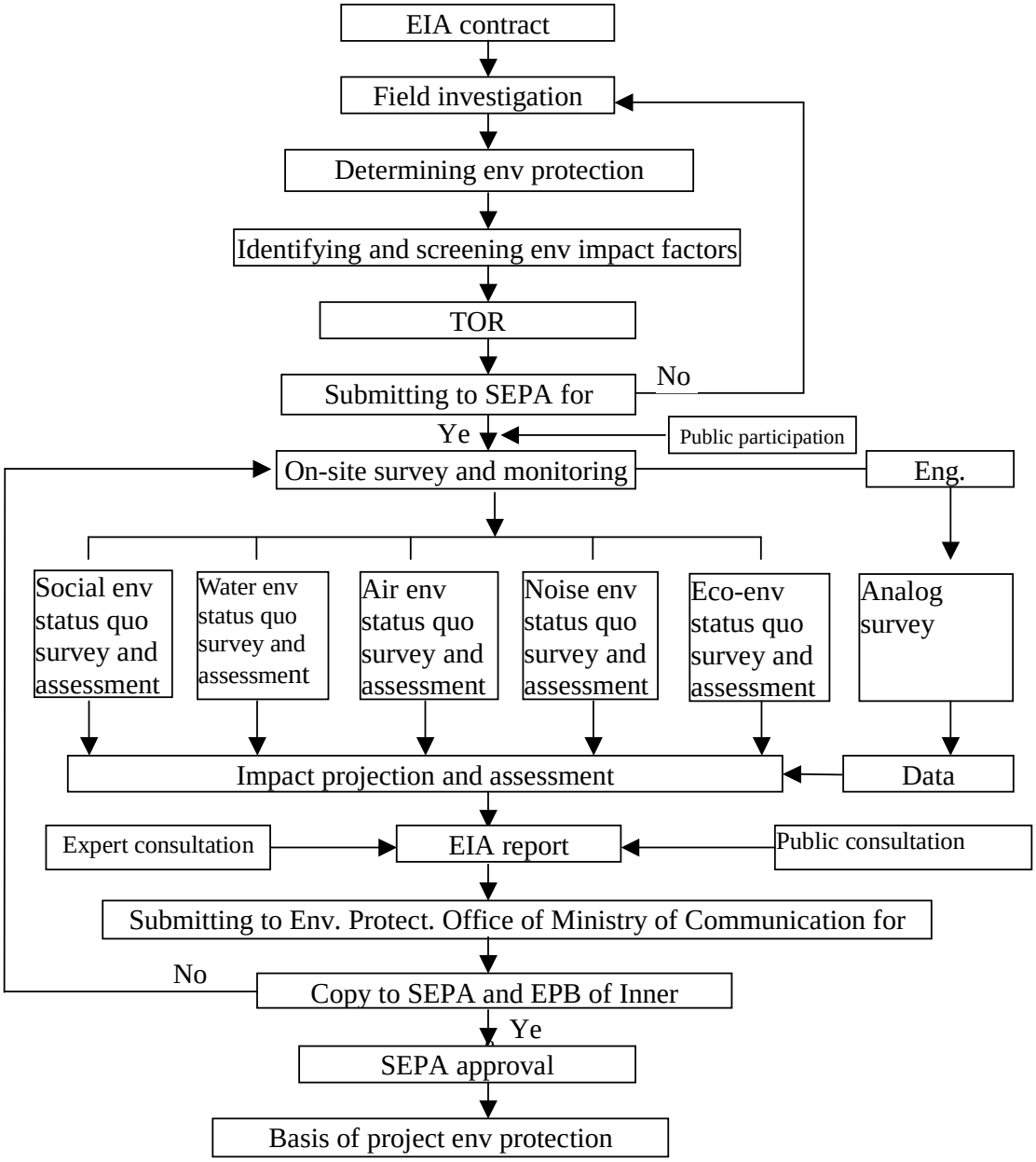


Figure 1-1 The EIA Procedure of the Proposed Project

1.9 INTRODUCTION TO EIA UNIT AND TWO ECOLOGICAL EXPERTS ENGAGED IN THE EIA

Chinese Research Academy of Environmental Sciences (CRAES) is a state level multidisciplinary research institution under the State Environmental Protection Administration (SEPA). It has Grade A Environmental Impact Assessment License granted by SEPA. The license number is EIA License Grade A No. 1001. There is currently research staff of nearly 300 people, including three academicians of Chinese Academy of Engineering (CAE), equipped with advanced devices and technical instruments on air, water, ecological, soil and noise environmental monitoring and several key laboratories. It has powerful capability in environmental protection researches and technical consultation. There are more than 100 people having obtained the EIA certificates, and in recent years they have prepared 40~50 EIA reports for various types of large-scale construction projects. All the reports have met with national and local environmental management requirements, having provided technical supports for the coordination of national economic development and environmental protection, as well as good quality technical services to the project units.

In this EIA, two ecological experts, LI Qingfeng and Tao Li , have been invited to participate. Mr. LI Qingfeng is a professor and Supervisor of Ph D students in College of Ecology and Environment, Inner Mongolia University of Agriculture. His membership of professional societies is Standing Board member, Grassland Society of China Vice president, Grassland Society of Inner Mongolia Vice president, Ecology Society of Inner Mongolia. Mrs. Tao Li , a senior engineer with Inner Mongolia Academy of Environmental Sciences, has engaged in the research on wetland ecological system and ecological environmental impact.

CHAPTER 2 PROJECT DESCRIPTION

2.1 Routing Scheme and Main Control Points

In the recommended scheme for the project of Hailar–Manzhouli Section of Shuifenhe-Manzhouli Highway, the overall routing orientation is from east to west. The starting point is located at Aobao Mountain of Hailar District, linking with the Yakeshi-Hailar Section (K397+000) of State Highway of Suifenhe-Manzhouli. The line goes along old State Highway 301 through Haotetaohai Branch Farm, deviates from the old line at a distance of about 4km to Bayankuren Town, and passes by the north side of Bayankuren Town. The Chenbaerhu Qi Interchange is set up on the north side of Bayankuren Town to connect with Bayankuren Town. The line goes back to State Highway 301 at 3km to the west of Bayankuren Town, crossing Morigele River and going along the west side of Huhenuoer Lake along the old line. A level cross is set up at 11km to the north of East Wuzhuer. The highway goes through West Wuzhuer Sumu and deviates the old line at Cuogangyakou. It then goes straight to the west for 15km and reaches the wetlands where the Hailar Bridge and Xinkai Bridge are set up. The line goes further to the west and through the joint of the Xinkai River and the lake. The Zalainuoer Interchange is set up to the north side of the mineral area and the connection line established to link with Zalainuoer Mineral Area. The highway goes back to the old line at the fence of the Zalainuoer Mineral Area Hospital, goes through Sanshili Highway Maintenance Squad and Shibali Herding Team, deviates from the old line at 4km to the east of Manzhouli City, passes by the north side of the Oxidization Pond, links with Manzhouli Port Road by level cross, and ended at the new Manzhouli Highway Port. This section routing orientation is illustrated in Figures 2-3.

The main control points of this section: Aobao Mountain (to the north of Hailar), Bayankuren, West Wuzhuer, Cuogangyakou, Zalainuoer Mineral Area, Manzhouli, Manzhouli Road Port (finishing point).

The total length of the line in the recommended scheme is 189.718km, belonging to plain and slight hilly area. The line goes through Chenbaerhu Town (Bayankuren), Xinbaerhu Zuo Qi, and Manzhouli City. The connection line with East Wuzhuer is 20km. One 2km-long connection line is set up respectively to link with Chen Qi Interchange and Zalainuoer Interchange.

2.2 Projected Traffic Flow

According to the Feasibility Report and the amended report, the traffic flow in future years after the construction of the proposed project is given in Table 2-1.

Table 2-1 Traffic Flow Projection Result

(Small-Scale Standard Vehicle vehicles/d)

Section	2008	2015	2030
Hailar Bei-Chen Qi	8480	16518	38930
Chen Qi-Wuzhuer	6936	13512	32374
Wuzhuer-Cuogangyakou	5888	11394	27376
Cuogangyakou- Zalainuoer	6918	13068	29822
Zalainuoer-Manzhouli	13612	25412	56292
Manzhouli-Manzhouli Port	3976	7744	22324

2.3 Construction Scale and Main Technical Criteria

2.3.1 Construction Scale

According to the description in the Initial Design on the starting point, finishing point, of the proposed project, main control points, alternative selection, highway grade, and technical criteria elaboration, the construction scale of this project is shown in Table 2-2.

Table 2-2 Construction Scale of the Proposed Project

Classification	Item		Quantity	Unit	Note
Main body engineering	First Class highway		189.718	Km	
	Earth and stone work	Earthwork	8194.17	1000m^3	
		Stonework	1004.694	1000m^3	
	Land acquisition	Permanent	1084	Ha	
		Temporary	172.2	Ha	
	Bridges	Small	352/18	m/bridge	
		Middle	525.5□7	m/bridge	
		Big	1326□4	m/bridge	
	Interchange crosses		4		
	Pathways and passenger overpasses		47		
	Culverts		110		
	Connection line		20		
Supporting engineering	Management branch center		1		Together with Chen Qi Management agency
	Management agencies		2		The management agencies, maintenance area and open main-line toll station at each section is constructed at the same site
	Open main-line toll stations		3		
	Maintenance areas		2		
	Service area		1		Chen Qi Service area
	Parking areas		3		
Auxiliary engineering	Access roads for construction		20.97	Km	
	Access ridges for construction		445/9	m/bridge	

	Construction sites	8		
Public facilities	Septic tanks	5		
	Oily wastewater treatment facilities	2		
Environmen t. protection works	Greening engineering	189.718	Km	

2.3.2 Technical Indicators

According to the traffic projection results and in combination with the analysis of traffic capacity, service standard and traffic flexibility, the technical criteria of different sections are shown in Table 2-3.

Table 2-3 Technical Criteria of the Proposed Highway by Sections

Section	Mileage (km)	Highway grade	Vehicle speed (km/h)
K397+000 -- K398+000	1	First Class, newly built	100
K398+000 -- K413+500	15.5	Rebuilt	100
K413+500 -- K425+000	11.5	First Class, newly built	100
K425+000 -- K516+000	91	Rebuilt	100
K516+000 -- K586+718	70.718	First Class, newly built	100
East Wuzhuer Connection Line	11	Hardening pavement	
	9	Newly built	
Chen Qi Interchange	2	Newly built	
Zalainuoer Interchange	2	Newly built	

The main technical indicators are as shown in Table 2-4.

Table 2-4 Main Technical Indicators

Highway grade	First grade	Note
Topology type	Plain (slight hilly) convex	
Total length of the line (km)	189.718	
Calculated vehicle speed (km/h)	100	
Traveled lane width (m)	2*7.5(7.5)	The values outside the brackets are for integral type

Roadbed width (m)	24.0(12.75)	brackets are for integral type cross-section; and those inside are for separate type cross-section.
Extreme plain curve minimum radius (m)	400	
General plain curve minimum radius (m)	700	
Minimum radius without cant setting (m)	4000	
Stop stadia (m)	160	
Maximum longitudinal slope (%)	4.0	
Design loading for bridges	Car 20, trailer 120	
Net width of bridge surface building limit (m)	11.0(11.75)	The values outside the brackets are for integral type cross-section; those inside are for separate type cross-section.
Pavement width (m)	10.5(11.25)	
Pavement structure type	Bitumen concrete surface	
Road section	Trunk line	

2.4 Main Engineering Amount

2.4.1Main engineering amount

The main engineering amount of this proposed project is shown in Table 2-5. The labor and main materials amounts required for the project are shown in Table 2-6.

Table 2-5 Main Engineering Amount

No.	Item	Unit	Quantity	Note
I	Line length	Km	189.718	
II	Roadbed			
1	Roadbed earth and stone work	$1000m^3$		
	Earth work	$1000m^3$	8150.682	
	Stone work	$1000m^3$	999.362	
2	Soft base treatment	Km	21.3	
III	Pavement			
	Pavement length	Km	189.718	

	Pavement layer	1000m^2	3452.038	
IV	Bridges and culverts			
1	Culverts		110	
2	Small sized bridge	m/bridge	352/18	
3	Middle sized bridge	m/ bridge	525.5□7	
4	Big sized bridge	m/ bridge	1326□4	
5	Extra sized bridge	m/ bridge	-	
V	Tunnels	m/ bridge	-	
VI	Interchange crosses		4	
VII	Separate crosses		-	
VIII	Pathways and passenger overpasses		47	
IX	Land occupied	ha	1084	
X	Protection work			
	Earth fence	m^3	-	
	Drainage prevention	1000m^3	265.985	
XI	Building move	m^3	358	
XII	Electric & telecommunication move	posts	60	
XIII	Optic cable move	Km	1.5	
XIV	Connection line	Km	24	
	East Wuzhuer Connection Line pavement hardening	Km	11	
	East Wuzhuer Connection Line new building	Km	9	
	Chen Qi Interchange new building	Km	2	
	Zalainuoer Interchange	Km	2	

Table 2-6 Labor and Main Material Amounts

No.	Item	Unit	Quantity
1	Labor	Man-day	11,199,947
2	Wood	M^3	1,041
3	Sawn timber	M^3	5□579

4	Rolled steel	T	18,512
5	Steel wires	T	873
6	bitumen	T	80,696
7	Cement	T	234,049

2.4.2 Roadbed engineering

The standard cross section drawing of roadbed is illustrated in Figure 2-4.

(1) Roadbed cross section

For two section, i.e. one from the point 1km to the west of starting point to east side of Bayankuren Town (K398+000 -- K412+000) and one from west side of Huhenuoer Lake to West Wuzhuer (K440+000 -- K496+000), with a total of 70km, the old road is used to construct separate cross-section (the old road is widened as one way with a new one constructed), with the roadbed width of 12.75m, including 7.5-m driveway, 2.75-m left hardened verge, 1.0-m right hardened verge, and 2x0.75-m earth verges. The way using old road will be fulfilled completely by widening the two sides on the base of the old road.

For other sections with a length of 118.423Km, the roadbed width is 24.0m, including 2x7.5-m driveways, 2x2.75-m hardened verges, 2x0.75-m earth verge and 2.0-m.middle belt.

(2) Roadbed side slope

For sections with general geology, roadbed fill height is less than 8m, the side slope is with single slope rate, with the rate of 1:1.5. When the roadbed fill height is from 8m to 20m, the side slope is with fold-line slope rate, with the rate of 1:1.5 when the fill is higher than 8m and 1:1.75 when the fill is lower than 8m.

Excavating side slope rate is determined based on the soil geologic conditions, generally being 1:0.5 - 1:1.0. When the fill height is greater than 20m, one platform is set up for each 10m, with the platform width of 2.0m, 2-m platform at the foot of the slope, and a water catch at 5m to the slope top.

Specific design is performed for special roadbed sections (i.e. soft bed sections, and sections with accumulative snow and sand).

(3) Roadbed height

In general, the roadbed height is mainly constrained by pass and bridge net height, roadbed design flood frequency (1/100) and minimum fill height. The average fill height is about 1.9m and the maximum excavation depth is about 30m.

(4) Roadbed drainage and its protection

The roadbed drainage facilities include side ditches, drainage ditches, watercatch ditches, jet flow duct and seeping ditch, etc. When the vertical slope is greater than 4%, all the surface drainage facilities are consolidated with bonded chip stones.

The slope surface is protected with vegetation and engineering work. When the roadbed fill height is less than 4.0, vegetation protection is applied. When the roadbed fill height is greater than 4.0, concrete framework and vegetation protection are applied. Bonded chip stones protect the sections with wetland below under the design water level. The trench side slope is protected by bonded chip stonewalls or other forms of measures. The protection of roadbed is illustrated in Figure 2-5.

(5) Treatment of roadbed at unfavorable geological sections

There are mainly soft base (lake and marsh) sections at unfavorable geological conditions in this project. The bag sand drain and iso-overload prepressing treatment methods are applied.

For wind-blowing-snow sections, open roadbed and snow storage yard are applied.

2.4.3 Pavement engineering

(1) Natural zoning and earth matrix type

The proposed project is located at Zone VII by highway natural zoning, belonging to grassland mid-drought area in Inner Mongolia. The fill is mostly high at plain sections. The excavation is deep at some parts, mostly with sand or bedrock. The earth matrix is treated as drought type.

(2) Pavement type selection

The climate characteristics in this project area are: small precipitation, big temperature difference, long winter season and low frost line. Frost heaving is the

main factor leading to destruction of the pavement. As bitumen concrete pavement is soft, having stronger adapting capacity to possible roadbed distortion compared with cement concrete pavement and being easier to repair incase of destruction than the latter, it is adopted in this project.

(3) Pavement structure design

The pavement is designed with three layers for the entire line, i.e. 4-cm middle-sized grain bitumen concrete antiskid surface layer, 4-cm coarse grain bitumen concrete antiskid middle layer, and 5-cm coarse grain bitumen concrete antiskid lower layer. The toll stations adopt cement concrete pavement.

The stone resource is rich, and the base along the entire line uses cement to stabilize chip stones. The demand for anti-freezing is considered in the design. At the separate cross-section, the original pavement of the driveway of the old line is utilized as base layer. The surface layer is added on the base layer after width adjustment.

The hardened verge has the same structure as the surface layer. The earth verge in the entire line uses precast concrete slab as pavement.

(4) Pavement drainage

In order to prevent accumulation of snow and water, the middle belt is set up with level-type central separation strip which is paved by concrete. The cross slope is the same as the crown cross slope on both sides, with the rate of 1.5%. The verge cross slope rate is 3%. The water on the pavement surface is drained through the verges.

2.4.4 Bridges and culverts engineering

The rivers within the region belong to the Hailar River system. The annual precipitation is small, distributed unevenly over the year, and the annual evaporation is big. The rivers that the highway line crosses include the Hailar River, the Moergele River, and the Xinkai River, all of which have no requirement for aviation. All the bridges are general ones.

There will be 4 big-sized bridges (1326m long), 7 middle-sized bridges (525.5m long), 18 small-sized bridges (352m long) and 110 culverts.

According to the hydraulic, geological and river (ditch) bed characteristics of the rivers and ditches, and combined with the landform situations, the superstructure of the big- and middle- sized bridges adopts 20-m, 16-m and 13-m prestress concrete simple-support cored slabs. The substructure adopts gravity-type piers and ribbed slab abutment and the base adopts that of drilling pouring posts. The substructure of small- and middle- sized bridges adopts pillar-type piers and stands (or U-type abutment) and the base adopts drilling pouring posts.

The patterns of small-sized bridges and culverts are determined based on the condition requirements of their positions. The small-sized bridges mainly adopt steel concrete rectangle slabs and cored slabs, and culverts use the patterns of round pipe, cover plate and box in steel concrete.

Table 2-7 The List of Big-Sized and Middle-Sized Bridges Engineering

No.	Central post No.	River or location name	No. – diameter of openings (openings-m)	Length of bridge	Width of bridge surface (m)	Bridge pattern
Big-sized bridge						
1	K432+764	Huhenuoer Bridge	5-20	106.5	24.0	Prestress concrete cored slabs
2	K545+220	Hailar River	24-20	486.5	24.0	Prestress concrete cored slabs
3	K550+900		6-20	126.5	24.0	Prestress concrete cored slabs
4	K551+620	Xinkai River	30-20	606.5	24.0	Prestress concrete cored slabs
Middle-sized bridge						
1	K477+660	-	2-20	46.5	24.0	Prestress concrete cored slabs
2	K542+130	-	3-20	66.5	24.0	Prestress concrete cored slabs
3	K542+980	-	3-20	66.5	24.0	Prestress concrete cored slabs
4	K546+500	-	4-20	86.5	24.0	Prestress concrete cored slabs
5	K547+840	-	4-20	86.5	24.0	Prestress concrete cored slabs
6	K548+060	-	4-20	86.5	24.0	Prestress concrete cored

						slabs
7	K574+800	-	4-20	86.5	24.0	Prestress concrete cored slabs

Table 2-8 Culverts in Erka wetland section

No.	Central post No.	Patterns	Size
1	K541+650	Plate-covering	1-4□2.7
2	K541+980	Round pipe	1-Φ1.5
3	K542+750	Box	1-6□3
4	K543+250	Round pipe	1-Φ1.5
5	K544+100	Box	1-6□3
6	K544+400	Box	1-6□3
7	K547+260	Plate-covering	1-4□3
8	K549+020	Plate-covering	1-4□3
9	K550+000	Plate-covering	1-4□3
10	K552+674	Round pipe	1-Φ1.5

2.4.5 Cross engineering

The entire section is partly enclosed and with control on entry and exit. There are 4 interchanges, 47 pathways and 9 level crosses.

(1) Interchanges

Four third-grade interchanges are set up, including Hailar Interchange, Chen Qi Interchange, Zalainuoer Interchange and Manzhouli Interchange, with the main line going from the below.

Table 2-9 The List of Interchanges

No.	No. Central post	Name	Interchange pattern	Crossing method	Name of connected highway	Grade of connected highway
1	K397+000	Hailar	Semi-clover leaf	Main line going from below	Province Highway 201	3
2	K420+629	Chen Qi	A-type single horn	Main line going from below	State Highway 301	3
3	K554+65	Zalainuo	A-type	Main line	State	3

	0	er	single horn	going from below	Highway 301	
4	K573+220	Manzhouli	Semi-directional	Main line going from below	State Highway 301	2

(2) Pathways

A total of 30 pathways will be set up in the entire line. The car pathway is 6x3.5m, cultivation tractor pathway is 4x2.7m and the passenger pathway is 4x2.2m.

(3) Level crosses

9 level crosses will be set up in the entire line, adopting canalized cross and simple cross.

2.4.6 Facilities along the line

The project line has following facilities, i.e. 1 management branch center, 2 management agencies, 3 open main-line toll station, 1 service area, and 3 parking area. The locations of the facilities are illustrated in Figure 2-6.

Table 2-10 Summary of Facilities along Hailar–Manzhouli Section

No.	Facility	Quantity (places)	Note
1	Management branch center	1	Together with Chen Qi Management agency
2	Management agencies	2	The management agencies, maintenance area and open main-line toll station at each section is constructed at the same site
3	Open main-line toll station	3	
4	Maintenance area	2	
5	Service areas	1	Chen Qi Service area
6	Parking areas	3	
7	Total	12	

2.4.7 Road laying materials and transportation conditions along the line

The distribution of materials along the line for construction of the highway is shown in table 2-11 and Figure 2-7. There are no sensitive sites such as residences, schools and hospitals.

(1) Sand and grit

The distribution of sand and grit materials is uneven, including mainly sand and grit yards at Hailar District and Manzhouli City. The sand and grit yards at Hailar District have pure clean sand and grit with less mud, good quality and rich reservation, able to meeting with the engineering requirement. The sand and grit yards at Manzhouli City have more mud and can be used for base layer of the pavement. The yards can be easily accessed by roads and vehicles. The transportation condition is well.

(2) Lime

The lime used in this project mainly comes from Xiertala Building Material Factory and Weigang Trade Company, Ltd. The lime can reach the quality of Grade III. The transportation condition is well.

(3) Stone

The stone resources are basically distributed on both sides of the line, including Hailar Beishan Stone Factory, Chen Qi Daqiao Yard, West Wuzhuer Material Yard, Zhucheng Cement Manufactory Company, Fada Industrial Company, Ltd., and Shibali Material Yard. The rock character of the stones is mainly magmatite such as andesite and grayish-green rock., being hard and compact, with complete specifications, rich reserve and good transportation conditions.

Table 2-11 Survey Table of Materials Yards for the Highway Construction along the Line

Material	No. yard	Yard name	Post No.	Distance from start (Km)		Description of the yard	Stock	Transport mode	Transport condition
				Left	Right				
Sand	□-1	Hezuo Team Three Sand and Grit Yard	K397 +800		24	The yard belongs to Jianshe Township and is 22km to the east of Hailar. There are several producers of sand on the Hailar River flood plain, producing good-quality sands and grits, serving for the roadbed and drainage and protection works. Either Purchasing or joint exploration is feasible.	Rich	Vehicle	A 2.5-km access road from the yard to State Highway 301 needs repairing.
	□-2	Xingtai Sand Yard	K575 +500	20		The private owned yard lies 16km to the southwest of Manzhouli, with annual yield of about 150000m^3. The sand has relatively much mud, and after being washed can be used for roadbed and drainage and protection works. Purchasing is feasible.	Rich	Vehicle	The access road from the yard to Manzhouli is available. 5km of the road needs repairing.
Grit	□-1	Second Water Source Grit Yard	K556 +000	20		The yard is located at the west side of Zalainuoer, to the west of tap water source of Manzhuli on Tuweiba Mountain. The grit contains much earth and should be washed before serving for drainage and protection works. Nobody manages the yard now, and thus the construction unit can quarry it by themselves.		Vehicle	A 1-km access road needs repairing.

	□-2	Hezuo Team Three Sand and Grit Yard	K397 +800		24	The yard belongs to Jianshe Township and is 22km to the east of Hailar. There are several producers of sand on the Hailar River flood plain, producing good-quality sands and grits, serving for the roadbed and drainage and protection works. Either Purchasing or joint exploration is feasible.	Rich	Vehicle	A 2.5-km access road from the yard to State Highway 301 needs repairing.

Material	No. yard	Yard name	Post No.	Distance from start (Km)		Description of the yard	Stock	Transport mode	Transport condition
				Left	Right				
Lime	□-1	Xiertala Building Material Factory	K397 +800		36	The factory is 5km to the north of Xiertala Town. The products are quicklime and block lime with the quality of Class III, able to serve as roadbed material. Purchasing is feasible.	Rich	Vehicle	There is a 5-km access road from the yard to Xiertala Town and 13-km Class III Highway from Xiertala Town to State Highway 301.
	□-2	Weigang Trade Company, Ltd.	K575 +500	5		The company is located 3 km to the southwest of Manzhouli, The products are quicklime and block lime with the quality of Class III, able to serve as roadbed material. Purchasing is feasible.	Rich	Vehicle	The road condition is well.

Stone	□-1	Hailar Beishan Stone Factory	K397 +800		4	The factory is 10km to the north of Hailar. The block and reduced stone has the compression strength of 150Mpa, the crushing value of 10.85%. The stone can be used for roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well.
	□-2	Chen Qi Daqiao Yard	K433 +300		4	The yard lies 4km to the left of Chen Qi Bridge, belonging to self-exploring yard. The surface is covered with reduced stone with a depth of 0.5m. The yard rock belongs to magnetic rock with reduced stone at the upper layer, able to produce various sizes of reduced stone, and sliced and block stone for the usage in roadbed and drainage and protection works.	Rich	Vehicle	A 4-km access road needs building.
	□-3	West Wuzhuer Material Yard	K510 +000	0.3	0.3	The yard is located at the west part of West Wuzhuer, belonging to self-exploring yard. The surface is covered with reduced stone with a depth of 0.5m. The exploitable depth is 10m. The yard rock belongs to magnetic rock with reduced stone at the upper layer, able to produce various size of reduced stone, and sliced and block stone for the usage in roadbed and drainage and protection works.	Rich	Vehicle	A 0.6-km access road needs building.
Material	No. yard	Yard name	Post No.	Distance from start (Km)		Description of the yard	Stock	Transport mode	Transport condition
				Left	Right				

	□-4	Zhucheng Cement Company	K575 +500	5		The company is located 3km to the southwest of Manzhouli, producing various sizes of reduced stone, and sliced and block stone for the usage in roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well.
	□-5	Fada Industrial Company, Ltd.	K573 +000	0.5		The company has several stone yards within Manzhouli, producing various sizes of reduced stone, and sliced and block stone. The quality is satisfactory. The stone can serve for roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well.
	□-6	Shibali Material Yard	K566 +000	6		Shibali Material Yard of Zalainuoer, Manzhouli is 9km away from Zalainuoer. There are several private producers of various sizes of reduced stone, and sliced and block stone. The quality is satisfactory. The stone can serve for roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well.
Coal ash	□-1	East Hailar Power Plant	K397 +800		23	The power plant is 17km to the east of Hailar District, on the side of State Highway 301, with flexible transport condition. It yields quantities of coal ash, meeting quality requirement for the roadbed use. Purchasing is available.	Rich	Vehicle	The road condition is well and the road is linked with State Highway 301.
	□-2	Zalainuoer Lingquan Power Plant	K556 +000		20	The power plant is located within Zalainuoer, with flexible transport condition. It yields quantities of coal ash, meeting quality requirement for the roadbed use. Purchasing is available.	Rich	Vehicle	The road condition is well and the road is linked with State Highway 301.
Cement	□-1	East Hailar Cement Plant	K397 +800		22	The cement plant is 16km to the east of Hailar, on the side of State Highway 301, producing various kinds of cement meeting with national standards. The cement can serve for roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well and the road is linked with State Highway 301.

	□-2	Zhucheng Cement Manufacturing Company	K575 +500	5		The company is 3km to the southwest of Manzhouli, yielding various kinds of cement, lime, limestone mine powder, and block and sliced reduced stone. The materials have good quality and can serve for roadbed and drainage and protection works.	Rich	Vehicle	The road condition is well.

(4) Fillings for roadbed

The earth resource for the roadbed is rich along the project line. The plain and slight hilly areas are mainly with sandy soil, and the hilly areas from Zalainuoer to Manzhouli are mainly with chip stone soil. Both can be allocated vertically by the highway line. The centralized earth borrowing yards will be set up for subsidy of the earth shortage.

There will be 9 earth borrowing yards and 2 waste earth yards. See Table 2-12 and Figure 2-8 for details.

Table 2-12 A List of Borrowing Yards and Waste Earth Yards

No.	Post No.	Location		Transport distance (m)	Quantity (m^3)		Newly built access road (km)	Location
		Left (m)	Right (m)		Borrowing	Waste earth		
Borrowing yards								
1	K404+900		200	3982	241317		0.20	Grassland
2	K416+000	600		2862	290768		0.60	Grassland
3	K433+300	250		11388	539163		0.25	Grassland
4	K489+000		2000	4782	80967.51	-	2.00	Grassland
5	K527+400	100	100	543	46618.6		0.20	Grassland
6	K541+000	200	200	2133	580529		0.40	Grassland
7	K546+000	200		912	297000		0.20	Grassland

8	K548+500	200		1286	363375		0.20	Grassland
9	K576+900		200	6	291855		0.20	Grassland
Waste earth yards								
1	K456+150	3000		4036 (4021)		60931.7 (26452.4)	3.00	Grassland
2	K511+600	500		1832 (703)		42096.2 (89457)	0.50	Barren land
	Total				2731593		7.75	

Note: The borrowing yards include the earthwork of interchanges. The values in brackets in waste earth are waste stonework. Both the earthwork and stone work of borrowing and waste discard are natural ones.

(5) Water supply and power supply

The river and lake resource is rich along the line, with good water quality and generally without any corrosively. Most of the towns, qi and villages along the line have tap water supply, and the engineering can be supplied by natural water and tap water from the towns and qi. The power network has been set up along the line at present and the supply situation is good.

(6) Steel, wood, cement, bitumen

The steel, wood, cement, bitumen and other materials for this project can be supplied by Hailar District. The AH-90 road asphalt is used which cannot be substituted by general bitumen for construction use.

Mixing yards and prefabrication yards are set up along the highway line, especially located at K426+000, K490+000 and K560+000, all far away from residences and other sensitive sites.

2.4.8 Land occupation situations

Based on Initial Design, the total land occupation for this project is about 807.6ha, including grassland and wetland 534.1ha (66.1%), forest land 2.7ha (0.3%), barren land 139.9ha (17.3%), existing road 116.1ha (14.4%), arid land 5.1ha (0.6%) and sand land 9.7ha (1.2%).

Table 2-13 Project Move and Land Occupation Estimation

Starting and finishing post No.		K397+000—K505+180	K505+180—K545+150	K545+150—K586+718	Total
Administrative area		Chenbaerhu Qi	Xinbaerhu Qi	Manzhouli City	
Land occupation (ha)	Grassland & wetland	320.3	120.4	93.4	534.1
	Forestland	-	-	2.7	2.7
	Barren land	104.1	20.5	15.3	139.9
	Existing road	80.2	8.1	27.8	116.1
	Drought land	-	-	5.1	5.1
	Sand land	-	9.7	-	9.7
Move	House (m^2)	60	90	208	358
	Electricity transmission line (places)	8		2	10
	High-pressure line (places)	8		3	11
	Long-distance optic cable (m)	500	200		700
	Level communication line (m)	500		300	800
	Cross communication line (places)	8		4	12

2.5 Investment Estimation and Capital Raising

According to the proposed scale and technical criteria, the total investment is 2134.5

million RMB. The funding sources include foreign loan of 90 million US dollars, Ministry of Communications subsidy of 838 million RMB, domestic bank loan of 400 million RMB, self-raising fund of 150 million RMB.

2.6 Analysis of Main Environmental Impact Factors

The environmental impacts on along the highway line during the Construction and Operation Periods are multiaspect, mainly including impact of vehicle gas exhaust on air environment; noise impact of mechanical operations and running of vehicles on the two sides of the line; destruction of ecological environment by land occupation, use of earth and stone, water and soil erosion from vegetation removing, etc. Other problems involve socioeconomic, surface water and transport and communication modes issues, etc. The environmental impact matrix is used to analyze the impact types and impact degrees of the environmental impact factors. The results can be seen in Table 2-14.

Table 2-14 Environmental Impact Matrix of Hailar-Manzhouli Section during the Construction and Operation Periods

Item		Construction Period						Operation Period		
		Roadbed Surface	Bridge culvert	Material & earth yard	Material transport	Mechanic operation	Construct. camp	Greening	Transport.	Mainte-nance
Social environment	Socio-economy				○	○			□	
	Labor employment	○	○	○	○	○		○	□	□
	Migration	●								
	Transportation	●	●	●	●	●		○	□	□
	Tourism development	●	●						□	
	Farming and herding	●		●				□		
	Land use	■		●			●		□	
	Cultural relics	●		●		●				
environ	Topology and landform	●	●	●						
	Soil	●		●						

Surface water hydrology			●							
Surface water			●			●	●	□	■	
Air environment					●	●		□	■	
Noise					●	●		□	■	
Eco-environment	Landscape	●	●	●			●	□		□
	Plant	●		●	●	●	●	□	■	
	Animal	●		●		●		□	■	
	Water & soil conservation	●	●	●		●		□		□
Wetland		●	●	●	●	●			■	

Note: □/○: Long-term/short-term favorable impact; ■/●: Long-term/short-term unfavorable impact; Blank: without obvious or determined impact.

According to *Temporary Specifications on EIA for Highway Construction Projects* and the specific situations of this project, the main assessment factors are screened and determined as follows:

- ⌘ Water environment: pH, COD, SS, oil
- ⌘ Ambient air: NO_2, TSP
- ⌘ Noise environment: L_{Aeq}
- ⌘ Eco-environment: landscape, animal, plant, soil

CHAPTER 3 ENVIRONMENTAL OVERVIEW AND CURRENT ENVIRONMENT STATUS ASSESSMENT

3.1 Overview of Social Environment

3.1.1 Economic status

(1) Economic structure

In 2002, the GDP of the whole Hailar is 2553.96 million RMB, with a growth rate of 13% over the last year. The value of the first, secondary and tertiary industries is respectively 231.79million RMB (growth rate 7.8%), 771.30million RMB (growth rate 15.9%) and 1550.87million RMB (growth rate 10.9%), with the ratio being 9.1 : 30.2 : 60.7. The secondary industries include building material, power generation, milk product, and brewery and food product. The agriculture mainly includes planting of grains crops, vegetables and stockbreeding. The income of tourism is 98.51million RMB.

In 2002, the GDP of Chenbaerhu Qi is 618.68 million RMB, with a growth rate of 13.1% over the last year. The value of the first, secondary and tertiary industries is respectively 244.10 million RMB (growth rate 24.8%), 164.51million RMB (growth rate 11.9%) and 210.07million RMB (growth rate 4%), with the ratio being 39 : 27 : 34. The total output value of agriculture, stockbreeding, forest and fishery is 384.36 million RMB. The industrial output value is 234.82 million RMB. The industrial products are raw coal, power generation, building materials and milk products.

In 2002, the GDP of Xinbaerhu Qi is 504.00 million RMB, with a growth rate of 18.2% over the last year. The value of the first, secondary and tertiary industries is respectively 248.00 million RMB (growth rate 2.5%), 100.00 million RMB (growth rate 126.4%) and 156.00million RMB (growth rate 10.3%), with the ratio being 49.2 : 19.9 : 30.9. The economy of the whole *qi* depends mainly on stockbreeding and farming. The industrial output value is 36.66 million RMB.

The economy of Manzhouli City mainly depends on trans-frontier trading, tourism, industry and agriculture. The main industrial products are raw coal, power generation, milk products and building materials. The agriculture includes crop planting,

stockbreeding and fishery. In 2002, the GDP of the whole city is 2.013 billion RMB, with a growth rate of 14.6% over the last year. The value of the first, secondary and tertiary industries is respectively 0.111 million RMB (growth rate 3.1%), 0.519 million RMB (growth rate 9.0%) and 1.384 million RMB (growth rate 17.9%), with the ratio being 5.5: 25.8: 68.7

(2) Farming and herding

The Hulunbeier League is the important farming product production base in Inner Mongolia. The arable land has increased from 150900 ha in 1949 to 1086000 ha in 2000, with the corresponding gross grain yield increasing from 165400 tons to 1754000 tons. In 1989, the League realized self supply of grains under the situation that the ratio of farming population to non-farming population was 1:1.47.

The livestock production in the League has developed into benefit-oriented pattern. In 2000, the League further developed milk, flesh and grass, by encouraging the farmers and herdsmen to develop milk industry, and actively introducing and planting good feed grass. It also realized mechanization of grass harvesting, which ranks the first in China. Although under the serious natural disaster in the winter of 2000, the total livestock was 5763000 in the year, increasing by 87000 (1.5%) on the base of the last year.

3.1.2 Cities and towns and the population distribution along the line

The cities and towns along the proposed project line include: Hailar District, Chenbaerhu Qi, Xinbaerhu Qi, Xinbaerhu Zuo Qi and Manzhouli City.

Hulunbeier League is located at the northeast of Inner Mongolia, spanning 630km from east to west, with an area of 253000 km^2, or 21.4% of the total area of Inner Mongolia. The League neighbors Xingan League to the south, links with Heilongjiang Province to the east, connects with Russia to the north and northwest, and adjoins Mongolia to the west and southwest.

Hailar District is the capital city of Hulunbeier, locating at the central west part of the league and in the hinterland of Hulunbeier Grass. It links with Yakeshi City to the east, and connects with Ewenke Qi to the south and neighbors Chen Qi to the northwest. At the end of 2002, the total population was 249600, including 23400 of agricultural population and 226200 non-agricultural population. There are 25 nationalities.

Chenbaerhu Qi is located in the northwest part of Hulunbeier League. It links with Yakeshi City and Erguna City to the east and northeast respectively, neighbors Hailar District to the southeast, and connects with Ewenke Qi and Xin Zuo Qi to the south and southwest respectively. It faces Russia to the northwest crossing the Erguna River. At the end of 2002, the total population was 56200, including 20000 of agricultural population and 36000 non-agricultural population. There are 19 nationalities.

Xinbaerhu Zuo Qi is located in the hinterland of southwest Hulunbeier Grassland. It links with Chen Qi and Ewenke Qi to the east, neighbors Kerqin Youqian Qi of Xingan League to the south, and connects with Xinyou Qi and Manzhouli City to the west and northwest respectively. It faces Russia to the north crossing the Erguna River, and neighbors Mongolia to the southwest. At the end of 2002, the total population was 39700, including 19700 of agricultural population and 20000 non-agricultural population. There are 12 nationalities.

Manzhouli City, a land route port city in China, is located in the west of Hulunbeier League. It faces Xin Zuo Qi to the east, neighbors Xin You Qi to the west and the south, and adjoins with Russia to the north. At the end of 2002, the total population was 154200, including 670 of agricultural population and 153000 non-agricultural population. There are 20 nationalities.

3.1.3 Living quality

With great progress of urban planning and management system construction, the living quality of urban and rural residents has greatly improved.

In Hailar in 2002, the per capita disposable income of urban residents was 6760 RMB, the per capita net income of farmers was 5124 RMB. In Inner Mongolia Autonomous Region in 2002, the per capita disposable income of urban residents was 6051 RMB, the per capita net income of farmers was 2086 RMB.

In Chenbaerhu Qi in 2002, the per capita disposable income of urban residents was 5036 RMB, the per capita net income of herdsmen was 3418 RMB.

In Xinbaerhu Zuo Qi in 2002, the per capita disposable income of urban residents was 4148 RMB, the per capita net income of herdsmen was 2194 RMB.

In Manzhouli City in 2002, the per capita disposable income of urban residents was 6451 RMB, the per capita salary of employees was 8354 RMB annually.

3.1.4 Employment

In 2002, there were 83573 employed persons in Hailar District, 5560 lai-off workers from state own enterprises (SOEs), 3724 persons receiving employment insurance. The urban registered unemployment rate was 4.6%.

In 2002, there were 760 lai-off workers and 742 re-employment cases in Chenbaerhu Qi. The urban registered unemployment rate in Chenbaerhu Qi and Manzhouli City was respectively 4.6% and 3.2%.

3.1.5 Education, culture and public health

In Hailar, the nine-year compulsory education is universal, with primary and middle school enrollment rate reaching 100%. There are 86 medical service institutions (containing medical units, clinics), including 17 hospitals and medical care centers, with 1526 medical beds. There are 7 sanitation and antiepidemic stations and 2 health centers for women and children.

In Chenbaerhu Qi, the nine-year compulsory education is universal, with primary and middle school enrollment rate reaching 100%. There are 15 medical service institutions, with 448 medical technicians and 183 medical beds.

In Xinbaerhu Zuo Qi, the primary school enrollment rate is 99.67% and the middle school entrance rate 80.69%. There are 17 medical service institutions, including 11 *sumu* medical care centers, with 246 medical technicians and 143 medical beds.

In Manzhouli City, the nine-year compulsory education is universal, with primary and middle school enrollment rate reaching 100%. There are 69 medical service institutions, including 10 hospitals and 1 medical care center, with 930 medical beds in hospitals. There are 3 sanitation and antiepidemic stations and 3 health centers for women and children.

3.1.6 Traffic environment

(1) Current status of regional comprehensive transportation

The infrastructures construction has had great advancement in Hulunbeier City, but still lagging behind relatively. There are 4 trunk railway lines, 3 branch railway lines and 2 liaison railway lines within Hulunbeier League. Two State Highways and 4 Province Highways form the main framework of highways. It also has Hailar Airport, a national Class 4C airport. Despite the rich mineral resource in Hulunbeier City, the

current transportation condition is still the key factor constraining the regional development of the City.

(2) Overview of current highways and existing problems

The existing highway, starting from Hailar District in the east to Manzhouli City in the west, is part of State Highway 301. The highway is 203km long, was re-built in 1994 according to Grade 3 highway. After seven years of operation and especially impacted by the disruption of extra large flood in 1998, the entire service level of the highway is low and currently being the co-existence of Grade 2 and Grade 3.

The technical criteria of existing highway, such as roadbed height and width, pavement width, intensity and smoothness, and line vertical slope, are low and the passing capacity is poor.

1. The roadbed height is relatively low, and the snow and flood proof capacity is poor;
2. The bitumen pavement is weathered, and part of pavement has cracking phenomenon;
3. The drainage and protection engineering is simple and insufficient, and the anti-disaster capacity is limited;
4. Part of sections with unfavorable geological conditions have the problem of frost heaving, soft base, saline soil and other highway diseases, to be completely innovated;
5. Some sections already being innovated, although having widen the roadbed and improved line pattern and pavement status, still have low drainage and protection criteria, unable to meet with flood discharge requirement, with low design standard in bridge and culvert loading e.g. having low width;
6. Some sections at mountain areas have poor level vertical line pattern, with zigzag turns and continuous urgent curves, and have frequent accidents;
7. Many existing line sections have become the streets, e.g. Hailar downtown section, Bayankuren Town section, Zalainuoer Mineral Area section and Manzhouli downtown section, with many level intersections, leading to disorder traffic, which has to be innovated.

3.1.7 Resource utilization

(1) Land resource

The overall characteristic of land resource in Hulunbeier League is its large quantity, with the land area accounting for 11.9% that of Inner Mongolia. The per capita land area is 8.82ha with per capita arable land 0.49ha, per capita forest land 4.50ha, per capita herding grass land 3.08ha, being 11.5times, 4.9times, 27.3times and 16.3times of national average values.

The proposed project line will go by Hailar District, Chenbaerhu Qi, Xinbaerhu Qi, Xinbaerhu Zuo Qi and Manzhouli City. The land use situations along the line are shown in Table 3-1-1 and Figure 3-1-1.

Table 3-1-1 Current Status of Land Use

Item	Hailar District	Chenbaerhu Qi	Xinbaerhu Zuo Qi	Manzhouli City
Total area (ha)	133271	1914048	1979626	69256
Arable land (ha)	19472	28802	3451	1835
Forestland (ha)	20705	86584	66187	2425
Grassland (ha)	81580	162198	1840460	56334
Urban industrial land (ha)	6254	1956	1827	7658
Transportation land (ha)	2142	11556	9948	55.6
Water area (ha)	2501	26846	47712	948
Others (ha)	4370	136320	10040	14.3
Population density (persons/km^2)	167	2.6	1.8	221

(2) Mineral resources

The mineral resources are rich in the proposed project area. Nine kinds with 43 species and 370 mineral sites of minerals have been explored or initially explored. Among the total mineral sites, 116 mines have been explored with total mineral reserve of 34.8billion tons (97% being coal), accounting for 14.8% and 2.9% of Inner Mongolia and national explored reserve respectively. The total potential value is 17853.361 billion yuan, or 1.3% of national value, ranking the 3rd in Inner Mongolia. The explored mineral reserve per territory area in the League is 7048400 yuan/km^2, being 0.7 of the national average and 0.64 of the autonomous region's average. The main minerals include coal, Au, Ag, Al, Cu, Pb, Zn, Fe, cement limestone, sodium sulfate, natural base, dolomite, fluorite, quartzite, and spring water, etc.

(3) Tourism resource

Hulunbeier League has many kinds of tourism resources with grasslands, forest landscape, ethnic feeling, and historic relics. The China-Russia and China-Mongolia

bordering line is long with numeric ports, having regional advantages of tourism along the open border. The natural tourism landscape is rich, having landscapes of grassland, forest, river, lake, mineral spring, rare plant and animal, mountain ridge and snow, etc. The forest area of Daxinganling Mountains is the largest natural forest with good protection and complete natural landscape in China. It is also a natural museum of wild animals. Hulun Lake, with an area of 2339km^2, is one of China's 5 large freshwater lakes and called "the Pearl on the Grassland". The wandering rivers of the Hailar River, the Yimin River and Morigele River have formed a special beautiful scenic on the grasslands. The bordering river, the Erguna River, also have beautiful landscapes as well as different feelings on both sides. The ports, borders and State Gates have formed the main tourism landscape. The exotic atmosphere of neighboring country, Russia, also attracts foreign and domestic tourists.

Hulunbeier League has developed a batch of important tourism scenic spots including Hulunbeier Grassland, forests, lakes, ports, minority nationalities, etc., forming the tourism development framework with the main contents of domestic tourism, international tourism, bordering tourism, and outbound travel, etc.

3.1.8 Cultural relics resource

An overall survey was once carried out in 1988-1996 for the cultural relics within Hulunberer City. The survey was accomplished by Inner Mongolia Cultural Relics Archaeological Institute, Hulunbeier League Cultural Relics Management Station (former Hulunbeier Cultural Relics Management Committee) and local cultural relic institutes at qi and counties. The reference historic documents during the survey include *History of the Liao Dynasty*, *History of the Jin Dynasty*, and *Hulunbeier Chronicles*, etc.

According to the survey report on cultural relics along the proposed alignment areas, which was conducted by the Hulunbeier Cultural Relics Management Committee, there are no important cultural relics and cemeteries along the road construction area. If cultural relics are found during the highway construction, the Construction Unit will take joint protective measures with the Hulunbeier Cultural Relics Management Committee. (See Annex 3)

3.2 Overview of Natural Environment

3.2.1 Geographical location

The proposed project is located in Hulunbeier City of Inner Mongolia Autonomous Region, starting from Hailar District, through Chenbaerhu qi, Xinbaerhu zuo qi and Manzhouli City, and ending at New Manzhouli Highway Port.

3.2.2 Topology and landform

The project area lies to the west of Daxing'anling Mountains, belonging to Hulunbeier Plateau landform area. The landform types are complex, including erosive and denuded low hilly area and denuded high plain (alluvial plain, lacustrine plain and sandy land, etc.).

(l) Erosive and denuded low hilly area: To the east and southeast of the project area is the low hilly area of the west foot of Daxinganling Mountains. The elevation is high, being 700-1000m, with the highest point at Mushroom Mountain at Ewenke Qi (1706m). The continuous rolling round mountains are mostly comprised of granite, basalt and rhyolite, etc. The flat mild slope rate is mostly at l0-200m. The north side of the project, i.e. to the north of the line Fenggang Second Team – West Wuzhuer – Touzhan Hotel, is Chenbaerhu Mountain with elevation of 650-1000m. The mountaintop is slightly flat, the valley is wide with the elevation of 650-700m. It is mainly comprised of igneous rocks such as granite, andesite, quartz trachyte and tuff, etc. At the west section of the project area and to the west of Hulun Lake and the Wulegening River, is plateau low hilly area, generally with elevation of 650-1000m, the mountain body has mainly igneous rocks. The peak of the mountains is bare with rocks, the top is round, and there are low-lying lands among the mountains. The valleys and low-lying lands have serious salification and alkalization, with thin coarse-soil surface layer.

(2) Denuded high plain: The wide alluvial and lacustrine plains from the starting point to Hulun Lake and the east of the Wulegening River belong to Hulunbeier high plain area. To the east and southeast of the area lie Daxinganling Mountains (with elevation of 700-1000m), and to the north are Chenbaerhu Mountains (with elevation of 600-1000m). The Hailar Platform that the proposed project passes forms the main body of Hulunbeier high plain. In the project area that the Hailer River flows through, wide flooding plain is formed on both sides of the riverbed. The river valley is 4-l0km wide, with meandering watercourse. The low-elevation flood plain is developed, generally 1-2m higher than the water surface, and over the low plain are mostly marshes and some oxbow lakes. The Hailar River develops 2-grade terraces. The primary terrace is linked with flooding plain and has the elevation 5-10m higher than the flooding plain. The secondary terrace is outside the primary terrace and has the elevation 30-50m higher than the flooding plain.

In the low area, there are numeric lakes, marshes and wetlands. The area to the north of the Hailar River has meandering surface relief. The surface elevation gets increasing from the west to the east. The area to the south of the Hailar River is broad and level, forming wind accumulative sandy lands along Wulijietu – Huangde –

Wugunuoer – Hailar West Mountain. Moving and semi-stationary sandy dunes are scattered in the area. The relative height of the dunes is 5-20m, and windward side mostly faces the northwest or southwest.

3.2.3 Geological characteristics

The stratums in this project area include rocks in Upper Proterozoic group, Ordovician system, Jurassic system, Cretaceous system, Quaternary system and intrusive rock.

The first grade structural unit of this project area belongs to Paleozoic geosyncline fold zone of Tianshan Mountain – Mongolia – Xingan. The second grade structural unit belongs to Erguna Xingkai geosyncline fold system and Xiguituqi Hualixi geosyncline fold zone, which can further be divided into two third grade structural units, i.e. Xiguitu anticlinorium and Hailar Mesozoic and Cenozoic era sag.

The fracture structure in the project area develops, in which the fracture activity in the middle stage of Hualixi and early Yanshan is most obvious and intense.

The small and medium seismic activity is frequent in the project area. In the history, there are 59 earthquakes with magnitude of 3 or higher, 261 earthquakes with magnitude of 2.0-2.9, 596 earthquakes with magnitude of 1.0-l.9. The maximum magnitude is 5. The spatial distribution of the earthquake activity is generally controlled by Debuergan major dislocation and regional dislocation, mostly occurring at or nearby the fracture zone. According to *China Earthquake Intensity Zoning Maps* (1990), the project area has the earthquake intensity of VI degree.

The unfavorable and special geological conditions in the project area include sand storm, saline and alkali soil, marsh muddy soil and humic soil, etc. The sand storms are mainly distributed on the south side of the Hailar River, the sand belt is spread with nearly east-west belt, mostly being semi-stabilized sand dunes, sand posts and sand ridges. The land is mainly slight-wet sandy land, with sand chains. The saline and alkali soil, mainly being alkali soil, is mainly distributed at river valley low lands, lake basin low lands, and closed-flow low lands. The component is mainly lake and marsh sediments in Holocene series. The marsh muddy soil and humic soil is distributed in the flooding land of the Hailar River, mainly with alluvial and sediment mixture in Holocene series. It then was transformed into marsh environment. The main components are powder-fine grit and muddy soil, having rich organic matters, and with the thickness of 2-5m.

3.2.4 Climate and meteorology

The project area belongs to warm temperate zone continental monsoon climate, with long winter and short summer. The spring and autumn seasons are nearly linked and the change of temperature is very great. The average yearly temperature is -2.l □. The average monthly temperature is -26.8□ in January , 19.9□ in July, with the annual range of 46.7□. The historic extreme highest and lowest temperature is 40.l □ (1919) and -49.3□ (1922) respectively. There are 224.7 days with temperature below 0.0□ in a year, 47.4 days with temperature below -30□, and 6.3 days with temperature below -40□. The total annual radiation is 5283.0 MJ /m^2, annually averaged daily sunshine 2864.3h, annually averaged sunshine rate 64.3%, annually averaged evaporation l326.5mm. The annual average earth temperature is 0.l3□, extreme highest earth temperature 69.5□(1968.7.9), extreme lowest earth temperature -50.8□(l969.1.29) and biggest frost earth depth 389cm.

The average yearly amount of precipitation is 317.5mm, mainly from June to August in the summer, during which the precipitation accounts for 70% of the annual precipitation. The annual snowfall time is 37.6d, average annual snow accumulative time l42.0d, and maximum accumulative snow depth 39cm. The annual average frost-free time is 99.3d, with the first frost occurring in early September and last frost in late May. The annual average wind speed is 3.4m/s, with the maximum wind speed of 25.7m/s under the direction of NWW. The leading wind direction is SW-S. The annual average strong wind time is 22.ld, with the maximum value of 98d. The annual average hail time is 1.8d, with maximum of 6d. The annual average thunderstorm time is 24.1d, with maximum value of 42d and minimum value of 1d. The annual average first thunderstorm is in late May and last in middle September..

3.2.5 Hydrology

The surface water system of the proposed project area belongs to that of the Erguna River, which is the upper source of the Heilongjiang River. The Haier River and the Dalaneluomu River merges at nearby Abagaitu Mountain and forms the Erguna River. The mainstream of the river is the boundary river between China and Russia, with the right and left banks respectively belonging to China and Russia. The main surface waters include the Hailar River and Hulun Lake. The regional surface water system is shown in Figure3-2-1.

a. Hailar River: The river originates from the west foot of Jieleqilaoshan of Daxinganling Mountains in the Yakeshi City. The elevation is 1322m, the river length 715km, and the watershed area 54537km^2, accounting for 1/3 of the Erguna River water system. It flows through 6 cities (qi), including Yakeshi City, Ewenke Qi and

Manzhouli City. When the Hailar River flows from east to west to Abagaitu Mountain in the north of Zalainuoer, it merges with the Dalaneluomu River, and turns direction to the northeast. This is then called the Erguna River. The Hailar River watershed has the form of fan, the river network is centralized at the east half, the outer margin is semi-circular, and the river valley has U type. On both sides of the river are terraces with relative height difference of 20m. The river valley is wide at 3-5km, with flat slope. The shearing force of downstream is weak. The main branch of the Erguna River include Moergele River on the north side and the Yimin River and the Huihe River, etc. on the south side.

b. Hulun Lake water system: It is one component of the Erguna River water system and used to be one of the origins of the Erguna River. Only after the impact of earth crust movement, the lake area subsided, the lake water level decreased, the lake water stopped flowing out, temporarily disconnected with the Erguna River, and formed independent water system. In late 1950s and early 1960s, the lake water level increased, the lake water surface expanded, the lake water again flowed into the Erguna River through the Dalaneluomu River, and the lake then became outflow water system. In late 1960s and 1970s, the lake water level decreased and the lake again stopped flowing out. From 1984, the lake level again increased and the water flowed into the Erguna River and finally into the sea. The water systems of Hulun Lake and the Erguna River some times are interconnected and form a common water system and sometimes are independent. But in general, the lake belongs to the outflow water system of the Erguna River. The main branches of Hunlun Lake are the Krlulun River and the Wuerxun River.

3.2.6 Natural disaster

(1) White disaster

The white disaster is caused by heavy accumulation of snow that covers the herding grass and makes the animals not able to obtain food and finally die of hunger. The regional livestock farms are areas with serious and frequent white disaster, which has resulted in serious loss in livestock production in the region.

(2) Drought disaster

The project area is located in inland high plateau, controlled by drought continental air mass for 7-8 months each year. The annual average precipitation is 250-350mm, with decreasing trend from east to west. On the other side, the evaporation is 1400-1900mm, much greater than the precipitation. The drought possibility is very high mainly in the spring. In some years, small precipitation in the summer and autumn can cause drought in the two seasons, thus affecting the yield of herding grass. The

drought can also reduce the river and lake water amount and shrink the scope of wetlands, limiting the activities and habitats for rare wild animals.

(3) Black disaster

After the ice slush or ice freezing in the rivers and lakes formed in early winter, there is less snow or even no snow for continuous days, which makes difficult for the humans and animal to drink water, and the grass farms unable to be utilized without water, forming “black disaster”. The black disaster can affect the production of herding for some degree.

3.3 Surface Water Environment Baseline

3.3.1 Overview of surface water environment

(1) Hydrology

The main highway sections of the proposed project are located in the Hailar River basin. The highway goes along the mainstream of the Hailar River. The east part of section spans across the Morigele River of the branch stream of the Hailar River at nearby Huhenuoer, and the west part of the section spans across the Xinkai River.

The Hailar River originates from the west foot of Jieleqilaoshan of Daxinganling Mountains in the Yakeshi City. The origin lies at east longitude 122°28′ and north latitude 49°57′, with an elevation of 1300m. The river length is 715km, and the watershed area 54537km^2, accounting for 1/3 of the Erguna River water system. The annual run-off is 3.13billion m^3, annual maximum flow 1800m^3/s, annual minimum flow 0, and annual freezeup period 150d. It flows through 6 cities (qi), including Yakeshi City, Ewenke Qi and Manzhouli City. When the Hailar River flows from east to west to Abagaitu Mountain in the north of Zalainuoer, it merges with the Dalaneluomu River, and turns direction to the northeast. This is then called the Erguna River.

The monthly averaged flows of the Hailar River for years are shown in Table 3-3-1.

Table 3-3-1 Monthly Averaged Flow of the Hailar River Unit: m^3/s

Month / River	1	2	3	4	5	6	7	8	9	10	11	12
Hailar River	1.80	0.96	1.38	55.9	112	101	130	134	136	77.3	19.5	6.05

The Morigele River originates from the west foot of Daxinganling Mountains. The origin lies at east longitude 121□00′ and north latitude 50□03′, with an elevation of 1040m. The river length is 319km, and the watershed area 4987km^2. The river flows through the whole Chenbaerhu Qi in the direction from northeast to southwest, with the watershed area being flat and wide. The river slope is small and the waterway twists and turns, especially called “the first zigzag water on the earth”. On both sides of the river are beautiful grasslands and good natural meadows. The river flows into Huhenuoer Lake at the downstream, and flows out of the lake before merging into the Hailar River.

The Xinkai River is a man-made canal constructed from June 1965 to September 1971, replacing the old stream way of the Dalan’eluomu River. It starts from the foot of Heishantou Hill to nearby Shazishan Hill, with a length of 16.4km. Across the canal, the drainage inlet gate and outlet flood detection gate have been established. When the water level of the Hailar River is higher, the water flows through the Xinkai River into Hulun Lake,. Otherwise, when the water level of Hulun Lake is higher, the water flows through the Xinkai River into the Hailar River.

(2) Major polluters

The major water polluters along the proposed project line are shown in Table 3-3-2.

Table 3-3-2 Major Water Polluters along the Highway Line

Name of Enterprise	Wastewater discharge (10000t/a)	Discharge of pollutant (t/a)		
		COD	NH_3-N	SS
Maorixile Coal Mining Company	1136.7	3606.6		7533.2
Zalainuoer Coal Mining Company	404.8	868.3		603.4
Hailar Chenming Paper Company	350.0	5250.0		700
Manzhouli Lingquan Power Plant	104.6	116.1		66.2
Hailar Bewery Group Comapny	98.4	85.2		
Hulunbeier Sanyuan Milk Product Company	44.2	21.7	0.34	6.0
Hailar Junlong Plant Protein Company	41.6	31.6	0.27	
Hailar Thermoelectric Plant	22.7	11.3		
Hailar Shanghai Yuansheng Food Product Company	1.8	30.8		1.6

The total wastewater discharge was 21.2 million t in Hailar District in 2000, including 9.5 million t industrial wastewater. Total COD discharge was 8260 t, all discharged into the Hailar River.

3.3.2 Current status monitoring for surface water

(1) Monitoring sections

Three monitoring sections were set for surface water along the proposed highway line. The detailed positions of them are shown in Table 3-3-3 and Figure 3-3-1.

Table 3-3-3 Position of Monitoring Sections for Surface Water Environment

No.	Name of the River	Name of the Bridge	Position of section
1	Morigele River	Huhenuoer Bridge	K432+764
2	Hailar River	Hailar River Bridge	K550+900
3	Xinkai River	Xinkai River Bridge	K551+620

Note: During the monitoring period, the Morigele River was frozen and cut-off, and thus the monitoring data in the in level water period in the autumn in 2001 are referred. As there have been no major change in the environment along the river and there are no new polluters, the water quality has no major change.

(2) Monitoring time and frequency

The monitoring of current status of surface water was carried out from December 6~8, 2002.

Monitoring in 3 continuous days, with one sampling a day.

(3) Monitoring items and analysis methods

Considering the characteristic pollutants in the wastewater and the characteristics of the regional surface water, 4 items (factors) are selected for monitoring, i.e. pH, SS, COD and oil. The analysis methods are shown in Table 3-3-4.

Table 3-3-4 Surface Water Monitoring Items and Analysis Methods

Monitoring item	Analysis method	Minimum detected limit
PH value	Glass electrode method	-
SS	Filter membrane method	-
COD	Potassium dichromate method	5 mg/l
Oil	Infrared spectrophotometry method	0.04mg/l

3.3.3 Current status assessment of surface water

(1) Assessment standard

The Class III standard of *Surface Water Environmental Quality Standards* (GB3838-2002) is adopted for surface water assessment.

(2) Assessment method

Single Pollution Index Method carries out the assessment.

$$P_i=C_i/S_i$$

Where, P_i ----pollution index for assessment factor i;

C_i----concentration value of assessment factor i;

S_i----assessment criterion for assessment i.

For pH:

$$P_i= (7.5-C_i) / (7.5-S_{sd}) \qquad (C_i \leq 7.5)$$

$$P_i= (C_i-7.5) / (S_{su}-7.5) \qquad (C_i > 7.5)$$

Where, S_{sd}----lower limit of pH stipulated by the standard;

S_{su}----upper limit of pH stipulated by the standard.

(3) Monitoring results and assessment

The statistics and assessment of monitoring results are shown in Table 3-3-5.

Table 3-3-5 Statistics of Monitoring Results for Current Status of Surface Water

Unit: mg/l (excluding pH value)

Section \ Item		pH	SS	COD	Oil
Morigele River	No. samples	3	3	3	3
	Average value	7.68	75	33.4	ND.
	Pollution index	0.12		1.67	0.4
Hailar River	No. samples	3	3	3	3
	Average value	6.90	18.7	61.6	ND.
	Pollution index	0.19		3.08	0.4
Xinkai River	No. samples	3	3	3	3
	Average value	7.79	45	69.3	ND.
	Pollution index	0.4		3.47	0.4
Dalai Lake	No. samples	3	3	3	3
	Average value	7.70	34	43.6	ND.
	Pollution index	0.4		2.2	0.4
Assessment criteria		6-9		20	0.05

Note: ND. means not detected.

The rivers under monitoring have been polluted by organic pollutants obviously. All the COD values exceed national standard value, belonging to Class V or worse water body. The reasons for the water quality pollution of the rivers include:

(1) The Morigele River is a river flowing through the grasslands, with small river run-off. The rotten matters from riverbed scouring and non-point sources, feces of cattle and sheep, and drinking water by plenty of cattle and sheep in the rivers have contributed to the increase of organic pollutants in the rivers and the high concentrations of COD measurement.

(2) The water pollution is serious in the Hailar River under drought period with very small flow, affected by industrial and residential wastewater discharge from Yakeshi, Dayan and Hailar cities along the river. The problem has been paid high attention to by various levels of governments. A plan of integrated control for the river basin has been formulated, and treatment engineering projects will be kicked off from now on. The aim is to obviously improve the water quality in the river in 2 to 3 years.

(3) The Xinkai River is the flood drainage river for Dalai Lake. The natural eutrophication in Dalai Lake has led to high COD concentration in the lake. Also,

in the freezing periods, the ice accounts for a big proportion in the total water volume, having obviously resulted in further enrichment of pollutants.

3.4 Air Environment Baseline

3.4.1 Survey of current status

3.4.1.1 Topology and landform

Along the highway line of Hailar-Manzhouli Section are low-relief hills and undulating Hulunbeier High Plain. On the south side of the highway is Hailar river valley, and there is an east-west stabilized and semi-stabilized sand belt on the south bank of the Hailar River. The surface relief along the line is high in the east and low in the west, with the elevation of Hailar District in the east being around 610m, and the lowest elevation at Zalainuoer (nearby Dalai Lake) being about 550m. From Zalainuoer to Manzhouli City, the relief increases and reaches an elevation of about 600m at Manzhouli.

3.4.1.2 Main polluters

The regions that generate air polluters along Hailar-Manzhouli Highway Section include Hailar District, Bayankuren Town and Manzhouli City.

There is a non-agricultural population of 226000 in Hailar District. The main air polluters include: industrial coal-burning boilers in large enterprises such as Hailar Thermoelectric Plant, most of which have installed dust collectors for boilers and the emission of smoke dust and SO_2 is up to the standard; small heating boilers in some enterprises and institutions, residential areas and hotels and restaurants, only a small amount of which have installed dust collectors with dust emission in compliance with the national standard; low-chimney air pollution from residential stoves. The pollution in Hailar District belongs to coal-smoke pattern. The centralized heating area reaches 2.5 million m^2 in the district, which in combination with the use of liquefied petroleum gas (LPG) has greatly alleviated the air pollution in the district, making the air quality basically meet with Class II standard requirements. The annual emission of smoke dust and SO_2 was respectively 14280 t and 9633 t in Hailar District in 2002.

There is a population of more than 10000 in the town area of Bayankuren Town. There are not many industrial enterprises in the town. The air polluters mainly include small heating boilers and low-chimney emission from residential stoves. The air quality can meet with Class II of national air quality standard.

There is a non-agricultural population of 151000 in Manzhouli City. The main air polluters include: Lingquan Power Plant which has waste gas emission in compliance

with national standards; industrial and heating boilers in Zalainuoer Coal Mining Company, the old enterprise that has out-of-date dedustors equipped on the boilers and the smoke dust dedusting rate of less than 50%; and some small industrial and heating boilers in small enterprises and institutions and low-chimney air pollutant emissions from residents. The city is of smoke-dust pollution pattern. After the expanding construction of Manzhouli City Guangming Thermoelectric Company, the centralized heating area of the city will reach more than 1 million m^2, so as to improve somewhat the air quality, making it basically meet with Class II standards. The annual emission of smoke dust and SO_2 was respectively 4442 t and 3725 t in Manzhouli City in 2002.

3.4.1.3 Air environmental functional zoning

Class 2 standard of *Ambient Air Quality Standards* (GB3095-1996) is applied for Hailar District, Bayankuren Town and Manzhouli City along the proposed project line.

3.4.2 Current status monitoring for air environment

3.4.2.1 Layout of monitoring sites

According to the requirements of the TOR for this EIA, representative sensitive sites within 200m along the project line are selected for monitoring of current status of air environment. The monitoring sites and monitoring items are shown in Table 3-4-1 and Figure 3-3-1.

Table 3-4-1 Monitoring Sites for Current Ambient Air Quality

No.	Post No.	Position	Distance to central line of the highway (m)	Note (No. households, sensitive sites)
1	K493+400	West Wuzhuer Sumu	76m to the left of the highway	256 households and 1195 people in total
2	K557+800	Zalainuoer Mineral Area Hospital	About 140m to the fences on the left side of the highway	4 floors, with 260 medical beds; about 100m to the fences of the in-patient building

3.4.2.2 Monitoring time and frequency

Three continuous days with non-abnormal meteorological conditions were selected to perform monitoring.

The time duration: December 5~8, 2002.

Frequency: 18h continuous sampling and monitoring for each day for TSP and NO_2.

3.4.2.3 Monitoring items and monitoring methods

Monitoring items: TSP and NO_2.

Monitoring and analysis methods: adopting the methods stipulated by the national standards.

3.4.2.4 Monitoring results

The monitoring results are shown in Table 3-4-2.

Table 3-4-2 Monitoring Results of Current Status of Air Environmental Quality

Unit: mg/m^3

Monitoring site	Monitoring time	NO_2	TSP
West Wuzhuer Sumu	Dec. 5~6	0.001	0.037
	Dec. 6~7	0.005	0.013
	Dec. 7~8	0.026	0.055
	3-d average	0.010	0.035
Zalainuoer Mineral Area Hospital	Dec. 5~6	0.001	0.053
	Dec. 6~7	0.016	0.098
	Dec. 7~8	0.183	0.121
	3-d average	0.067	0.091

3.4.3 Current status assessment for air environment

3.4.3.1 Assessment factors

The assessment factors for current status of air environment are TSP and NO_2.

3.4.3.2 Assessment standard

The assessment of TSP and NO_2 adopts Class II standard of *Ambient Air Quality Standard* (GB3095-1996). The assessment criteria are shown in Table 3-4-3.

Table 3-4-3 Air Environmental Quality Assessment Standards Unit: mg/m^3

Valuing time	TSP	NO_2
Daily average	0.30	0.12

3.4.3.3 Assessment methods

(1) The rates and times of exceeding the allowable limits for individual items are calculated.

(2) Single Pollution Index Method is adopted to perform the assessment. The formula is as follows:

$$I_i = C_i / S_i$$

Where, C_i ----concentration of pollutant i;

Si ----assessment standard of pollutant i;

I_i<0.5 means clean;

0.5< I_i<1 means basically clean;

I_i>1 means already polluted.

(3) The pollution load coefficients of individual pollutants are calculated to identify main pollutants. The formulae are as follows:

$$K_i=I_i/I\times100\% \qquad I=\Sigma I_i$$

Where, K_i----load coefficient of pollutant i;

I ---- sum of load coefficients of all the pollutants.

3.4.3.4 Assessment results

The assessment results are shown in Table 3-4-4, table 3-4-5 and Table 3-4-6.

Table 3-4-4 Assessment Results of Current Status of Air Environment

Monitoring site	TSP		NO_2	
	3-d average (mg/m^3)	I_i	3-d average (mg/m^3)	I_i
No. 1	0.035	0.12	0.010	0.08
No. 2	0.091	0.30	0.067	0.56
Result	Clean		Basically clean	

Table 3-4-5 Statistics of Ambient Air Quality Monitoring Results

Unit: mg/m^3

Monitoring site	Item	Daily average concentration scope	Exceeding rate over the standard (%)	Reasons of exceeding the standard
No. 1	TSP	0.013□0.055	0	The one-time NO_2 measurement at No. 2 monitoring site exceeds the allowable limit. The main reasons are: the strong
	NO_2	0.0005□0.026	0	
No. 2	TSP	0.053□0.121	0	

	NO_2	0.001□0.183	33.3	temperature inversion at that day, making air pollutants difficult to be diffused; one vehicle parking nearby the monitoring site for downloading the goods. Both made the NO_2 measurement exceeding the allowable limit and high TSP measurement value.

Table 3-4-6 Statistics of Air Pollutant Load Coefficients

Item	TSP	NO_2
Pollutant load	0.40	0.60

3.4.3.5 Conclusions

(1) The daily averaged TSP concentration in the assessment area is below the national standard limit. The one-time NO_2 measurement at one monitoring site exceeds the allowable value. This is mainly caused by special weather conditions (temperature inversion). The ambient air quality in the assessment area is basically clean and basically meets with national Class II standard.

(2) As seen from the statistics table of pollutant load coefficients of individual pollutants, the load coefficient of NO_2 and TSP in the assessment area is basically 60% and 40%, showing that the pollution of NO_2 is slightly heavier than that of TSP, which is a result of special one-time measurement values.

3.5 Noise Environment Baseline

The main noise source is traffic noise. The noise monitoring siting principle is “using individual points to represent the entire line”. Reprehensive residents and hospitals at sensitive sites along the highway line are selected for monitoring of current status of noise environment. See details as follows.

3.5.1 Monitoring points

According to the noise sensitive sites within 200m to the central line of the highway and their function requirements, 5 monitoring points are identified for noise environment monitoring. See Figure 3-3-1.

3.5.2 Monitoring item

The monitoring item: equivalent sound level.

3.5.3 Monitoring time and frequency

Monitoring time: January 15~16, 2003.
Monitoring frequency: two time intervals respectively representing the daytime and night.

3.5.4 Monitoring and analysis methods

The monitoring and analysis are based on *Urban Ambient Noise Measurement Methods* (GBIT14623□93). The noise is assessed using continuous equivalent sound level and statistical sound level (L_{1O}, L_{50}, L_{90}).

3.5.5 Monitoring results

The positions of noise monitoring points are listed in Table 3-5-1, and the monitoring results are shown in Table 3-5-2.

Table 3-5-1 Positions of Ambient Noise Monitoring Points

No.	Post No.	Position	Distance to the highway central line (m)	Note (No. households, sensitive sites)
1	K404+300	Haotetaohai Brach Farm	About 44m on both sides	475 households 1662 people
2	K409+700	The Fifth Team of Haotetaohai	About 46m on the left side	42 households 138 people
3	K493+400	West Wuzhuer Sumu	About 76m on the left side	256 households 1195 people
4	K505+500	Yihe	About 60m on the left side	17 households 58 people
5	K557+800	Mineral Area Hospital	About 140m to the fences on the left side	4 floors, 260 medical beds, about 100m to the fences of the in-patient building

Table 3-5-2 Monitoring Results Statistics Table Unit: dB(A)

Moni-toring point	Monitoring item	Daytime (14:10--17:00)				Night (21:30--02:30)			
		15.Jan	Note	16.Jan	Note	15.Jan	Note	16.Jan	Note

Haotetaohai Brach Farm	Leq	64.4	Vehicle flow: 2.4 vehicles/min	62.2	Vehicle flow: 1.6 vehicles/min	40.5	Vehicle flow: 0.4 vehicle/min	39.5	Vehicle flow: 0.2 vehicle/min
	L_{90}	41.8		41.5		34.3		35.4	
	L_{50}	51.5		48.5		37.1		36.4	
	L_{10}	67.6		64.8		42.5		41.3	
The Fifth Team of Haotetaohai	Leq	61.1	Vehicle flow: 2 vehicles/min	63.1	Vehicle flow: 3 vehicles/min	52.7	Vehicle flow: 0.4 vehicle/min	51.3	Vehicle flow: 0.6 vehicle/min
	L_{90}	40.4		43.6		35.1		41.0	
	L_{50}	52.1		54.9		44.4		45.5	
	L_{10}	64.8		68.5		56.5		55.4	
West Wuzhuer Sumu	Leq	45.6	Vehicle flow: 0.4 vehicle/min	53.5	Vehicle flow: 0.4 vehicle/min	41.1	Vehicle flow: 0.4 vehicle/min	43.5	Vehicle flow: 0.4 vehicle/min
	L_{90}	33.8		34.8		32.8		37.0	
	L_{50}	37.3		40.1		36.5		40.9	
	L_{10}	49.9		60.0		44.5		46.9	
Yihe	Leq	51.1	Vehicle flow: 0.2 vehicle/min, with dog barks	61.4	Vehicle flow: 1 vehicle/min, with dog barks	39.2	Vehicle flow: 0 vehicles/min	45.8	Vehicle flow: 0.4 vehicle/min
	L_{90}	41.0		41.3		38.0		39.6	
	L_{50}	46.4		44.1		38.8		41.8	
	L_{10}	55.8		63.3		39.5		48.8	
Mineral Area Hospital	Leq	63.5	Vehicle flow: 1.6 vehicles/min	55.5	Vehicle flow: 1.4 vehicles/min	50.7	Vehicle flow: 0.4 vehicle/min	54.6	Vehicle flow: 1.8 vehicles/min
	L_{90}	50.8		54.4		47.4		42.4	
	L_{50}	54.5		58.5		48.0		46.9	
	L_{10}	63.5		69.1		53.6		55.1	

3.5.6 Assessment of current status of noise environment

(1) Assessment standard

The noise assessment for residences in the Operation Period implements Class 4 standard of *Standards on Ambient Noise in Urban Areas (*GB3096). The noise assessment for hospitals in the Operation Period implements Class 1 of the standard.

Table 3-5-3 Noise Environment Assessment Standard

Limit in the Operation Period Unit: dB (A)

Classification or sensitive targets	Daytime	Night

GB3096-93, Class 4	70	55
GB3096-93, Class 1	55	45

(2) Assessment results

The monitoring results are shown that the daytime noise at Haotetaohai Brach Farm, the Fifth Team of Haotetaohai, West Wuzhuer Sumu and Yihe is ranging between 45.6~64.4 dB (A), and night noise between 39.5~54.7 dB (A). The noise environmental quality can meet Class 4 limit values. The daytime noise at the enclosure of Zalainuoer Mineral Area Hospital is ranging between 63.5~65.2 dB (A), and night noise between 50.7~54.6 dB (A), higher than Class 1 standard limit. This is mainly contributed by heavy highway traffic of Zalainuoer Mineral Area on the south side of the hospital.

3.6 Ecological Environment Baseline

3.6.1 Survey of landscape ecology types

(1) Composition of ecological landscape types

Based on satellite RS and GIS techniques and in combination with field survey, the ecological landscape types have been investigated within the project region, with the survey scope of 11470.0ha, which covers the area within 300m to both sides of the highway and that within 100m around the borrowing and waste earth yards. The main landscapes are grassland landscape, wetland landscape, forestland landscape, sand landscape, human building landscape, and arable land landscape. The area of the landscapes is shown in Table 3-6-1 and Figure 3-6-2.

Table 3-6-1 The Mix of Ecological Landscapes in the Assessment Area

Landscape type	No. patches	Occupied area (ha)
1. Grassland landscape		7386.6
High coverage	30	7144.4
Middle coverage	9	177.9
Low coverage	7	64.3
2. Wetland landscape		3235.2
Riverbank shrub forest	6	273.7
wetland	4	83.9
River wetland	14	204.5
Lake wetland	32	2587.1
Reed and weeds marsh	8	86.0
wetland		

River and lake lowland salina		
3. Forestland landscape		26.3
Wooded land	2	18.1
Sparse wood land	1	8.2
4. Human building landscape		673.3
Urban land use	1	60.5
Farming and herding residences	4	166.4
Industrial & traffic construction	9	346.4
5. Sand landscape	26	170.3
6. Arable-land landscape	9	72.5

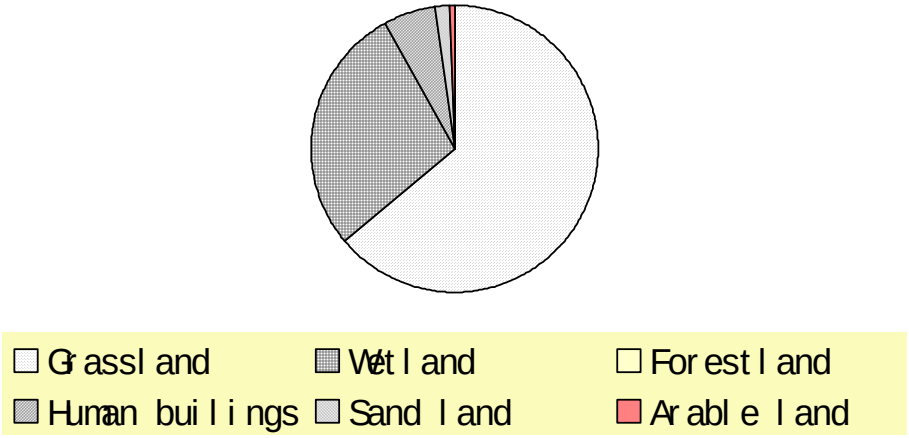


Figure 3-6-1 Mix of Ecological Landscape in the Assessment Area

(2) Landscape distribution and characteristics

The first landscape in the project area is grassland landscape, with a total area of 7386.6 ha, or 64.4% of the total assessment area. The grassland is the main component of Hulunbeier Grassland area, forming important base of landscape in the area. Continuous and large grasslands, with small number of patches, characterize the landscape. It is classified into high, middle and low coverage grassland. The high coverage grassland has biggest area, accounting for 96.7% of the total grassland landscape area and distributed over the wide hills and high plains in the area. The middle and low coverage grasslands have small area, only accounting for 3.3% of the

total grassland landscape area and distributed nearby the residential areas and other plots with more human activities.

The second landscape is wetland landscape, characterized by huge wetland area, relatively centralized distribution, a good number of patches forming the wetland landscape, rich bio-resources, high biodiversity and bio-productivity, and sound stability of ecosystem structure. The wetland ecosystem includes Huhenuoer Lake, Benpo Lake, Erka Wetland, the Morigele River, the Hailar River, the Xinkai River and their flooding lands, etc., with a total area of 3235.2ha, accounting for 28.2% of the total assessment area. The wetland landscape can be classified by vegetation form and wetland type into lake wetland, river wetland, riverbank shrub forest wetland, reed and weeds marsh wetland, river and lake lowland salina. There is a big marsh wetland on the sides of the Morigele River, growing with dense reeds. Erka Wetland has rich aquatic vegetation, shrub vegetation, marsh vegetation and meadow vegetation, etc., with integrated ecosystem structure.

The forestland landscape includes mainly pinus sylvestris var mogolica**,** man-made forest, sand small arbor forest, etc., with an area of 26.3ha, accounting for 0.23% of the total assessment area.

The sand landscape has an area of 170.3ha, accounting for 1.48% of the total assessment area. This includes bare sand landscape and stabilized and semi-stabilized sand landscapes. The patches are small in area and the landscape has high degree of fragmentation. There is a bare sand landscape distributed in belt form along the Hailar River, and there are also patch-form sand lands by State Highway 301 and on the grasslands, being moving sand dunes or semi-stabilized sand dunes.

The area of human building landscape is 673.3ha, accounting for 5.87% of the total assessment area. This kind of landscape does not have big proportion in the project assessment area, and mainly includes residential areas of cities, towns and sumu, and landscape of highways, natural roads and construction land uses. Examples are Bayankuren Town (city and town landscape, the capital of Chenbaerhu Qi) , Taohai pasture land (residential area), and Old Highway 301 from Hailar to Manzhouli.

The arable land is mainly dry-farming farmland, with an area of 72.5ha or 0.63% of the total assessment area.

3.6.2 Survey of vegetation

Hulunbeir Environment Mornitoring Station has moninitored the vegetation of this assessed area for years. By field investigation and analysis of series samples from

percific area in different period, the Station has accieved much valueable data, which helps to discribe the general vegetation situation of the assessed area.

(1) Plant resources

Based on an overview of the plant resources in the project area, there are a total of 440 species of wild advanced plants, respectively belonging to 240 genera and 66 families. The plant families and genera are rich but with less variety, many genera being monotypic or oligotypic genus. The Compositae family has most numerous varieties with 71 species. At the next places are Gramineae, Leguminosae and Rosaceae families. The first 4 families cover 41% of all the species, and the first 10 families have a percentage of 65%. There are 23 families that contain only one species. The genera of Artemisia and Potentilla have most species, each having 16 species. The genus of Carex, Allium, Iridaceae, Vicia, Astragalus, Saussurea and Poa are next to them, all having 5 species. Each of other genera has less than 5 species. There are few rare plants or endangered plants under key conservation. But pinus sylvestris var mogolica is a national protection species, which is tolerant to drought, frost and low nutrient and grows fast. The species is mainly founded on the stabilized sand dunes in the medium stream of the Hailar River. It grows more easily in the east rather than in the west. There are no pinus sylvestris var mogolica within 200m along the project line.

Among the plants in the region, 305 species are medicinal plants, including 32 species of common Chinese medicines and 10 common Mongolian medicines. There are also 50 species of good meadows, 20 edible wild plants and 32 fancy species.

There are 24 cultivated plants, mainly being potato, carrot and tomato.

(2) Flora composition

The grasslands in the project area are located in Middle Asia sub-zone of Eurasia grassland plant zone, typical of grasslands in the mesothermal grassland belt. The geographical composition of the flora in the region is complex, with 20 types. There are 226 flora of wide-area temperate zone (Pan Arctic, Palearctic and East Palearctic), accounting for more than half of the total. There are 99 (22.5%) grassland flora mainly with Dawuli-Mongolia species. 17.25% are flora with East Asia, Northeast China and North China composition. 10 species are East Siberia flora and only a few are Europe-Siberia and northern Xinganling Mountains. 2 species are Arctic circle and Arctic alpine flora. As seen from the flora composition, the project area is mainly of grassland, plus developed wetlands, and deeply affected by broad-leaved forests of Siberia and East Asia.

(3) Plant types and distribution

The assessment area belongs to typical grassland belt of Hulunbeier High Plain. There is also lakeshore plain, alluvial plain, flood plain, sand hill and hilly lands. The variety of the topology has led to complexity and diversity of vegetation types in the region. From the viewpoint of zonal rules, the representative vegetation is typical in the region. Also, affected by local topology and other non-zonal factors, there are distributed intrazonal vegetation, such as meadow, salinization and sand vegetation, etc.

a. Typical grassland vegetation

Typical grassland is zonal vegetation in the region, widely distributed in the fluctuating high plains and including Stipa grandis, Chinese wildrye, Stipa krylovii and Artemisia frigida, etc.

Stipa grandis is the most stable top-level community among the typical grasslands. In respect of landscape physiognomy, primary Stipa grandis grassland has been developed and kept good conditions in less utilized areas.

Chinese wildrye is perennial rhizome grass of Gramineae family, with wide ecological range. Therefore, Chinese wildrye can often be found in various kinds of ecological environment, and play subdominant role in most vegetation types.

Stipa krylovii is non-zonal vegetation in the project area, distributed in surroundings of lakes, residential areas and livestock farmers. It is formed by degradation of Stipa grandis due to over-grazing, and is more xerophytic than Stipa grandis grassland.

Artemisia frigida is a result of gradual degradation of Stipa grandis and Stipa krylovii grasslands, distributed at the edge of lakes, nearby the residential areas, the middle and top of hills, and other over-grazing areas. The total area of this kind of grassland is small in the project area.

b. Sand vegetation

The sand vegetation is distributed over stabilized and semi-stabilized sand dunes in the project area, growing with trees such as pinus sylvestris var mogolica, Malus baccata and elm. Pinus sylvestris var mogolica is evergreen mesophytic needle-leaved arbor, distributed continuously on the sand areas nearby the Hailar River. Malus baccata and elm are small arbor forest, often growing at dune valleys and northern slope and wetting areas.

c. Meadow vegetation

Meadow vegetation is intrazonal vegetation. There is a large area of wetland, covered with developed meadow vegetation including Carex, weed and salinized meadow. The weeds and salinized meadow are distributed in the river flood lands.

d. Shrub vegetation

The shrub vegetation is mainly distributed along the banks of the Hailar River. The Salix microstachya var. bordensis (Nakai) C.F.Fang is the advantageous species and the community structure is stable. The herbage under the shrubs is dense, mostly being marsh vegetation such as Carex.

e. Marsh vegetation

The marsh vegetation in the project area is mainly reed marsh, distributed in seasonal or perennial pools zones at low flood lands of Erka Wetland in Manzhouli. The reed is tall and dense, pure in plant composition, and distributed in large-area single dominant species. All the community patches are small in area, some are independent and others are mosaic in the marshlands.

f. Aquatic vegetation

Aquatic vegetation is scattered in the shallow waters on the shore of the lakes and rivers. The submerged plant includes Potamogeton pectinatus. The floating plants include Nymphoides paltata, Potamogeton distinctus, Polygonum and Lemna minor, etc.

3.6.3 Survey of wild animals

According to the record of field observation carried out for more than 20 years by Hulunbeir Environmental Morintoring Station, a basically analysis of information on wilid animals of the assessed area is as follows.

There is a record of 226 species of wild animals (vertebrates) in the assessment area, including 37 fishes, 10 amphibians and reptiles, 38 mammals and 141 birds.

(1) Fish and amphibians and reptiles

There are found 37 species of wild fish in the water system in the project area, belonging to 5 orders and 9 families, respectively being 3 families in Cypriniformes order, Salmoiformes order, Gadidae family of Cadiformes order, Petromyzonidae family of Petromyzoniformes, and Perciformes order.

5 species of amphibians, including Rana amurensis, Rana nigromaculata, Salamandrella keyserlingi, Bufo raddei and Rana chensinensis, are found and widely distributed in the assessment area. In some hillocks, Bufo gargarizans is also found. Reptiles are mainly distributed in sand dunes, including Eremias argus, Takydromus

amurensis and, Lacerta vivipara, but with small numbers. There are two species of snakes, i.e. Elaphe dione and Agkistrodon ussuriensis.

(2) Mammals

There are 6 orders, 14 families and 38 species of mammals, mainly with small ones and no large carnivorous and herbivorous animals. Among the 38 species of mammals, Rodentia and Carnivora orders have most species, accounting for more than one half. Insectivora and Chiropiera orders are next to them. In addition, some national Class II key protective animals, such as Procapra gutturosa, Lutra lutra and Otocolobus manul, were once found along the project line before 1990, but very unusual afterwards.

(3) Bird resources

Among the 141 species of birds recorded in the project area, palearctic species and dispersed species account for 61% and 39% respectively. If classified by ecological patterns, water fouls account for 47.5%, Non-Passeriformes 73.8%, and prey birds 10.6%.

Among 141 species of birds, there are 6 species of national Class I key protective birds, i.e. Grus leucogernaus, Grus japonensis, Grus monacha, Otis tarda, Ciconia ciconia and Ciconia nigra. There are 6 species of national Class II key protective birds, i.e. Platal leucorodla, Cygnus cygnus Cygnus, C. columbianus, Aquila rapax, Aquila heliaca, Milvus migrans, Buteo hemilasius, Buteo buteo, Buteo lagopus, Aegypius monachus, Circus cyaneus, Circus aeruginosus, Circus cyaneus, Pandion haliaetus Falco cherrug, Falco rusticolus, Falco peregrinus, Falco amurensis, Falco tinnunculus, Grus grus, Grus uipio, Anthropoides uirgo, Numenius borealis, Nyctea scandiaca, Athene noctua and Asio flammeus.

The wild animals are mainly concentrated in Erka Wetland. The current status of wild animals can be referred in Section 5.4.

Table 3-6-2 Vegetation Types and Characteristics

No.	Vegetation type		Community characteristic				
			Height (cm)	Coverage (%)	Yield (kg/ha)	Species (m^2)	Main plant species
1	Typical grasslands	Stipa grandis	60	50-70	4500	20	Sand soils, dark Castanozems soil, small shrub, grass and weed grasslands. The community establishment species: Stipa grandis, Chinese wildrye, Cleistogenes squarrosa (Trin.) keng, Galium verum L., Carex duriuscula C.A.Mey., Allium tenuissimum L., Serratula centauroides L., Heteropappus altaicus (Willd.) Novopokr., Artemisia frigida, Melilotoides ruthenica(L.)Sojak, Astragalus adsurgens Pall., etc.
					4050		Dark Castanozems soil soil, creeping stem grass and weed grasslands. The community establishment species: Stipa grandis, Chinese wildrye, Cleistogenes squarrosa (Trin.) keng, Artemisia frigida, etc.
		Chinese wildrye	60	50-70		20	Chinese wildrye, Stipa grandis, Cleistogenes squarrosa (Trin.) keng, Galium verum L., etc.
		Stipa krylovii	50	50		20	The community establishment species is Stipa krylovii; dominant species are Cleistogenes squarrosa (Trin.) keng, Agropyron michnoi, Chinese wildrye, Potentilla acaulis L., etc.
		Artemisia frigida	5	30		20	Artemisia frigida, Stipa grandis, Stipa krylovii
2	Sand vegetation		10-40	20-50		6-8	The community establishment species are: Artemisia filifolia, Agriophyllum pungens, Astragalus root, Corispermum, Agropyron michnoi, etc.
3	Meadow vegetation		30-50	70-80	6000		Phalaris arundinacea L., Calamagrostis epigeios, Deyeuxia langsdorffii, Leymus chinensis, Carex enervis, etc.
4	Shrub vegetation						Salix microstachya var. bordensis (Nakai) C.F.Fang, Carex, etc.

5	Marsh vegetation					Scirpus triqueter L., Eleocharis sp., Eleocharis acicularis, Carex appendiculata, Zizania latifolia, Glyceria triflora, Butomus vmbellatus, Halerpestes sarmentosa, Hippuris vulgaris, Alisma gramineum Lejeune, Sagittaria trifolia, Callapalustris, Sium suave Walt, Sparganium stoloniferum, Triglochin palustre, Typha laxmanni, Triglochin palustre, Typha laxmanni, etc.
6	Aquatic vegetation					Potamogeton pectinatus, Nymphoides paltata, Potamogeton distinctus,Polygonum,Lemna minor, etc.

3.6.4 Survey of soil environment

The typical soil types in the project area include dark Castanozems soil, meadow soil, bog soil, saline soil, and Aeolian soil, among which dark Castanozems soil is zonal soil, and meadow soil, bog soil, saline soil, and Aeolian soil are intrazonal soils.

(1) Dark Castanozems soil
Dark Castanozems soil is widely distributed in the project area. It is widely found in the high plains and river terraces and denuded residual hills, etc. with obvious zonal distribution. The natural vegetation is typical grassland vegetation, comprised of xerophytic herbaceous perennids. The main plant is tussock grasses, with root grasses next to them. The community establishment plants are mainly Stipa grandis, Leymus chinensis, Cleistogenes squarrosa (Trin.) keng, Koeleria cristata (L.) Pers, annual meadowgrass (Poa), etc.

(2) Meadow soil
There is little distribution of meadow soil, mainly at the plots with low-level groundwater, such as river valley lowlands and lakeshores. The groundwater level is generally 1~3m. The main vegetation is mainly hygrophilous meadow vegetations, including Sanguisorba officinalis L., Leymus chinensis, Carex, etc.

(3) Bog soil
There is a little distribution of bog soil in river flood plains and river furiotile lowlands. The groundwater level is generally below 1m, being seasonal accumulated water of the surface. The surface vegetation is mainly hydrophilic swamping vegetation or meadow vegetation. The communities include Carex, Phragmites australis, mat grass, etc.

(4) Saline soil
Saline soil is distributed in the river valley lowlands, lakeshores and closed-flow depressions in the project area. It has small area and overlays with saline meadow soil and alkali soil. The vegetation is mainly saline plant, mostly being saline meadow communities, including Suaeda corniculata (C.A.mey.) Bunge, Iris lactea Pall.var.chinensis (Franch.) Koidz., etc. The vegetation coverage is generally low.

(5) Aeolian soil
Aeolian soil is distributed over sand dunes and sand hills in the project area, being divided into 2 sub-classes, i.e. stabilized Aeolian soil and semi-stabilized Aeolian soil. The stabilized Aeolian has developed for long, with high vegetation coverage, generally greater than 30%, and with organic content of 1~2% or so. The semi-

stabilized Aeolian has a thin humus coloring layer on the top, with low organic content, generally below 1%, and with low vegetation coverage.

3.6.5 Survey of main eco-environmental problems

(1) Grassland degradation

The area is one typical livestock breeding ecological region. During last several decades, the population has grown rapidly in the project area, the number of livestock is increasing, the pressure on the grassland is getting greater and greater. The pastures are commonly over grazing and under poor management. Affected by unreasonable utilization such as over-exploitation of medicinal materials and natural disasters such as drought pests, the grassland ecosystem has been under interference exceeding the thresholds, resulting in destruction of grassland resources, wide degradation and desertification of grasslands, and great reduction of good pastures.

(2) Soil salinization

The lakeshore wetland, bog wetland and butterfly lowland as well as plots with poor drainage system are sensitive zones of soil salinization in the project area. As clearly seen from the satellite TM images, there exists obvious distinct between the salinized soils and the surrounding landscape after the grassland degradation in the lakeshores and flood plains. In recent years in particular, as the climate is drought, many lakes has been extinct, forming greyish-white salt incrustation on the surface and having obvious landscape characteristics. At present, there is an area of 55.1 km^2 with obvious soil salinization in the assessment area.

(3) Soil erosion

The soil erosion in the assessment area includes mainly water erosion and wind erosion. The soil erosion in the assessment area at present belongs to slight erosion (below Level II). As the current status survey shows, there occurs slight water erosion at slope zones with destructed vegetation and natural roads of gentle slopes.

The grassland in the assessment area belongs to high sensitive zone of wind erosion desertification, with serious soil wind erosion. According to the current status survey, wind erosion often occurs in the desertification zones and soil bare zones after vegetation destruction during dry and windy seasons in the spring and autumn.

(4) Desertification

There is 170.3ha sand land in the project area. Along the river shores of the Hailar River, are obvious sand dunes, mostly stabilized or semi-stabilized sand dunes. Additionally, there are sporadic sand patches on the grasslands and nearby the residential areas, with low vegetation coverage. They are badly stabilized duo to wind

erosion, and the topsoil is activated. In the high plains within the project area, there is a large area of sand soil and dark Castanozems soil zone, with sand layer deposit underlying the thin topsoil. The soil is loose and extremely liable to wind erosion and desertification after destruction of vegetation and occurrence of breaches in grasslands, thus being potential desertification areas.

(5) Pollution impacts

Most plots in the assessment area are grasslands and wetlands, with wide land and rare population. The economy depends mainly on traditional livestock production, without major “three wastes” pollution, despite pollution discharge in some town area.

3.6.6 Sensitive assessment of regional habitats

Eco-environmental sensitivity mainly refers to the types and possibility of the occurrence of regional eco-environmental problems. In the project area, the landscape ecological structure is mainly grassland and wetland. The wetland vegetation has diverse vegetation types, rich habits and species, many rare protective birds and huge ecological function. Compared with this, the grassland ecosystem has simpler structure, low ecological function, and the anti-interference capability is relatively low, with a small fluctuation of eco-environment able to cause a deep change of ecosystem. In recent years, with human exploitation of natural resources, the degradation and desertification of grassland and destruction of wetland, the biological habits have been seriously affected, the biodiversity threatened, regional ecosystem become very fragile, and the sensitivity of the habitats to unfavorable interferences increased.

3.6.7 Summary of current status of ecology

(1) The occupation of natural ecosystems such as grasslands, meadows, marshes, shrubs, rivers, lakes and sand lands in the proposed project area is biggest, accounting for 94.3% of the total, construction lands such as towns, farmers and herdsmen residential areas, traffic roads account for 5.87%, and farming planting land use accounts for 0.63%. The land use functions of the project area are mainly in the natural condition, with a few towns, residences, industrial and traffic land uses, and fewer farming planting lands. The land resources are relatively rich in the project area.

(2) The natural landscape in the project area is mainly typical grassland landscape of Hulunbeier Grassland. Under the grassland matrix and background, there distribute a large area of rivers, lakes, marsh wetlands, with grasslands and

wetlands accounting for 92.6% of the total project area. The grassland landscape and wetland landscape patches are small in number, huge in area, high in linkage degree, playing decisive roles in stabilization of regional ecosystem. The grasslands and wetlands have diverse plant varieties and vegetation types, rich animal resources, especially with many national key protective rare animals.

(3) The regional economy is mainly traditional livestock production, with a long history. The current primary productivity of pastures is decreasing, but the natural system characteristics of the pastures still remain unchanged, with sound eco-environment. However, the regional eco-environment has also obvious fragility, with high sensitivity to external unfavorable interference. The sand dark Castanozems soils and stabilized and semi-stabilized sand dunes are potential desertification areas. The regional soil belongs to slight water erosion area and slight salinization area. However, due to big sandy characteristic of the soil, the drought climate and windy weather, the region belongs to serious wind erosion area.

3.7 Natural Reserves

According to investigation at Hulunbeier Environmental Protection Bureau (EPB), and browsing of related materials, there are no national or Inner Mongolian natural reserves along Hailar-Manzhouli Section line.

The distribution of national and Inner Mongolian natural reserves in Hulunbeier City is shown in Figure 3-7-1 and Table 3-7-1.

Table 3-7-1 Distribution of National and Inner Mongolian Natural Reserves in Hulunbeier City

No.	Name	Level	Protection content	Occupied area (ha)	The shortest distance from the proposed project
1	Dalai Lake Natural Reserve	National	Rare fowls wetland	740,000	19
2	Hanma Natural Reserve	National	Forest ecosystem, wild animal protection	107,348	-
3	Hailar Xishan	Inner	Forest park, landscape	13,996	9.5

	Mongolian Scotch Pine Forest Park	Mongolian	scenic spot		
4	Zalantun Landscape Scenic Spot	Inner Mongolian	Landscape scenic spot	-	-
5	Aoluguya Ewenke Nationality Township Historic and Cultural Protection Zone	Inner Mongolian	Ewenke minority nationality rare culture relics	1,240	-
6	Gaxiandong Forest Park	Inner Mongolian	Forest park	15,984	-
7	Huihe Natural Reserve	National	Rare fowls	120,000	32
8	Honghuaerji Mongolian Scotch Pine Forest Park	Inner Mongolian	Forest ecosystem, wild animal protection	6,167	-
9	Moerdaoga Forest Park	Inner Mongolian	Forest ecosystem, wild animal protection	5,207	-

Note: The natural reserves No. 2, 4, 5, 6, 8, 9 are far away from the project.

The national rare fowl wetland reserves in Hulunbeier City include Dalai Lake Natural Reserve and Huihe River Natural Reserve.

(1) Dalai Lake Natural Reserve

The area is located among Xinbaerhu You Qi, Xinbaerhu Zuo Qi and Manzhouli City, with east longitude of 117□00′~117□41′ and north latitude 48□30′~49□20′. The total area is 740000 ha. It was list among the world's important wetlands of *Wetland Convention* in 1992.

The wetland ecosystem is formed from the Dalai Lake water system, integrating the lake, river, marsh, shrubbery and reed pond. It is a comprehensive natural reserve to protect wetland ecosystem, typical grassland ecosystem and the numerous water fowls and rare and endangered species that inhabit, breed or migrate in Dalai Lake area. The wetland has typical characteristics of wetlands in the arid grassland zone, i.e. having good primitive character and natural character.

There are 74 families and 653 species of wild seed plants and 30 species of fish in the reserve. There are 6 orders, 13 families and 35 species of mammals, including 3 species of national Class II protective mammals, i.e. Procapra gutturosa, Lutra lutra and Otocolobus manul. There are 292 species of birds recorded, including 9 species of national Class I protective birds (Grus japonensis, Grus leucogernaus, Grus monacha, Larus relictus, Ciconia nigra, Aquila chrysaetos, Aquila heliaca, Otis tarda, and Haliaeetus leucoryphus) and 43 species of national Class II protective birds. It is the largest breeding base of Anthropoides virgo population in China, and the important dak for migrating water fowls in Northeast Asia and Australia.
The functions of Dalai Lake are to provide physical base of herding, fishery, urban water supply and tourism, and to provide a good habit for numeric birds. This proposed project passes by at around 19km to the north of the natural reserve.

(2) Huihe River Natural Reserve
Huihe River Natural Reserve is located in the southwest of Hulunbeier City of Inner Mongolia, lying in the administrative areas of Ewenke Nationality Autonomous Qi and Xinbaerhu Zuo QI. It is 22.5km from the northern boundary of the reserve to Hailar City, and the reserve is also linked with Honghuaerji Mongolian Scotch Pine Forest Park in the south. The geographical coordinates are N48□10′~49□17′;E118□30′~119□45′.

The Huihe River, the main river in the reserve, is the tributary of the Yimin River. The river valley is wide, with low relief, and forms a huge marsh. The water surface area within the reserve is 22.09km^2, with 115 small lakes. The watershed area is 54.68 km^2, mostly being alkali lakes.

There are 60 families, 199 genera and 344 species of plants in the reserve, including 1 family, 1 genus and 2 species of Pteridophyte; 2 families, 2 genera and 2 species of gymnosperms; and others (angiosperms). There are 31 species of fish in the Huihe River, belonging to 5 orders and 8 families. There are 3 orders, 5 families and 10 species of amphibians and reptiles, with numerous Rana amurensis and Rana nigromaculata. On some hillocks, there are Bufo raddei and Bufo gargarizans. The protection focuses are: rare and endangered birds, wetland ecosystem, meadow and grassland vegetation, and sand land Mongolian Scotch pine forest. There are 8 species of national Class I protective birds, and 28 species of national Class II protective birds.

3.8 Summary

(1) According to the current status of surface water, the rivers under monitoring have been polluted by organic pollutants obviously. All the COD values exceed national standard value, belonging to Class V or worse water body. The reasons for the water quality pollution of the rivers include: The mainstream Hailar River accepts industrial and residential wastewater along the river and has serious water pollution under drought period; The Xinkai River is the flood drainage river for Dalai Lake. The natural eutrophication in Dalai Lake has led to high COD concentration in the lake. Also, in the freezing periods, the ice function has obviously resulted in further enrichment of pollutants. The Morigele River has small river run-off. The rotten matters from riverbed scouring and non-point sources, feces of cattle and sheep, and drinking water by plenty of cattle and sheep in the rivers have contributed to the increase of organic pollutants in the rivers and the high concentrations of COD measurement.

(2) The daily averaged TSP concentration in the assessment area is below the national standard limit. The one-time NO_2 measurement at one monitoring site exceeds the allowable value. This is mainly caused by special weather conditions (temperature inversion). The ambient air quality in the assessment area is basically clean and basically meets with national Class II standard.

(3) The current status monitoring data of ambient noise show that the residences along the project line can meet with Class 4 noise standard, and the ambient noise quality at Zalainuoer Mineral Area Hospital cannot meet with Class 1 standard requirement, as the hospital is close to the highway.

(4) The current status assessment of eco-environment shows as follows:

a. The land use functions of the project area are mainly in the natural condition, with a few towns, residences, industrial and traffic land uses, and fewer farming planting lands. The land resources are relatively rich in the project area.
b. The natural landscape in the project area is mainly typical grassland landscape of Hulunbeier Grassland. Under the grassland matrix and background, there distribute a large area of rivers, lakes and marsh wetlands. The grassland landscape and wetland landscape patches are small in number, huge in area, high in linkage degree, playing decisive roles in stabilization of regional ecosystem. The grasslands and wetlands have diverse plant varieties and vegetation types, rich animal resources, especially with many national key protective rare animals.
c. The regional economy is mainly traditional livestock production. The eco-environment is good, but has also obvious fragility, with high sensitivity to

external unfavorable interference. The sand dark Castanozems soils and stabilized and semi-stabilized sand dunes are potential desertification areas. The regional soil belongs to slight water erosion area and slight salinization area. The region belongs to serious wind erosion area.

(5) Environmental protection targets along the line

According to current status of social environment and natural conditions of the project area, the main environmental protection targets along the highway are identified, including grassland, wetlands, related rivers, and residents along the highway line. See Table 3-8-1.

Table 3-8-1 Main Environmental Protection Targets along the Highway

Sensitive plots along the line	Environmental protection targets	Relation with the highway	Main sensitive environment
Hulunbeier Grassland	Residents in Haotetaohai	Within 44m on both sides (475 households, 1662 people)	Noise environment; air environment
	Residents of the 5th Production Team in Haotetaohai	About 46m to the left of the highway (42 households, 138 people)	
	Residents in West Wuzhuer	About 76m to the left of the highway (256 households, 1195 people)	
	Residents in Yihe	About 60m to the left of the highway (17 households, 58 people)	
	Zalainuoer Mineral Area Hospital	About 140m to the fence on the left side of the highway (4 floors, 260 beds)	
	Landscape, wildlife	The highway crossing the typical grassland	Eco-environment

		Stabilized and semi-stabilized dunes; decertified grassland, grassland vegetation	The highway crossing Hailar River and the dunes on both sides of the river; crossing dune belt to the east of Cuogang Town	Eco-environment
Erka Wetland		Wetland landscape	The highway crossing Erka Wetland for 13.2km.	Eco-environment
		Wild animals		
		Wild plants		
		Soil vegetation		
		Second Water Source of Manzhouli City		
Lake	Huhenuoer Lake (1900ha)	Animals and plants	The highway is 500m away from the south side of the lake.	Eco-environment
	Benbo Lake (500ha)	Animals and plants	The highway is 500m away from the nouth side of the lake.	
River	Morigele River (K431+870)	River water quality (Class III function)	Crossed by the highway bridge	Surface water environment
	Hailar River (K543+850)	River water quality (Class III function)	Crossed by the highway bridge	
	Xinkai River (K550+150)	River water quality (Class III function)	Crossed by the highway bridge	

Note: No sensitive spots such residences are found along the line of earth borrowing yards and waste earth yards.

CHAPTER 4 ENVIRONMENTAL IMPACT PROJECTION AND ASSESSMENT

4.1 Social Environment and Emigrant Settlement Impact Analysis

4.1.1 Social environmental impact analysis

4.1.1.1 Regional socioeconomic development plan

According to *Outline of the Tenth Five-Year Plan for National Economy and Social Development in Hulunbeier City*, the main targets of Hulunbeier City in national economy and social development in the Tenth Fiver-Year Plan Period (2001~2005) are: during the Tenth Fiver-Year Plan Period, the economic growth rate will reach 9%. In 2010, the per capita GDP will be doubled on the base of that in 2000, the people will be more well being, living will be more warfare, and sound foundations will be laid for the city to rank among the first in Inner Mongolia.

(1) Development plan of Hailar District

The development focuses and main tasks determined by Hailar District in the Tenth Fiver-Year Plan Period are: further adjusting industrial structure and promoting industrial update; enhancing S&T innovation capacity; widening opening up to the outside and raising the funds for construction.

(2) Development plan of Chenbaerhu Qi

The main economic objectives of Chenbaerhu Qi in the Tenth Fiver-Year Plan Period are: during the Tenth Fiver-Year Plan Period, the annual growth rate of GDP will be 8%, and the GDP will reach 706.1 billion RMB (2000 price) in 2005, with per capita value of 10871 RMB. The total social fixed assets investment in the Tenth Fiver-Year Plan Period will accumulate to 35 million RMB, with the annual growth rate of 10%. The total financial revenue will increase by 7% annually and reach 74.5 million RMB. The urban resident per capita disposable income will reach 6000RMB, with annual growth rate of 7.4%.

(3) Development plan of Manzhouli City

The main socioeconomic development targets of Manzhouli City in the Tenth Fiver-Year Plan Period are: GDP will increase by 10% annually on the base of the value of 1.5 billion RMB in 2000, the fixed assets investment by 10%, total social consumer goods retail by 12%, border trade impost and exports by 12%, and total financial revenue by 10.8%.

4.1.1.2 Impact on economic bases

The proposed highway will connect Hailar District and Manzhouli City. Hailar District is the political, economic, cultural and social activity center of Hulunbeier City. Manzhouli City is an important port city of Hulunbeier, locating at the center of Northeast Asia Circle comprised of northeastern China, Siberia region of Russia, Mongolia, Japan, Korea and DPRK, and at the joint of external and internal markets, thus being the pivot of the development of northeastern economy and tourism.

Communication and transport is a comprehensive and leading base industry for the development of national economy. The proposed highway will play important roles in the inter-regional economic development and material exchange.

The proposed project will bring about important long-term positive impacts on the development of regional economy.

4.1.1.3 Impact on economic, industrial, and labor structure

The construction of the proposed project will bring along the urban and rural construction along the line, promote the exploitation and utilization of land and resources. At the interconnections and inlets/outlets of highway from/to the nearby towns, new industrial and commercial zones can be developed.

The tourism in the project area will develop rapidly. The demand for transport of energy, raw materials, building materials and passengers is great, the construction of the proposed project will promote increase of proportions of the secondary industry (mainly industrial and building materials sectors) and tertiary industry (mainly transport, commerce, finance and issuance sectors) in all the three industries.

The construction of the proposed project will increase a plenty of employment opportunities, and thus alter the employment structure. The number of employees and urban individual laborers will increase somewhat.

4.1.2 Impact on employment and unemployment

4.1.2.1 Employment

The construction of the proposed project will increase following employment opportunities:

.1. 11.2 million labor days will be needed for construction of the highway, thus can increase a great number of employees. Workers who will directly serve the construction project will also be needed.

.2. The project will speed up local economic development and thus greatly increase the transportation. This can lead to a good many employment opportunities.

.3. The regional economic development will indirectly increase the employment.

.4. In the Construction Period, great quantities of road materials will be purchased, thus promoting development of related industries along the line and increase employment opportunities.

In an all, the construction of this project will directly and indirectly increase a lot of employees.

4.1.2.2 Unemployment

As the construction of the highway will occupy a plenty of lands, part herdsmen may lose their rangeland. According to related stipulations on construction project in China, the local governments and construction unit will be responsible for the settlement of work or re-allocate new rangelands for them. There should be no problem in this issue.

4.1.3 Impact on emigration

In the routing of the project line, towns and villages should be avoided as far as possible in order to reduce removal. As the local village density is low, the removal amount of residences is small, with a requirement of removal of 358m^2 houses. The types and quantities of removal are shown in Table 4-1-1.

Table 4-1-1 Types of Removal and Quantities of Removal

Starting and finishing post No.	Removal type and quantity					
	House (m^2)	Power transmission sequences	High-voltage lines	Long-distance cable (m)	Translation communication lines	Cross communication lines
K397+000--K505+180	60	8	8	500	500	8
K505+180--K545+150	90			200		
K545+150--K586+718	208	2	3		300	4
Total	358	10	11	700	800	12

In respect of removal settlement, local governments and village committees will be responsible for the settlement nearby original sites. The construction unit will pay the compensations for removal, to build new houses. This can avoid large-scale long-distance removal, and minimize the social impacts from the removal as far as possible.

In order to implement the settlement smoothly, the construction unit will set up specific personnel and institution, formulate corresponding settlement measures and implementation plan, and coordinate with local governments and other related departments. The compensations will be calculated for each households to be removed, in consideration of detailed requirements of them and in accordance with relevant documents, policies and standards of local governments.

As the removal work is small as the removal is nearby, it should not bring about unfavorable impacts on the residents to be removed as long as the work is carefully planned and carried out. In a long term, the living conditions of these residents can be updated and improved.

4.1.4 Impact on public facilities

(1) Impact on local transport
As part of the proposed highway will utilized original State Highway 301, the local transport may be affected in the Construction Period, which can be alleviated through building construction access roads and reasonably allocating construction time.

In the comprehensive transport system in the impact area, highway transport plays an important role. This proposed communication construction project will greatly improve local highway transport status, reduce traffic accidents, enhance running speed of the vehicles, and greatly enhance the service level of the highway.

The construction of the proposed project will also greatly promote improvement of local tourism conditions.

(2) Impact on public facilities along the line
The following principles will be abided by for the important electric and communication facilities: the routing should be carried out to avoid removal of electric and communication facilities as far as possible. No major communication facilities will be removed, except for some village electric and communication facilities. In the whole project line, there will be 10 power transmission sequences, 11 high- voltage lines, 700m long, -distance cable, 800m translation communication lines, and 12 cross communication lines to be removed (see Table 4-4-1).

4.1.5 Impact on social security

(1) Impact on social stability
Hulunbeier City is a minority agglomeration with Mongolian as the main body and Han people with the most population. After more than 50 years of construction, the regional socioeconomic development has achieved huge advance, and the minority has also obtained huge development in economic, cultural, education and public

health fields. All the nationalities are getting along very well and the society is stable. The construction of this highway will play important roles in pulling up the economic development along the line, improving the travel conditions, further enhancing exchange and communication between the minorities in the border area, promoting unity of all the nationalities, and maintain the social stability.

(2) Impact of construction persons from the outside on local residents
The Construction Period will last for 3 years. Persons from the outside will be employed besides local people. Therefore, personnel management for the construction team should be strengthened to avoid their impacts on the living of local residents.

4.1.6 Impact on cut-offs

(1) Impact on residents on both sides of the highway

The highway will go through some villages and pastures and produce in convenience to the production activities of local herdsmen, and the communication and liaison of the herdsmen and among the sumu. The design of the project has already considered pathways for herdsmen and tractors, so as to alleviate impacts of the highway on the traffic cut-offs. Based on public consultation survey, pathways and passenger overpasses are increased from 30 to 47 and culverts from 104 to 110, compared with original design.

Table 4-1-2 Summary of Pathways along the Line

Name of engineering	Unit	Quantity	Note
Interchange crosses		4	The pathways are mainly set in the areas with dense population. There are a total of 47 pathways.
Pathways and passenger overpasses		47	
Level crosses		22	
Small sized bridge	m/bridge	352/18	There are totally 139 bridges and culverts.
Middle sized bridge	m/ bridge	525.5□7	
Big sized bridge	m/ bridge	1326□4	
Culverts		110	

(2) Impact on livestock

The highway will have some impact on the livestock breeding when going through the pastures. During the construction documents design phase, these impacts should be fully considered and sufficient pathways reserved. It is suggested that the pipe

culverts in the pasture areas be changed to decking culverts, so as to facilitate the livestock to go through the highway.

4.1.7 Impact on hydrology

4.1.7.1 The impact on surface water

There will be 4 big-sized bridges (totaling 1326m), 4 middle-sized bridges (525.5m), and 18 small-sized bridges (totaling 352m) along the project line.

There were once uprivers of different depths (20-190cm) in Erka Wetland during extra big flood period (flood in a century) in 1998. The design of bridges has considered the flood drainage on both sides of the roadbeds, with bridges and culverts set up at ditches and rivers with water flow in the drought seasons. The design parameters are under the case of one flood in a century and the spans expanded somewhat.

On the basis of original feasibility study, some adjustment are suggested for the wetland sections, as follows:

(1) Adding 4-20m middle sized bridge at K546+500;
(2) Adding 4-20m middle sized bridge at K547+840;
(3) Adding 4-20m middle sized bridge at K548+060;
(4) Adding 6-20m big sized bridge at K550+900;
(5) Replacing 24-20m big-sized bridge with 30-20m middle sized bridge at K550+150, and the length of the bridge is increased by 20 percent. The central post number being K551+620.

After this adjustment, the total length of bridge will be 480m longer, which can meet with the flood drainage requirements of the Hailar River and the Xinkai River, and avoid runoff cut-offs of the rivers and wetlands as the result of construction of the proposed highway. The set-up of the bridges and at Erka Wetland Section is illustrated in Figure 4-1-1.

4.1.7.2 The impact on the groundwater

Reasonable design scheme and engineering measures will be considered and adopted for bridge base and ground base during the Design Period in order to reduce the impact on the groundwater.

According to the hydraulic, geological and river (ditch) bed characteristics of the rivers and ditches, the superstructure of the bridges generally adopts 20-m, 16-m and 13-m prestressed concrete simple-support cored slabs. The substructure of big-sized bridges adopts gravity-type piers and ribbed slab abutment and the base adopts that of

drilling pouring posts. The substructure of small- and middle- sized bridges adopts pillar-type piers and stands (or U-type abutment) and the base adopts drilling pouring posts. The base adopting that of drilling pouring posts could occupy less area and lower the impact on groundwater.

The roadbed at wetland section is about 3-4m high and the underside of the roadbed is rubbles with diameter 10-30cm.It can lower the impact on the groundwater. The roadbed of the highway in wetland section is shown in Figure 4-1-2.

4.2 Surface Water Environmental Impact Analysis

4.2.1 Polluters analysis

The highway construction can be divided into the Construction Period and the Operation Period. In the Construction Period, the water environmental pollution is mainly from sewage discharge of constructors and the SS nearby the construction sites of bridges construction. In the Operation Period, the water pollution is mainly from water washing of vehicle exhausts and from the sewage at service areas.

4.2.2 Water environmental impact in the Construction Period

The following impacts can be produced on river downstream water quality from bridge construction:

- The construction machineries contain oily wastewater that may yield oil pollution of rivers when it is discharged in to the rivers.
- The construction materials such as bitumen, oil and chemicals can pollute the waters after being washed by the rainfall if not properly managed.
- The sewage and garbage from constructors can be directly discharged into the rivers and pollute the river water if the management is not strengthened.

4.2.3 Water environmental impact in the Operation Period

(1) Bridge surface rainfall runoff pollution projection

a. Bridge surface rainfall pollutant concentrations

The discharge of initial rainfall into the water body can have some impact on the water quality. This EIA refers to monitoring data and document materials of other highways. The pollutant concentrations of bridge surface rainfall are shown in Table 4-2-1.

Table 4-2-1 Bridge Surface Rainfall Pollutant Concentrations

Item	pH	COD_{Cr} (mg/l)	Oil (mg/l)

Average within 20min of runoff	7.4	107	7.0

b. Bridge surface rainfall runoffs

According to local climate characteristics of Hulunbeier City, and based on the line strike of the proposed highway, topology characteristics and the positions of the rivers, the lengths and surface runoffs of the highway sections that have impacts on surface water are determined and shown in Table 4-2-2.

Table 4-2-2 Highway Surface Rainfall Runoff

Item		Morigele River	Hailar River	Xinkai River
Rain collection bridge surface length (m)		106.5	486.5	606.5
Rain collection bridge surface width (m)		24	24	24
Rain collection area (m^2)		2556	11676	14556
Rainfall (mm/d)		317.5	317.5	317.5
Runoff coefficient		0.9	0.9	0.9
Runoff (m^3/h)		30.4	139.0	173.3
The pollution brought by the discharge of initial rainfall into the river in the first 20 minutes (kg)	COD_{Cr}	1.08	4.96	6.18
	Oil	0.071	0.324	0.404
the river water flow in the period June to August□m^3/s□		20-31	101-134	115-165

c. Highway surface rainfall runoff pollution

The rainfall in the region is concentrated in June to August, accounting for 70% of the total annual precipitation. This belongs to high water period with larger water flow. The discharge of initial rainfall into the water body can have some impact on the water quality. The impact should stop as the rain stops therefore belonging to short-term impact. Bridge surface rainfall runoffs has less impact on the water quality of the river.

(2) Sewage impact of service areas

According to the feasibility study of the proposed highway, a service area will be setup at Chen Qi. As the scale and facilities of the service area has not been

determined, the impact is performed by analog to other Class I highway service areas in Inner Mongolia.

It is supposed that the park, oil station, maintenance center, restaurant, shop, toilet and lavatory are set up in Bayankuren Service Area (K425+000), with main functions of traffic management and maintenance.

The population the service area in supposed to be 20 employees, and the passengers can be converted to permanent population of 200 people. The living water use is 150L/d for each person, and the daily total sewage is calculated at 33m^3 in the service area, including dinning, offices and bathrooms washing water and faces. The sewage concentrations are: COD_{Cr}=500mg/l, BOD_5=220 mg/l, Oil=100mg/l, and the pollutant discharge intensities are: COD_{Cr}=16.5kg/d, BOD_5=7.26 kg/d, oil=3.3kg/d.

Therefore, the sewage from the service area must be treated before discharging in to the surface water. It is suggested that comprehensive treatment facilities be set up for living sewage and oily wastewater (see Chapter 7), in order to guarantee the compliance with Class 2 requirements of *Farmland Irrigation Water Quality Standards* (GB5084-1992) (COD□300, SS□200mg/L, oil□10mg/L).

(3) Conclusions

- The main impacts the proposed project in the Operation Period are main initial rainfall, but with small amounts of pollutants and thus no major impact on the characteristics of the original water body.
- The living and oily wastewater sewage from the service area in the Operation Phase should be treated to meet with Class 2 requirements of *Farmland Irrigation Water Quality Standards* before discharge.

4.3 Ambient Air Impact Projection and Assessment

4.3.1 Ambient air impact in the Construction Period

The air pollution of the highway in the Construction Period comes mainly from the following linkages: (1) resuspended dust from lime-soil mixing, bitumen concrete mixing and vehicle transportation; and (2) bitumen smoke from bitumen concrete preparation and on bitumen laying on the road surface. Detailed analysis is as follows.

4.3.1.1 Resuspended dust

In the Construction Period of the highway, land leveling, pile driving, surface laying, materials transportation and loading, and material mixing are linkages that can generate resuspended dust, with the most important sources being from vehicles

running and construction operation (concrete mixing and cement unloading, material feeding, etc.).

(1) Resuspended dust from vehicles

With reference to similar projects, in the construction zones, most transport vehicles run on earth access roads that have much dust, and thus the road dust resuspension is serious. In particular, in the process of concrete, the lime-soil transport vehicles will have obvious impacts on both sides. According to related documents, the TSP concentration will be greater than 10mg/m^3 at 50m downwind of the highway side, while it will be greater than 5mg/m^3 at 150m downwind of the highway side.

(2) Resuspended dust from construction operation

Among the construction resuspended dusts (land leveling, earth borrowing, loading of road materials, lime-soil mixing, etc.), the resuspended dust from lime-soil mixing is most serious. The lime-soil mixing has two types, i.e. road mixing and station mixing (central mixing). Table 4-3-1 provides monitoring results of resuspended dust from lime-soil mixing of similar highways. As seen from the table, both road mixing and station mixing have impact within 100m downwind. When adopting station mixing, the resuspended dust impact within 100m downwind is serious, and the TSP concentration will be 0.5mg/m^3 or so at 150m downwind.

Table 4-3-1 Monitoring Results of Resuspended Dust from Lime-Soil Mixing in the Construction Period of Highways

Monitoring site	Lime-soil mixing type	Wind speed (m/s)	Downwind distance (m)	TSP(mg/m^3)
A overpass ramp	Road mixing	0.9	50	0.389
			100	-
			150	0.271
A lime-soil mixing station	Central mixing	1.2	50	8.849
			100	1.703
			150	0.483
A lime-soil mixing station	Central mixing	-	Center	9.840
			100	1.970
			150	0.540
			Background	0.400

To sum up, in the Construction Period, the resuspended dust will have some impact on the ambient air along the line, with the impact scope within 200m of the construction site. Among various construction activities, the lime-soil mixing and

vehicle transportation are most important sources of resuspended dust. They can have obvious impact within 100m downwind of the construction site.

4.3.1.2 Bitumen smoke

The proposed highway will adopt bitumen concrete pavement, with an area of 3452038m^2 of bitumen concrete cover. In the construction of the bitumen pavement, the bitumen smoke is another important pollution source, in addition to resuspended dust. It is mainly generated from the processes of bitumen cooking, mixing and pavement laying, among which bitumen cooking has the largest emission of bitumen smoke. In the bitumen smoke, the main toxic and harmful substances are THC, phenol and 3, 4-BaP.

There are generally two methods of bitumen cooking. One is generally adopted by large highway construction projects and adopts closed-type mixing process with dust collectors. The bitumen is transported to laying construction sites by sources without heat or high-temperature containers. The other melts the bitumen with open pots in the cooking shed, then directly lay the pavement. The latter is generally used for highway repairing and has obviously greater impact (both in degree and scope) than the previous. The generation amount of bitumen smoke is directly related to the mixers. Put Italian-made MAZY-type equipment (160t/h) as an example, the exhaust height is about 20m, and the measurement results are shown in table 4-3-2 and Table 4-3-3.

Table 4-3-2 Pollutant Source Intensity of Closed-Type Plant-Mixer

Item / Time	Smoke ($N\ m^3$)	Smoke (kg)	THC (kg)	3,4-BaP (mg)
Hour	933.5	3.74	0.14	0.75
Day	4800	19.23	0.72	3.86

Table 4-3-3 Surrounding Pollutant Concentration of Closed-Type Plant-Mixer

Pollutant / Monitoring site	THC (mg/m^3)	3,4-BaP ($\mu g/m^3$)		Phenol (mg/m^3)
		Maximum	Average	
Downwind 50m	0.034	0.12×10^{-2}	0.95×10^{-3}	<001
Downwind 100m	0.057	0.17×10^{-2}	0.15×10^{-2}	<0.01

Downwind 200m	0.043	0.89×10^{-3}	0.71×10^{-3}	<0.01
Reference standard	5(Israel standard)	1.0×10^{-2}		0.02

As seen from the monitoring results, if the type of mixers is properly chosen, the close-type plant-mix process can have small impact of bitumen pollution on the ambient air.

In addition, according to related materials, the impact distance of bitumen smoke is about 100m downwind from bitumen laying.

4.3.2 Ambient air impact in the Operation Period

4.3.2.1 Climate and pollution meteorological characteristics

(1) Climate characteristics

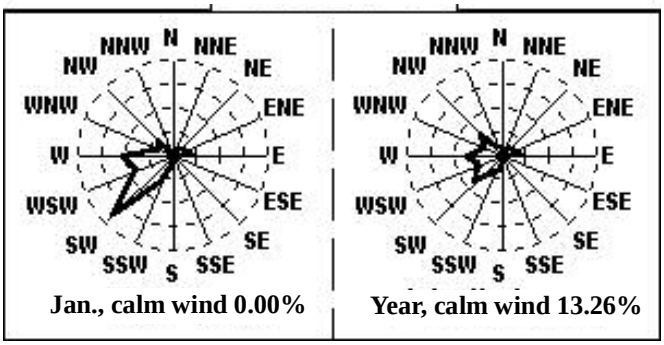
The project area belongs to mesothermal zone continental climate. The overall characteristics are: The winter is cold and long, the summer is warm and short, the spring is dry and windy, and the autumn sees rapid temperature decrease and has early frost. According to data of Manzhouli Meteorological Station, the annually averaged temperature is -1.3ºC, and the historic extreme highest and lowest temperature is 37.8 ºC and -42.7ºC respectively. The annually averaged frost-free time is 110d. The annually averaged precipitation is 299.5mm, and the annually averaged evaporation l454mm. The leading wind direction is in SW direction. The annually averaged wind speed is 4.4m/s, and maximum wind speed 40m/s. The light resource is rich, with annually averaged daily sunshine of 3722.3h and annually averaged sunshine rate of 63%.

(2) Pollution meteorological characteristics

a. Wind direction

The project area belongs to windy area. The leading wind direction in a year is SW, with secondary wind direction W. See the following wind rose map.

Wind Rose Map



b. Wind speed

The annually averaged wind speed is 4.4m/s. The monthly averages value in the spring is great (maximum 6.1m/s) and the wind speed in August is smallest. The statistic results of wind speed are shown in Table 4-3-4.

Table 4-3-4 Main Meteorological Elements along the Project Line

Item	Chen Qi	Xin Zuo Qi	Manzhouli
Annually averaged air temperature (ºC)	-2.6	-0.5	-1.3
Extreme lowest air temperature (ºC)	-48.0	-40.1	-42.7
Extreme highest air temperature (ºC)	37.7	39.5	37.8
Average surface temperature (ºC)	-0.3	1.8	0.7
Annually averaged precipitation (mm)	307.7	272.6	299.5
Free-free time (d)	115	122	116
Maximum frozen soil depth (cm)			389
Strong wind days (d)	25	35	40
Annually averaged wind speed (m/s)	3.5	4.1	4.4

c. Air pollution coefficients

The pollution coefficients of ESE and E direction in the four seasons and the whole year are all great. The maximum value in the winter and the whole year reaches 5.42 and 4.32 respectively. In the summer, the pollution coefficients in ENE and E direction are also high, being 2.16 and 2.23 respectively.

d. Air stability

Pasquill classification method was adopted to perform statistics of air stability on the base of meteorological data in recent 5 years. The results show that the frequencies of

Category D in the four seasons and the whole year are all highest, being 52.86%, 57.48%, 55.12%, 37.89% and 49.86%, respectively. In the autumn, the frequencies of Category E and Category F are also high, being 25.36% and 22.43%, respectively.

e. Distribution of joint frequency of wind direction, wind speed and air stability
The distribution of joint frequency of wind direction, wind speed and air stability in the project area is obtained on the base of meteorological observational data in recent 5 years. See Table 4-3-5 and Table 4-3-6 for details.

f. Low-altitude temperature field characteristics
Low-altitude air temperature detection was once carried out in Hailar region at the end of 1980s. In summer season, the temperature inversion occurs after the sunset and disappears before the sunrise in Hailar region. The elevation of inversion cap is averaged 183m, the thickness 159m, and strength 2.2ºC/100m.

In winter season, the temperature inversion layer has low bottom, with great thickness and strong intensity. It already occurs before the sunset and disappears a long time after the sunrise. The elevation of inversion cap is averaged 236m, the thickness 205m, and strength 3.62ºC/100m.

If considering the latitude and compared with Hailar, there should also be strong air temperature inversion along the highway line. However, as the topology is wide and flat, local climate becomes windy, with more neutral and unstable weathers, and the frequency of the inversion weather and the strength of the inversion should be less than that of Hailar.

Table 4-3-5 Distribution of Joint Frequency of Wind Direction, Wind Speed and Air Stability in the Project Area (Whole Year)

Stability	Wind speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
A-B	<=1.9	0.0001	0	0.0004	0.0004	0.0004	0	0.0001	0	0.0003	0	0.0003	0.0003	0.001	0	0.0004	0	0.0047
	2-2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3-4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	<=1.9	0.0006	0	0.0011	0.0007	0.0003	0.0001	0.0001	0.0003	0.0004	0.0006	0.0018	0.0008	0.0022	0.0008	0.0008	0.0003	0.0136
	2-2.9	0.0006	0.0003	0.0006	0.0004	0.0018	0.0003	0.0006	0	0.0004	0.0004	0.0015	0.0006	0.0014	0.0006	0.0007	0.0001	
	3-4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B-C	<=1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2-2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3-4.9	0.0014	0.0007	0.0007	0.0012	0.0041	0.001	0.0016	0.0003	0.0018	0.0008	0.0016	0.001	0.0023	0.0015	0.003	0.0007	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	<=1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2-2.9	0.0003	0.0006	0.0012	0.0016	0.0022	0.0004	0.0003	0	0.0008	0.0012	0.004	0.0034	0.0034	0.001	0.0012	0.0008	
	3-4.9	0.0019	0.0007	0.0014	0.0037	0.0036	0.0022	0.0001	0.0006	0.0022	0.0027	0.0055	0.007	0.0103	0.0044	0.006	0.0022	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 4-3-5 (continued) Distribution of Joint Frequency of Wind Direction, Wind Speed and Air Stability in the Project Area (Whole Year)

Stability	Wind speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
C-D	<=1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2-2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3-4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5-5.9	0.0004	0.0001	0.0003	0.0006	0.0006	0.0003	0.0004	0.0006	0.0019	0.0006	0.0006	0.0006	0.0008	0.0006	0.0025	0.0011	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	<=1.9	0.0003	0.0001	0.0022	0.0004	0.0014	0.0003	0.001	0	0.0001	0.0006	0.0027	0.0015	0.0018	0.0004	0.0012	0.0004	0.0255
	2-2.9	0.0015	0.0008	0.0027	0.0036	0.0047	0.0003	0.0006	0.0004	0.0014	0.0011	0.0025	0.0022	0.0025	0.0015	0.0021	0.0011	
	3-4.9	0.0047	0.0027	0.0108	0.0104	0.0211	0.0037	0.0033	0.0025	0.0048	0.0084	0.0226	0.0141	0.0196	0.0063	0.0111	0.0048	
	5-5.9	0.0033	0.0011	0.0034	0.0034	0.0084	0.0016	0.0027	0.0012	0.004	0.0041	0.0053	0.007	0.0162	0.0114	0.0122	0.0026	
	>=6	0.0049	0.0014	0.0053	0.0044	0.0048	0.0014	0.0015	0.0027	0.0174	0.006	0.0062	0.0036	0.0163	0.0266	0.0416	0.0108	
E	<=1.9	0.0003	0.0004	0.0016	0.0016	0.0019	0.0003	0.0004	0.0004	0.0011	0.0011	0.0047	0.0021	0.0022	0.0004	0.0006	0.0001	0.0341
	2-2.9	0.0006	0.0004	0.0023	0.0029	0.0034	0.0008	0.0018	0.0007	0.0025	0.0025	0.0074	0.0043	0.0067	0.0006	0.0023	0.0008	
	3-4.9	0.0022	0.0003	0.0022	0.0037	0.0053	0.0004	0.0014	0.0012	0.0056	0.0155	0.0358	0.0141	0.0153	0.0033	0.0058	0.0026	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F	<=1.9	0.0008	0.0011	0.0014	0.0019	0.0014	0.0007	0.0004	0.0003	0.0018	0.0044	0.0092	0.0064	0.0062	0.0015	0.0016	0.0001	0.0551
	2-2.9	0.0014	0.001	0.0027	0.0021	0.0044	0.0022	0.0012	0.0007	0.0032	0.0088	0.0229	0.0147	0.0092	0.0015	0.0026	0.0011	
	3-4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5-5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	>=6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 4-3-6 Distribution of Joint Frequency of Wind Direction, Wind Speed and Air Stability in the Project Area (Winter)

Stability	Wind speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
B	0-1	0.08		0.08				0.08				0.17					0.08
	1-1.9	0.06		0.06				0.06				0.11					0.06
C	2--3	0.06	0.06		0.11	0.11				0.06	0.06	0.22	0.11		0.06		0.06
	3--5	0.17			0.17	0.22				0.06		0.50	0.60	0.82	0.22	0.22	0.17
D	0-1	0.01	0.01	0.04	0.09	0.24	0.02			0.04	0.19	0.54	0.31	0.47	0.23	0.29	0.05
	1-1.9			0.06	0.11	0.11					0.11	0.55	0.22	0.06	0.06		0.06
	2--3			0.06	0.28	0.39	0.06	0.06		0.22	0.06	0.39	0.17	0.06	0.17	0.11	0.06
	3--5	0.11	0.06	0.33	0.77	2.69	0.11		0.06	0.28	2.20	6.59	2.64	3.63	0.88	0.77	0.17
	5--6		0.11	0.11	0.22	0.60	0.11			0.17	0.71	1.26	1.81	2.97	0.99	1.26	0.28
	>6		0.06	0.22	0.11	0.28				0.11	0.17	0.50	0.44	1.26	1.81	2.80	0.28
E	0-1	0.01		0.11	0.23	0.21	0.04	0.01		0.13	0.74	2.28	0.78	0.94	0.08	0.17	0.04
	1-1.9			0.17	0.39	0.06	0.06			0.06	0.17	0.66	0.28	0.44	0.06		
	2--3			0.22	0.33	0.71	0.11			0.22	0.39	1.59	0.88	0.82	0.06	0.33	0.06
	3--5	0.06		0.11	0.33	0.17		0.06		0.33	2.80	8.13	2.42	3.02	0.28	0.44	0.11
F	0-1		0.06	0.20	0.34	0.31	0.08			0.20	0.79	1.95	0.96	0.71	0.11	0.17	
	1-1.9			0.17	0.22	0.06					0.33	0.99	0.55	0.60	0.22	0.11	
	2--3		0.11	0.22	0.44	0.55	0.17			0.39	1.21	2.80	1.32	0.77		0.22	

4.3.2.2 Ambient air impact projection and assessment in the Operation Period

(1) Projection model

a. When the included angle between the wind direction and line source 0□θ□90 0, calculating the integral model of arbitrary form of line source (applicable to concentration distribution of line source with limited or unlimited length). Assuming the limited length of line source (AB section), the diffusion model is as follows:

$$C_{PR}=\frac{Q_j}{U}\int_A^B \frac{1}{2\pi\sigma_y\sigma_z}\exp\left(-\frac{y^2}{2\sigma_y^2}\right)\left[\exp\left(-\frac{(z-h)^2}{2\sigma_z^2}\right)+\exp\left(-\frac{(z+h)^2}{2\sigma_z^2}\right)\right]dl$$

Where: C_{PR}--Pollutant concentration at projection point R_o resulted from highway line source AB section, mg/m^3;

u —Average wind speed at the effective source height of projection section (m/s);

Q_j— Emission intensity of gaseous pollutant j (mg/vehicle · m);

σ_y, σ_z— Horizontal crosswind and vertical diffusion parameters (m);

$\sigma_y=\sigma_y(x)$ □ $\sigma_z=\sigma_z(x)$

x—The downwind distance from line source infinitesimal to projection point(m);

y—The crosswind distance from line source infinitesimal to projection point(m);

z—Height of projection point over the earth surface (m);

h—Height of effective emission source (m);

A, B—Starting and ending points of line source.

The values of U and σ_y, σ_z will be determined according to *Temporary Specifications on EIA for Highway Construction Project* (JTJ005-96).

b. When wind direction and route are perpendicular ($\theta=90^0$), pollutant concentration diffusion model at the earth surface is as follows.

$$C_{垂直}=\left(\frac{2}{\pi}\right)^{1/2}\frac{Q_j}{U\sigma_z}\exp\left(-\frac{h^2}{2\sigma_z^2}\right)$$

c. When wind direction and route are parallel (θ=0 0), pollutant concentration diffusion model at the earth surface is as follows.

$$C_{平行} = \left(\frac{1}{2\pi}\right)^{1/2} \frac{Q_j}{U\sigma_z(r)}$$

$$r = \left(y^2 + \frac{z^2}{e^2}\right)^{1/2}$$

$$e = \sigma_z / \sigma_y$$

(2) Determination of model parameters

a. Pollutant source intensity of highway vehicle exhaust

According to the traffic flow projected in the Feasibility Report of the proposed project, the exhaust intensity is calculated using emission factors data of main vehicle types at home and with the following model:

$$Q_j = \sum_{i=1}^{3} A_i E_{ij} \cdot 3600^{-1}$$

Where, Q_j—Emission intensity of gaseous pollutant j (mg/s·m);

A_i—Traffic flow of vehicle i in the target year (vehicles/h);

E_{ij}—Single vehicle emission factor of vehicle i and pollutant j under operating mode on the vehicle specific road (mg/vehicle·m).

The emission intensity of different sections of the proposed highway is shown in Table 4-3-7.

Table 4-3-7 NO_2 Emission Intensity of the Vehicle Exhaust in Different Sections of Proposed Highway Unit: mg/m·s

Highway section	2008	2015	2030
Hailar Bei—Chen Qi	0.42	0.72	1.44
Chen Qi --Wuzhuer	0.33	0.59	1.24
Wuzhuer --Cuogang	0.27	0.51	1.06
Cuogang --Zalainuoer	0.24	0.45	0.98
Zalainuoer –Manzhouli	0.59	1.03	2.02

(3) Result of NO_2 diffusion projection of vehicles

Two representative sections of the proposed highway, West Wuzhuer (K493+400) and Mineral Area Hospital (K557+800) are selected for projection of daily averaged NO_2 concentration distribution on the sides of the highway in 2008, 2015 and 2030. The results are illustrated in Figure 4-3-1 and Figure 4-3-2.

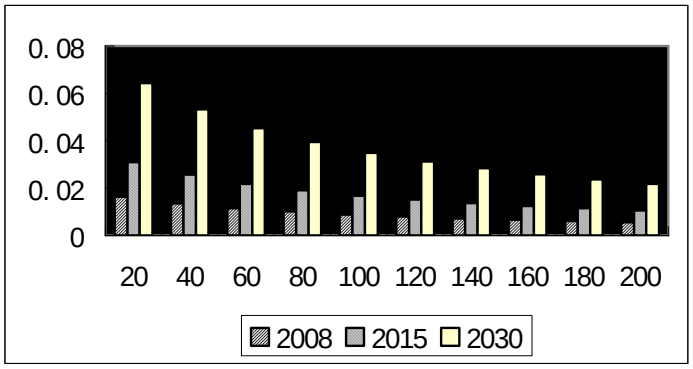


Figure 4-3-1 NOx Daily Averaged Concentration at West Wuzhuer (K493+400) Unit: mg/m^3

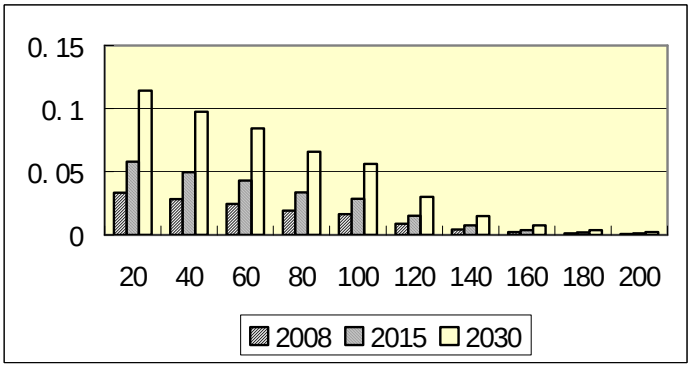


Figure 4-3-2 NOx Daily Averaged Concentration at Mineral Area Hospital (K557+800) Unit: mg/m^3

From the above figures, it can be seen that the impact of NOx concentration is mainly nearby the highway (between 0-40m from the highway sides). In the long future in 2030, the NOx concentration on the sides of the highway does not exceed the Class 2 standard stipulated in GB3095-1996.

4.4 Noise Environmental Impact Assessment

4.4.1 Noise environmental impact analysis in the Construction Period

4.4.1.1 Noise source intensity

Common machineries for highway construction include electric generators, excavators, bulldozers, Land levelers, road compressors, spreaders, cranes, and transport vehicles, etc. Analog monitoring results of these construction machineries are shown in Table 4-4-1.

Table 4-4-1 Noise Source Intensity of Main Construction Machineries

No.	Constriction machinery	Monitoring position (m)	Noise level [dB(A)]
1	Electric generators	1.0	89.4
2	Road compressors	1.0	85.3
3	Land leveler	5.0	90.0
4	Mechanical loaders	5.0	89.0
5	Spreader	1.0	87.0
6	Bulldozers	1.0	90.0
7	Earth excavators	1.0	91.4
8	Crane	1.0	80.1
9	Road roller	1.0	82.1

4.4.1.2 Noise environmental impact analysis

The following formula is adopted to estimate the noise impact of construction machineries in the Construction Period:

$$L_{oct}(r) = L_{oct}(r_0) - 20\lg\left(\frac{r}{r_0}\right) - \Delta L_{oct}$$

Where,

Loct(r)—Octave band noise pressure level at the projection point generated by point noise source;

Loct(r0)-- Octave band noise pressure level at reference position r0;

r—Distance from projection point to noise source, m;

r_0—Distance from reference position to noise source; m;

ΔLoct—Noise attenuation resulted from various factors (including attenuations from noise shelter, barrier, air absorption and earth surface effect, etc. See text of *Technical Specifications for Environmental Impact Assessment*).

If the octave band noise pressure level (Lw oct) of noise source is known and the noise source can be regarded as on the earth surface, then

$$L_{oct}(r_0) = L_{w\ \ oct} - 20\lg r_0 - 8$$

Because the machineries on the construction fields have different operational conditions, the noise level ranges from 75 dB to 100dB. With the increase of distance to the construction machineries, the noise level is decreasing. The noise level at different distances for main construction machineries is shown in Table 4-4-2.

Table 4-4-2 Noise Impact Estimates of Main Construction Machineries

No.	Construction machinery	Noise estimation [dB(A)]					
		10m	30m	50m	100m	150m	200m
1	Electric generators	69.4	59.9	55.4	49.4	45.9	43.4
2	Road compressors	65.3	55.8	51.3	45.3	41.8	39.3
3	Land leveler	84.0	74.4	70.0	64.0	60.5	58.0
4	Mechanical loaders	83.0	73.4	69.0	63.0	59.5	57.0
5	Spreader	67.0	57.5	53.0	47.0	43.5	41.0
6	Bulldozers	70.0	60.5	56.0	50.0	46.5	44.0
7	Earth excavators	71.4	61.9	57.4	51.4	47.9	45.4
8	Crane	60.1	50.6	46.1	40.1	36.6	34.1
9	Road roller	62.1	52.6	48.1	42.1	38.6	36.1

The standard values in *Noise Limit for Construction Site* (GB12523-90) are adopted for the assessment of the noise in the Construction Period. The standard values are shown in Table 4-4-3.

Table 4-4-3 Noise Limit for Construction Site (Excerpt) Unit: dB (A)

Construction stage	Main noise sources	Noise limit	
		Daytime	Night
Earth and stone	Earth mover, excavator, mechanical loader, etc.	75	55

Piling	Various types of pile engines	85	Constructio n prohibited
Structure	Concrete mixer, vibrator, electric saws, etc.	70	55
Fitment	Crane, elevator, etc.	65	55

Compared the estimation results with the reference standards, the impact scopes of various machineries in the daytime are all within 50m. The noise will be below 70 dB(A) beyond 50m, and below 60 dB(A) beyond 100m.

The impact scope at night is greater. The noise will be 55 dB(A) only beyond 100m for most construction machineries, and it can reach 55 dB(A) only beyond 300m for land levelers, mechanical loaders and other high-noise machineries.

The noise impact of construction is limited in the Construction Period and will disappear once the construction is finished. Also the construction noise has intermittent or sporadic (e.g. pile drivers) characteristics, and will not have serious impact if the construction stops at night.

4.4.2 Traffic noise impact projection and assessment in the Operation Period

4.4.2.1 Traffic noise source intensity

(1) Traffic flow

According to the traffic flow provided by the Feasibility Report of this project and based on an analysis of 24h variation characteristics and communication composition for the existing State Highway 301, the daytime/night traffic flow ratio is 0.83 : 0.17at Hailar Bei, and 0.875:0.125 at Manzhouli.

The classification criteria for large, middle and small vehicles are shown in Table 4-4-4.

Table 4-4-4 Classification Criteria of Vehicle Types

Vehicle type	Total weight
Small vehicle (s)	Below 3.5t
Middle vehicle (m)	3.5t - 12 t
Large vehicle (L)	12t up

The hourly traffic flow of the proposed highway is provided in Table 4-4-5 for different highway sections, and proportion of different vehicle types in Table 4-4-6.

Table 4-4-5 Traffic Flow of Different Highway Sections

Small standard vehicle Vehicle/d

Highway section	2008	2015	2030
Hailar Bei—Chen Qi	8480	16518	38930
Chen Qi --Wuzhuer	6936	13512	32374
Wuzhuer --Cuogang	5888	11394	27376
Cuogang --Zalainuoer	6918	13068	29822
Zalainuoer –Manzhouli	13612	25412	56292

Table 4-4-6 Proportion of Vehicle Types for Different Highway Sections

Unit: %

Highway section	Small vehicle	Middle vehicle	Large vehicle
Hailar Bei—Chen Qi	51	39.2	9.8
Chen Qi --Wuzhuer	61.5	30.6	7.9
Wuzhuer --Cuogang	57	32.3	10.7
Cuogang -- Zalainuoer	53.3	40.7	6
Zalainuoer – Manzhouli	53.3	40.7	6

(2) Running speed

a. The average running speed of small vehicles is calculated by the following formula:

$$Y_S = 237X^{-0.1602}$$

Where, YS -- Average running speed of small vehicles, km/h;

X – Hourly traffic flow of small vehicles in the target year, vehicles/h.

b. The average running speed of middle vehicles is calculated by the following formula:

$$Y_M = 212X^{-0.1747}$$

Where, YM -- Average running speed of middle vehicles, km/h;

X – Hourly traffic flow of middle vehicles in the target year, vehicles/h.

c. The average running speed of large vehicles is calculated at 80% that of small ones.
d. The running speed at night is calculated as 80% of the above running speed.

(3) Average radiation noise level of different vehicles

According to *Temporary Specifications on EIA for Highway Construction Projects*, the average radiation noise level $L_{W□I}$ of various vehicles are calculated in the following formulae:

Large vehicle: $L_{W□L}=77.2+0.18V_L$

Middle vehicle: $L_{W□M}=62.6+0.32V_m$

Small vehicle: $L_{W□S}=59.3+0.23V_S$

Where, $V_{L,}$ V_m, V_S – The average driving speed of large, middle and small vehicles.

4.4.2.2 Noise level projection

(1) Noise source attenuation

According to the specified method in *Temporary Specifications on EIA for Highway Construction Projects*, the projection models are as follows:

$$(L_{Aeq})_i=L_{w□i}+10\lg[N_i/(\upsilon_i\cdot T)]-□L_{distance}+□L_{toprake}+□L_{road\ surface}-13$$

Where, $(L_{Aeq})_i$ -- When i type of car running by day or at night, the hour noise value (dB);

$L_{w,i}$ -- i type (by order) of car's average radiating noise level (dB);

N_i -- Average hour traffic volume of i type (by order) of car running by day or at night (car/h);

υ_i -- Average running speed of i type car (km/h);

T -- LAeq projection time, with 1 h taken;

$□L_{distance}$ -- For the running noise or i (by order) type car, its distance attenuation volume by day or at night in the projection spot with "r" distance from the noise equivalent car running line, (dB);

$□L_{toprake}$ -- Modified volume of traffic noise caused by Highway top rake, (dB);

$□L_{road\ surface}$ -- Modified volume of traffic noise caused by Highway road surface, (dB).

(2) The traffic noise value received by projection spot mad by all types of cars running by day or at night is calculated by the following formula:

$$(L_{Aeq})_{traffic}=10\lg[10^{0.1(LAeq)L}+10^{0.1(Laeq)M}+10^{0.1(Laeq)S}]-\Delta L_1-\Delta L_2$$

$$L1=-\lg(\theta/1800)$$

$$\Delta L_2=\Delta L_{2forest}+\Delta L_{2building}+\Delta L_{2sound\ shadow\ zone}$$

Where, $(L_{Aeq})_L$, $(L_{Aeq})_M$ and $(L_{Aeq})_s$ are respectively the traffic noise value (dB) received by the projection spot of large, middle and small cars running by day or at night, dB;

$(L_{Aeq})_{traffic}$ -- Traffic noise value received by the projection spot day or night;

ΔL_1 -- Modified volume (dB) of traffic noise caused by the Highway curve or limited long road section;

ΔL_2 -- Traffic noise volume (dB) caused by the hindering article between the Highway and the projection spot.

θ – Included angle between the two lines of sight from the projection spot to the highway ends.

(3) The projection value of environmental noise day or night of the projection spot is calculated by the following formula:

$$(L_{Aeq})_{projection}=10\lg[10^{0.1(LAeq)traffic}+10^{0.1(LAeq)background}]$$

Where, $(L_{Aeq})_{projection}$ — Environmental noise value (dB) day or night of the projection spot;

$(L_{Aeq})_{background}$ — Environmental noise background value (dB) when the projection spot doing projection.

(4) Traffic noise projection in complex areas

The projection on traffic noise received at around the highway interchange cross should be calculated in the following formula:

$$L_{AeqT,C}=10\lg[10^{0.1(LAeq)T,H1}+10^{0.1(LAeq)T,H2}+\ldots+10^{0.1(LAeq)T,Hi}]$$

Where, Laeq T,C—Projection of traffic noise received at around the cross, dB.

Laeq T, H1—Traffic noise at projection point received from highway 1, dB.

LAeq T, H2-- Traffic noise at projection point received from highway 2, dB.

LAeq T, Hi-- Traffic noise at projection point received from highway i, dB.

4.4.2.3 Determination of model parameters

(1) Calculation of distance attenuation $\Delta L_{distance}$

a. The spacing of vehicles of type i in the daytime or at night is calculated with the following formula:

$$d_i = 1000 \frac{v_i}{N_i} \quad \text{(m)}$$

Where, N_i – Hourly averaged traffic flow of type i in the daytime or at night, vehicles/h.

b. Distance from the projection point to the noise equivalent driving line (r_2) is calculated with the following formula:

$$r_2 = \sqrt{D_N D_F} \quad \text{(m)}$$

Where, D_N—Distance from projection point to near driveway, m;

D_F-- Distance from projection point to far driveway, m□

c. $\Delta L_{distance}$ is then calculated as follows:

$$\left.\begin{array}{l} \mu\pm r_2 \le d_i / 2\hat{E}\pm: \Delta L_{¾à\grave{A}\beta} = K_1 K_2 20 \lg \dfrac{r_2}{7.5} .....(dB) \\ \mu\pm r_2 > d_i / 2\hat{E}\pm: \Delta L_{¾à\grave{A}\beta} = 20 K_1 \left[K_2 \lg \dfrac{0.5 d_i}{7} + \lg \sqrt{\dfrac{r_2}{0.5 d_i}}. \right] ...(dB) \end{array}\right\}$$

Where, K_1—Land surface status constant from projection point to the highway (Table 4-4-7);

K_2—Constant related to vehicle spacing d_i (Table 4-4-8).

Table 4-4-7 Land Surface Status Constant

Hard land surface	K_1=0.9
Common soil surface	K_1=1.0
Grassland surface	K_1=1.0

Note: Hard land surface refers to pavement road surface, e.g. of bitumen concrete, cement concrete, strip stone, block stone and crushed stone, etc.

Table 4-4-8 Constant Related to Vehicle Spacing

Di(m)	20	25	30	40	50	60	70	80	100	140	160	250	300
K_2	0.17	0.5	0.61	0.71	0.78	0.80	0.83	0.84	0.85	0.88	0.88	0.89	0.90

			7	6		6	3	0	5		5		8

(2) The modification of traffic noise resulted from highway longitudinal slope, ΔL_{slope},is calculated according to the following formula:

$$L\arg e\ vehicle: L_{slope} = 98 \times \beta \text{ K K K K } (dB)$$

$$Middle\ \ vehicle: L_{slope} = 73 \times \beta \text{ K K K K } (dB)$$

$$Small\ \ vehicle: L_{slope} = 50 \times \beta \text{ K K K K } (dB)$$

Where,β—Slope degree of longitudinal slope of highway, %.

(3) The traffic noise modification due to highway pavement,$\Delta L_{pavement}$, refers to the values in Table 4-4-9.

Table 4-4-9 Traffic Noise Modification Duo to Highway Pavement

Pavement	$\Delta L_{pavement}$ (dB)
Bitumen concrete pavement	0
Cement concrete pavement	1-2

(4) Traffic noise modification duo to bending or finite-length section, ΔL_1, is calculated as follows:

$$\Delta L_1 = -\lg \frac{\theta}{180} .....(dB)$$

Where, θ—The angle of sight from the projection point between the two ends of the highway, □

(5) Traffic noise modification duo to barriers between the highway and projection point ,ΔL_2, can be based on the following formula:

$$\Delta L_2 = \Delta L_{2\ forest} + \Delta L_{2building} + \Delta L_{2shadow}$$

a. $\Delta L_{2forest}$ is the noise attenuation resulted from forest barrier.

b. $\Delta L_{2building}$ is the noise attenuation resulted from building barrier.

c. $\Delta L_{2shadow}$ is the noise attenuation resulted from the sound shadow region of the project on the side of high road bank or low road trench.

4.4.2.4 Noise environmental impact assessment

(1) Ambient noise at sensitive sites

Within the assessment scope of the two sides along the proposed project line in the Operation Period, the distribution of ambient noise at sensitive sites for different sections in 2008, 2015 and 2030 is illustrated in Figures 4-4-1 ~ 4-4-5. From the figures, the ambient noise at sensitive sites for the whole highway in 2008, 2015 and 2030 is summarized in Table 4-4-10.

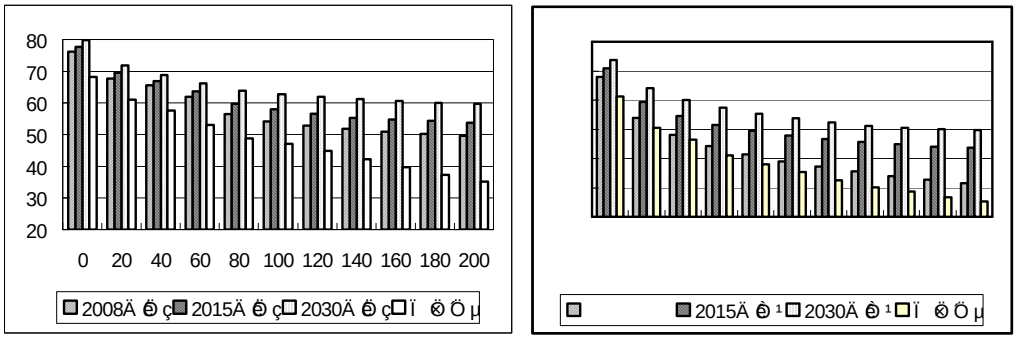
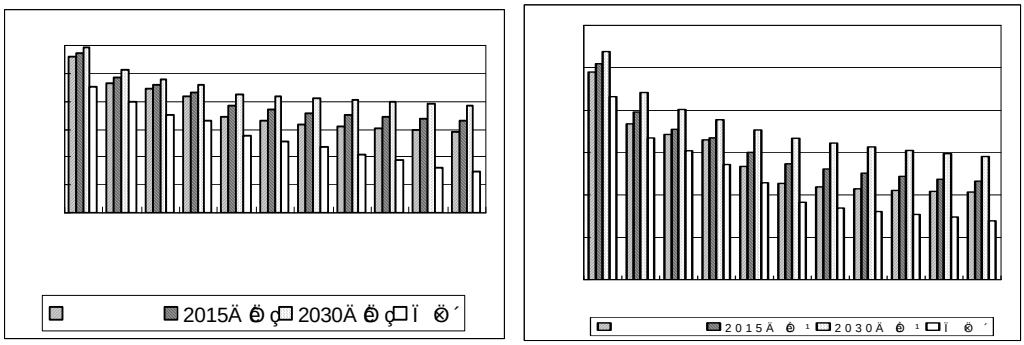


Figure 4-4-1 Projection of Traffic Noise Distribution at Haotetaohai Branch Farm (K404+300)



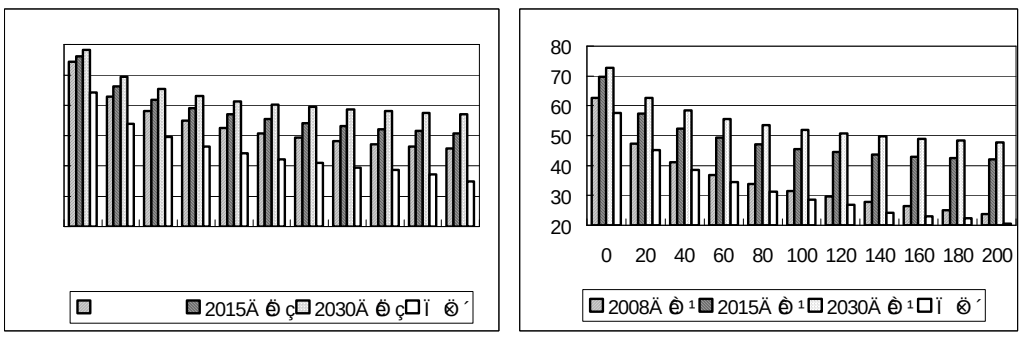


Figure 4-4-3 Projection of Traffic Noise Distribution at West Wuzhuer (K493+400)

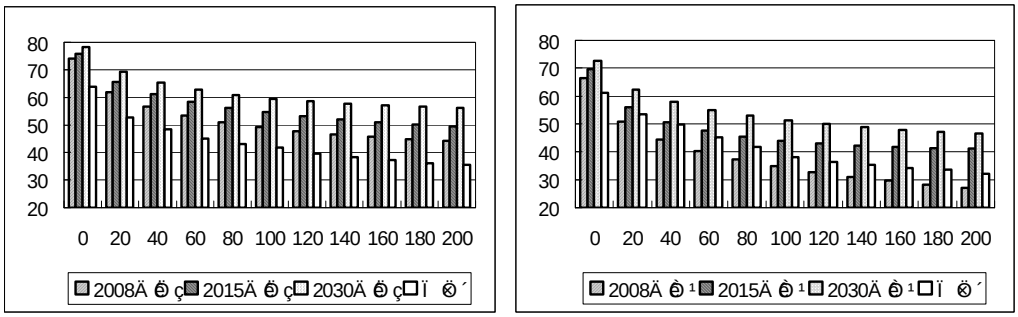


Figure 4-4-4 Projection of Traffic Noise Distribution at Yihe (K505+500)

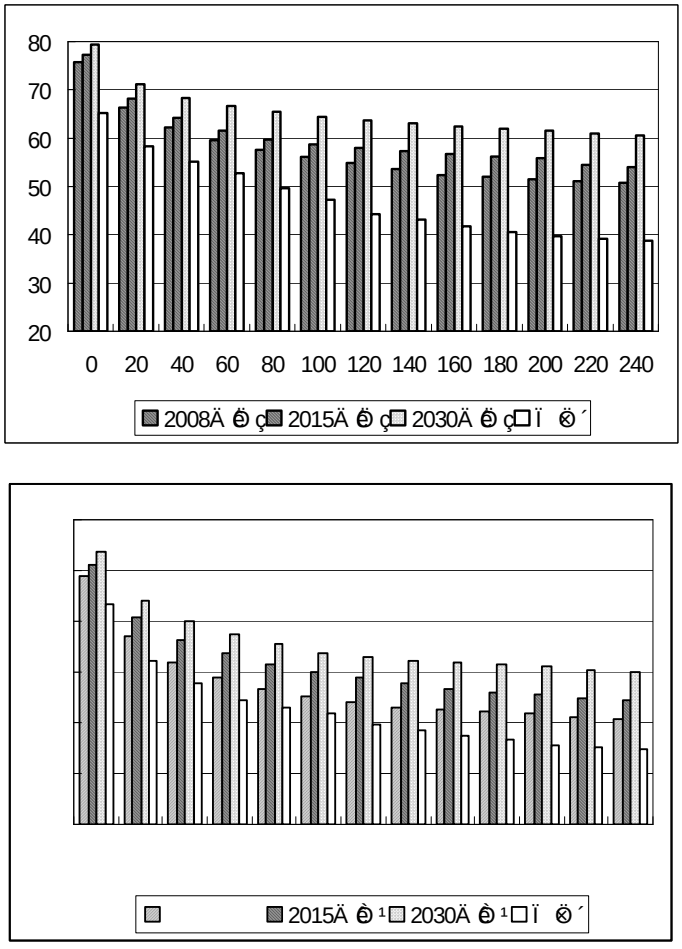


Figure 4-4-5 Projection of Traffic Noise Distribution at Mineral Area Hospital (K557+800)

The traffic flow of Zalainuoer Mineral Area section of the old Highway 301 will be split after the project is put into operation. According to the Feasibility Report, the traffic flow from Zalainuoer to Manzhouli dominates 52.7% of the total. The traffic flow of the old highway will reduce by 73.65% if the diversion percentage of the new Highway 301 is 50%. With the decrease of traffic flow, the noise impact of the old highway on the Mineral Area Hospital will be greatly lowered.

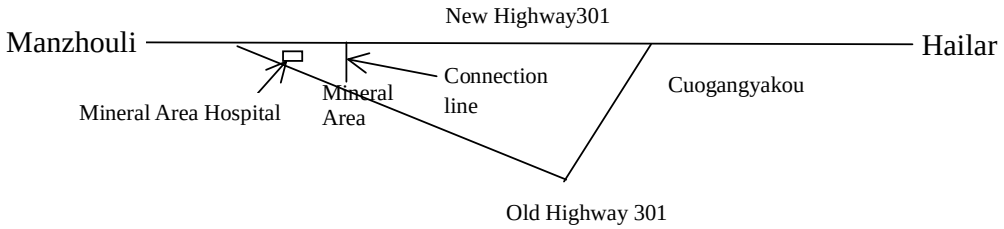


Figure 4-4-6 Mineral Area Hospital Section Traffic Flow Diversion Diagram

Figure 4-4-7 Mineral Area Hospital Section Plan Position Diagram

(2) Noise EIA in the Operation Period

Based on the projection of the ambient noise at sensitive sites within the assessment scope of the two sides along the proposed project line in the Operation Period, the noise EIA for the proposed project is as follows.

a. Residential area

Haotetaohai and the first household of the Fifth Team are near the proposed highway. The long-term noise projection at night at Haotetaohai Branch Farm exceeds the standard value by 4.5dB(A), and the medium-term and long-term noise projections at

night at the Fifth Team of Haotetaohai exceed the standard value by 0.1dB(A) and 2.3dB(A) respectively.

The long-term noise projection at night at West Wuzhuer exceeds the standard value by 2.9dB(A). The projected noise levels at other residential areas call meet with the national standards.

b. Hospital

The medium-term noise projection at night at Mineral Area Hospital exceeds the standard value by 4.1dB(A), and the long-term noise level in the daytime and at night exceeds by 5.37dB(A) and 6.27dB(A), respectively. To reduce the noise impact, six lines trees are planning to be planted between the road and hospital.

Table 4-4-10 Ambient Noise Level at Sensitive Sites of Proposed Highway in the Operation Period

No.	Sensitive site name Post No.	Sensitive site type	Distance to line center (m)	Year	Max. projection value dB(A)		Value exceeding the standard dB(A)	
					Daytime	Night	Daytime	Night
1	Haotetaohai Branch Farm K404+300	Residential area	44	2008	65.3	47.5	-	-
				2015	66.79	53.2	-	-
				2030	68.81	59.5	-	4.5
2	Fifth Team of Haotetaohai K409+700	Residential area	46	2008	64.3	52.94	-	-
				2015	66.01	55.1	-	0.1
				2030	68.1	57.3	-	2.3
3	West Wuzhuer K493+400	Residential area	76	2008	54.2	44.0	-	-
				2015	58.9	51.7	-	-
				2030	62.6	57.9	-	2.9
4	Yihe K505+500	Residential area	60	2008	62.02	50.31	-	-
				2015	55.48	53.26	-	-
				2030	65.09	54.76	-	-
5	Mineral Area Hospital, north enclosure K557+800	Hospital	240	2008	50.94	49.35	-	-
				2015	54.63	49.1	-	4.1
				2030	60.37	51.27	5.37	6.27

4.5 Ecological Environmental Impact Projection

The ecological impacts of highway construction include those in the Construction Period and Operation Period. The highway itself will occupy land permanently, and the construction of the highway will lead to soil compaction, plant striping, species extinction and decrease of vegetation coverage, duo to human activities such as roller compaction of machineries and vehicles, trampling of constructors, and land occupation of construction materials. Ecological patches will be generated in the original continuously distributed landscapes, causing physical abnormality of landform, surface temperature and humidity, interfering with the breeding and migration of surface vegetation and wild animals, altering the land uses patterns and functions, and changing the ecological landscape pattern along the highway line.

4.5.1 Impact on ecological complexity of regional natural system

The impact of the engineering project is within 300m of the two sides of the highway, with total direct impact area of 11383ha, permanent land occupation by the engineering of 1084ha or 9.52% of the total assessment area. The main body of the regional natural system is typical grassland vegetation, with intrazonal vegetation, such as meadow and marsh, distributed under the typical grassland vegetation. The impact of the engineering on the regional natural system is the direct occupation of grasslands and wetlands, which could decrease the productivity of the natural system in the region. The project will have much smaller impact on the productivity of other grasslands and wetlands that are not directly occupied by the project. Therefore, the impact of the engineering on the productivity of regional national system is acceptable.

Only a proportion of 9.52% grasslands and wetlands out of the assessment area will be changed, while other 90.48% of grasslands and wetlands will remain unchanged. Therefore, the role of main body of grasslands and wetlands in the region will not be altered, and the implementation and operation of the engineering will not generate major impacts on complexity of regional natural system.

4.5.2 Land use and livestock production loss

4.5.2.1 Land occupation

The permanent land occupation will be 1084ha, including grasslands, wetlands, farmlands, and other land uses. Among the occupied land, there will be 634.6ha high plain grasslands, and 230ha hilly grassland.

4.5.2.1 Livestock production loss

The grasslands to be occupied are all natural herding pastures. The change of pastures into highway lead to structural variation of land uses in the project area, and cause reduction of herding lands, decrease of grass yield and loss of livestock production.

The present grassland along the proposed highway line is mainly of high and medium coverage. Calculated at an average of fresh grass yield of 3000 kg/ha, there will be a reduction of about 259.4×10^4kg fresh grass annually along the highway line due to the permanent land occupation. In addition, the temporary land occupation during the Construction Period will destruct somewhat the vegetation, and there will be no grass grown within 10m of the construction site. Beyond 50m, the grass coverage will not decrease greatly, but the composition of plant species will be affected, making annual and biennial plants with low utilization value as the main body. This kind of impact is within the short term and reversible, and the vegetation on the temporally occupied lands will start to be rehabilitated after the end of construction. The vegetation rehabilitation will start with annual and biennial plants and can finally reach the original top-level population in 10 years. If calculated at a restoration period of 5 years and suppose that the fresh grass yield in the vegetation destruction area is 50% of that in normal grasslands, the total fresh grass loss in 5 years will be 648.5×10^4 kg.

4.5.3 Landscape impact analysis

The landscape in the proposed project area is comprised of grassland ecosystem, river bog and wetland ecosystem, forestland ecosystem, sand land ecosystem, arable land ecosystem, and human building (including roads, industries and mineral mining, residence, etc.) ecosystem. The quality of landscape ecosystem depends on the interaction among natural environment, various kinds of animals and plants and the human society.

The mosaic dominance method is adopted to analyze the landscape impact of the project.

The following formulae are used to calculate the dominance:

$$\text{Density } R_d = \frac{Number\ of\ mosaic\ i}{Total\ number\ of\ mosaics} \times 100\%$$

$$\text{Frequency } R_f = \frac{Number\ of\ quadrate\ of\ mosaic\ i}{Total\ number\ of\ quadrates} \times 100\%$$

$$\text{Landscape proportion } L_p = \frac{Area\ of\ mosaic\ i}{Total\ area\ of\ sample\ area} \times 100\%$$

$$\text{Dominance } D_o = \frac{(Rd + Rf)/2 + Lp}{2} \times 100\%$$

Table 4-5-1 The Dominance of Mosaics in the Region of State Highway 301

Mosaic type	Density R_d(%)	Frequency R_f(%)	Landscape proportion L_p(%)	Dominance D_o(%)
Grassland	28.4	85.1	64.0	60.4
Wetland	39.5	48.0	28.2	36.0
Forestland	1.9	8.6	0.2	2.7
Human	8.6	23.4	5.5	10.8
building	16	15.4	1.5	8.6
Sand land	5.6	7.2	0.6	3.5
Arable land				

As seen from Table 4-5-1, among the mosaics in the project area, the D_o of grasslands is highest, being 60.4%. In addition, the landscape proportion (L_p) of grasslands is 64.0%, and the occurrence frequency R_f 85.1%. This states that the grassland is the control composition in regional eco-environmental quality. However, the natural environmental characteristics also determine that the grassland ecosystem has obvious fragility and has weak anti-interference ability.

The implementation and operation of this proposed project will change certain current land uses. Based on the dominance calculation model, the dominance of various land uses after the implementation of the project is calculated and shown in Table 4-5-2.

Table 4-5-2 The Dominance of Mosaics After the Change of Lane Uses

Mosaic type	Density R_d(%)	Frequency R_f(%)	Landscape proportion L_p(%)	Dominance D_o(%)
Grassland	27.3	85.1	63.8	60.0
Wetland	38.0	48.0	28.0	35.5
Forestland	1.7	8.6	0.2	2.7
Human building	12.2	32.2	5.8	14.0
Sand land	15.1	15.4	1.5	8.4

Arable land	5.2	7.2	0.6	3.4

According to Table 4-5-2, the local land use patterns will make change after implementation and operation of the highway engineering. The dominance of human building (mainly roads) mosaic will increase from 10.8% to 14.0%. The dominance of grassland and other mosaics will only have small changes and the dominant role of grassland will not change. This indicates that the implementation and operation of the proposed project will not have major impact on the quality of natural system in the assessment area.

4.5.4 Ecological impact analysis in the Construction Period

4.5.4.1 Impact of temporary land occupation on grassland vegetation

(1) Loss of biomass

Temporary land occupation is required for building construction access roads and living camps and piling materials, etc. in the construction of highway. The total area of temporary land occupation will be 539ha. The building of construction access roads and living camps and pilling of construction materials will destruct surface vegetation, and the machineries rolling and constructors trampling will lead to loss of vegetation biomass in the Construction Period.

(2) Waste gas impact

The excavation of earths and stone and vehicle transportation will bring about resuspended dust that can naturally settle on the leave blades of surrounding vegetation, obstruct the stomas, affect the respiration and photosynthesis, and have negative impact on the growth of plants. The exhaust of construction machineries contains NOx and other harmful gases, which can destruct the leaf tissue of sensitive plants, lead to discoloration spots. The construction resuspended dust and exhaust cannot the plant growth during the construction year.

(3) Rehabilitation period

This kind of impact is in short term and reversible. After the end of construction, the vegetation on the temporarily occupied land will start to rehabilitate. Also, in the design, it is required that the topsoil be re-covered on the surface of side ditches, side slopes and earth borrowing pits. It is favorable to the vegetation rehabilitation. When the vegetation on temporally occupied land is rehabilitated to the surrounding vegetation, the impact can be finally eliminated. Generally, the side slopes can be rehabilitated quicker due to human grass planting and watering. The rehabilitation of construction access roads may be slower as the soil has been compacted and formed bare land. Without external interference, the rehabilitation to original top-level vegetation will require a time of 8~10 years.

4.5.4.2 Impact on wild animals

The animal resources in the project area include fish, amphibians and reptiles, mammals and wild birds, etc.

(1) Fish, amphibians and reptiles

During the construction period of the highway, the temporary land occupation and destruction of vegetation due to the earth and stone excavating, material piling and constructors living will have unfavorable impact on the varieties and quantities of rodents, amphibians and reptiles along the line, making them migrate to surrounding areas with less interference and adapt to and live in the new environment. After the end of construction, the varieties and quantities of rodents, amphibians and reptiles on the temporarily occupied land will gradually be rehabilitated.

(2) Mammals

There are some large and middle wild animals in the region. Two sections of the proposed highway from the starting end to West Wuzhuer will utilize old roads as separated cross sections. Within the region, there have been many human activities, with large traffic flows and great human interference, and there are few large and medium wild animals that are fear of human interference. From West Wuzhuer to Erka Wetland, the human activities are fewer, but there are also few large and medium wild animals. The construction of the highway during the Construction Period may affect the ways of migration, scope of feeding and the habits, but as the large and medium mammals have been few, the impact of highway construction on them should be low.

(3) Birds

The mechanical noise, human activities and vegetation destruction in the Construction Period will all affect the habitation and breeding of birds in the construction zones and nearby areas, making obvious change of varieties and species of the birds in the region. The impact on the birds will vary among different species. The sparrows and swallows that accompany the man will increase while others will decrease. The highway will have a long way through the wetland, which may affect local wild animals (see Section 5.1.5).

To sum up, the highway will have obvious impacts on small animals such as rodents, amphibians and reptiles. However, this impact should be temporary, will disappear gradually after the end of construction, and will not affect their living and population quantity. As there are currently few large, mammals along the line, the construction of the engineering will have small impact on large mammals. The construction will have major impacts on the birds along the line, especially on the birds habilitate and act in the wetland along the line. The construction will occupy and destruct the original

habitats and existence environment of the birds, forcing them to flee to other places. After the construction, some birds may return to the region, but others especially those that are more sensitive to human interference will migrate to other places.

4.5.4.3 Impact on soil environment

The impacts of the engineering construction on the soil environment will on the aspects of soil salinization, soil erosion and soil desertification, etc.

(1) Soil salinization

At present, there is a common phenomenon of soil salinization surrounding the small lakes along the highway line due to low groundwater level, over grazing and numerous human activities. The destruction of vegetation along the line due to engineering construction will deepen the salinization degree around the lakes. But because the salinized soil along the line is small in area, the impact area resulted from project construction will not be great compared with the whole project area.

(2) Soil desertification

The soil possibly impacted by the project would be to the east of the Hailar River in the area from West Wuzhuer to Erka Wetland. The soil of this section is mostly sand dark Castanozems soil with strong sandy characteristic. The over-grazing has made the pasture vegetation at slight and medium degradation. After the destruction of vegetation and top soil due to the engineering construction, the soil particles will be brought away by wind erosion, with sandy matters remained in the earth surface, thus forming desertification. There are also distributed sand dunes nearby the Hailar River that are currently stabilized and semi-stabilized ones with good vegetation coverage. The activities of road construction, earth excavation and bridge building, etc. will destruct the sand dune vegetation, and probably mobilize these stabilized and semi-stabilized sand dunes to form moving sand dunes. The wind erosion of 1ha bare sand can affect 3ha grasslands nearby. The construction of this sub-section of highway may aggravate the desertification trend. In addition to adopting grass grids to fix the sand at the side ditches and side slopes of the highway, it is suggested that enclosed cultivation of vegetation be implemented on the sand lands along the line and that measures to protect the sand lands formulated, so as to alleviate the destruction of the fragile local eco-environment and prevent land desertification.

According to the surveys, the soil water condition is good. Therefore, although there exist conditions of soil desertification in the project area, so long as the top soil is not destructed and grassland vegetation and sand land vegetation are well protected, the highway construction will not lead to serious soil desertification and sand dune mobilization.

(3) Soil erosion

The soil erosion from the engineering construction is supposed to occur at roadside slopes, side slopes of earth borrowing yards and waste earth yards, and natural roads on the gentle slopes and hillocks. In these areas, when the vegetation is seriously destructed with bare soil exposed, the wind erosion will occur in drought and windy spring days, and water erosion happen in rainy summer days. As the area does not belong to serious water erosion area, there should be no major water erosion problem as long as the vegetation protection on slopes is highlighted in the construction procedure. However, the area belongs to serious wind erosion area, the earth excavation and filling will lead to many bare lands, which may aggravate current soil wind erosion along the line.

For the excavation of hills and hillocks and filling of roadbed earth at low lands, when high steep slopes are formed on the roadsides, terraces will be required to be set up by the constructors. When the slope is greater than 20m, one terrace with the width of 2.0m should be set up for each 10m. Collection terrace will be set up at the bottom of the slope and water cut-off ditch at 5m to the top of the slope. The roadbed water drainage facilities include side ditches, drainage ditches, cut-off ditches, swift ducts, and seepage ditches, etc. When the longitudinal slope is greater than 4%, all the surface drainage facilities should be consolidated by masonry sliced stones. When the roadbed filling height is less than 4.0m, the slopes will be protected with grass planting, and when the height is greater than 4.0m, the grass planting should be combined with concrete grids. For Bayankuren-Huhenuoer section and Erka Wetland section, masonry sliced stones will be adopted below the design water level. The road trench slopes will be protected by masonry stonewalls, etc. All these measures can effectively reduce the water erosion and wind erosion of the roads. It is suggested that the constructors adopt section-by-section restoration method. This will implements timely grass planting immediately after the construction of one highway section and speed up the rehabilitation of the vegetation.

(4) Environmental impact of material yards, earth borrowing yards, waste earth yards and Living Quarters for Construction

There will be a total of earthwork of 8150682 m^3, and stonework of 999362m^3 for the proposed engineering. There will be set up one sand-gravel yard (see Table 2-11, II-1), 2 self-exploring stone yards (see Table 2-11, IV-2 and IV-2), 9 earth-borrowing yards and 2 waste earth yards (see Table 2-12), 8 Living Quarters for Construction. No sensitive spots such as residences are found along the line from earth borrowing yards and waste earth yards to highway.

The impacts of self-building material yards, earth borrowing yards, waste earth yards and Living Quarters for Construction include:

a. Occupying pastures in the Construction Period, causing a yield annual reduction of 245000kg fresh grass. After the end of construction, with the gradual rehabilitation of vegetation, the impact on pasture yield will gradually be reduced.
b. Destructing landforms and affecting the landscape along the line. The impact on the landscape will be small if the resources are reasonably exploited and land leveling and vegetation rehabilitation are properly carried out after the construction.

Destructing the vegetation and generating soil erosion.

There are 8 Living Quarters for Construction along the line, which are located at K420+900, K426+000, K432+900, K477+700, K490+000, K544+900, K560+000, K575+600B respectively according to the primary design. Because K544+900 is just in Erka Wetland, after negotiating with the design unit, this encampment of construction is moved to K538+750.

4.5.5 Ecological impact analysis in the Operation Period

4.5.5.1 Impact on animals

(1) Cutting off animal pathways

There are wild animals and domestic animals. The highway operation will cut off pathways of some wild animals, and affect communication of species. Especially in the section of K511+849~K549+949, which will be newly built in the grasslands and wetlands, the highway may have some cut-off impacts on the communication of wild animals. The main animals in the region are fish, amphibians and birds, and several bridges and culverts will be built, therefore, the cut-off impact on the animals will be small.

In the sections that utilize old highways, there is already cut-off on the animals. The animals have got used to the cut-off of pathways. When the road is widened, the cut-off degree will be increased. Therefore, the utilization of old roads will have less cut-off impact on the animals. Because the large and medium wild animals along the highway line are small in number, the highway as a barrier will not have major impact on the migration of large and medium wild animals. Among the large and medium mammals that are acting along the line are most domestic breeding animals, such as horse, cow and sheep, etc., which activities can be guaranteed by setting up bridges and culverts and specific passages to alleviate the negative impacts. In addition, the impact on the domestic animals may become less when they get used to the new environment in some time.

(2) Doing harm to animals

According to on-site investigation, many groups of Melanocorypha mongolica are currently flying over or resting on the roads, and are liable to striking by the vehicles. Because the proposed highway is of Class I and the design running speed is 100km/h, the rapid vehicles have high possibility of striking the flying or resting birds. Also the possibility that some small reptiles and rodents are rolled to death when they cross the highway is high.

(3) Surprising wild animals

After operation of the highway, the traffic noise will permanently affect the animals nearby. The noise from the running vehicles can directly scare and disturb the birds and other animals in the region, having certain impact on their habitation and breeding. This may force the animals to flee away from the region, resulting in reduction of animal varieties and quantities along the line. In the wetland and lake areas through which the highway goes, the birds are concentrated, and there are in particular many national protective birds. The running vehicles could seriously affect the habitation and activities of them. It is suggested that marks of prohibiting sound horns set up at the highway section, so as to reduce the scaring and disturbing of the wild animals.

4.5.5.2 Impact of land use patterns change on mini climate

The operation of the project will thoroughly change the land use patterns in the project line area, making the underlying surface of original grasslands and wetlands obviously changed. The increase of surface roughness and decrease of grassland and wetland area will change local surface temperature. The highway surface will absorb more radioactive energy from the sun, and the vehicles will charge more heat and gases. This will result in some heat island effect on the highway and the temperature of the highway surface will be 3~8ºC higher than that of grassland surface. However, because there are the Moergele River, the Hailar River, the Huhenuoer River and Erka Wetland, etc. nearby the highway line, the wetland area is large with and much evaporation, the adjustment ability of mini climate in the project line area is strong, and thus the humidity and temperature of the mini climate will not change obviously.

4.5.6 Impact of species intrusion

The proposed project line starts at Hailar District and ends at Manzhouli City. Manzhouli is an important port; foreign species transferred through international shipping will first arrive at this port. These foreign species may establish the their own communities if the environment is suitable and begin to disseminate afterwards.

The foreign species carried on the vehicles may settle and disseminate along the sides of the highway.

The foreign species often have harmful impact on the system and structure of the ecosystem, and endanger the local species, especially rare and endangered ones, causing the loss of biodiversity. Some foreign species can even bring about huge harm to local society and economy.

At present, the foreign species are often introduced into China by the following ways: intentional introduction, unintentional introduction with human activity, introduction with other animal and plant species, introduction by tourists, and natural importation. In order to avoid harmful impact from foreign species introduction, preventive and control measures should be adopted (see Section 8.2.5).

4.6 Solidwaste Environmental Impact Analysis

4.6.1 Construction Period

Based on the engineering analysis, the solidwastes generated from the proposed project will be mainly from the Construction Period, with the following kinds: engineering construction waste earth, building garbage, and living garbage of the constructors.

(1) Construction waste earth

According to the accounting of earthwork of this project in the engineering analysis, the project will require net import of earth, with the earth filling greater than the earth excavation. In order to avoid ecological impact by plenty of earth excavation, the earthwork within the project should be balanced. There is finally a problem of waste earth. Two waste earth yards will be set up which sites in low-relief area. Their locations are indicated in Figure2-8. Before the siting of waste earth yards, notifications to the local residents, government and negotiations with the public have been put into effect. The local residents and government agreed the site selections of the waste earth yards, and the waste earth yards have passed professional examination.

The accounting of earthwork of the project is shown in table 4-6-1.

Table 4-6-1 Earthwork Accounting of the Proposed Project Unit: 1000 m^3

Item	Excavation	Earth filling	Waste earth	Waste stone
Quantity	35.735	341.638	103.027	115.909

According to the environmental protection measures requirements, the waste earth should be timely compacted, covered with vegetation and conserved by necessary protective engineering. By doing this, the ecological impact will be small.

(2) Living and building garbage

The living garbage of the constructors refers to various solidwastes from living places of the constructors, including food wastes, residues, food packaging materials, etc. The per capita living garbage is calculated at 1.0Kg/d. The building garbage mainly refers to removal wastes along the highway line, waste earth and stone during road breaking, and waste materials in the construction procedure, etc.

The amount of living and building garbage produced from this project during the Construction Period will be small. They will have no negative impacts on the vegetation and land uses after the end of construction, if properly disposed.

4.6.2 Operation Period

The solidwastes in the Operation Period mainly come from living garbage generated from the staff active areas in the Service Area and other service facilities.

The project will set up one service area, with small amount of solidwastes. The impact of the solidwastes on the surrounding environment will be very small if adopting proper pollution control measures (e.g. central collation and periodical clearance). See Section 8.3.6 for detailed measures.

4.6.3 Summary

(1) Environmental protection measures will be adopted and necessary protective engineering set up for waste earth yards in the Construction Period.
(2) There will be very small amount of living and construction garbage in the Construction Period, and there will be no negative impacts on the vegetation and land uses, etc. after the end of the construction.
(3) In the Operation Period, environmental sanitation departments will clear the garbage on both sides of the highway, and the impact of the solidwastes on the surroundings will be very small.

4.7 Pollution Risk Analysis for Dangerous Goods

After the highway is put into operation, there will be possibility of traffic accidents. For the vehicles loaded with toxic, harmful, inflammable or explosive matters, in particular, once the traffic accident happens, the impact on the environment will be great. Considering that the risk of dangerous goods transportation is the emergency of traffic accidents, it can be prevented through certain management measures. In order to timely control possible occurrence of accidents, fire control institutions should be set up with professional personnel and monitoring instruments equipped, in order to timely eliminate and control the pollution. The transport units should strictly abide by national and sectoral norms and procedures on the transportation of the dangerous goods, equip the transport vehicles with preventive measures and necessary facilities, and normalize the labeling. It is important to train the practitioners with professional techniques and perform traffic safety education for the drivers. Once the traffic accident occurs for a dangerous goods vehicle, it should be timely informed to fire control and environmental protection departments. Major pollution accidents from traffic accidents should be reported level by level to national administrations. The risk of transportation of dangerous goods in this project will be small if adopting proper measures.

4.8 Accumulative and Indirect Impact Analysis

4.8.1 Accumulative impacts

The highway network in the proposed project area is shown in table 4-8-1 and Figure 4-8-1. The main environmental problems of the network construction include: social environmental impact, water environmental impact, ambient air impact, noise environment impact and ecological impact in both construction and operation periods.

Adopting corresponding environmental protection measures can minimize the environmental impacts of the network construction. The network projects will occupy a land area of 405.27ha. Considering that the network will be constructed on the base of existing natural roads or sand gravel roads, the new occupation of land will be small. The roads will be dispersive, and the accumulative impacts will be small.

Table 4-8-1 The Situations of Highway Network in the Proposed Project Area

No.	Name of projects	Length (km)	Standard	Current class of road	Roadbed (m)	Pavement (m)

1	Honghuaerji—Handagai	99	Mountain ridge, Class III	Natural road	7.5	6
2	Alatanemole—Amugulang	128	Class III	Class III&IV, sand gravel	7.5	6
3	Dayangshu—Nenjiang	111	Class III	Class III, sand gravel	8.5	7
4	Zalainuoer—Heishantou	165.5	Class III	Natural road	8.5	7

4.8.2 Indirect impacts

The construction of the proposed project will lead to change of industrial structure and economic types in the project area and finally bring about indirect impacts on the regional environment.

Considering that it is difficult to determine the spatial and temporal scopes and quantitative impact results in the EIA, this EIA only performs analysis in combination with current economic types and future industrial structure.

The current bearing capacity of State Highway 301 is low and cannot guarantee and meet with requirements of the safe pass of large freight cars. The construction of Hailar-Manzhouli Section will provide a speedy and safe transportation passage for the locality. The possible beneficial enterprises or enterprise groups include: Manzhouli Import Timber Processing Industrial Estate, Changfu Group, Zalainuoer Coal Mining Company, Fulun Paper Company and Chenming Paper Company, Non-ferrous Metal Mineral Resources Development Project of Xinbaerhu Qi, and Hailar Vegetables and Fruits Export Production Base. The basic situations of the beneficial enterprises are as follows.

(1) Manzhouli Import Timber Processing Industrial Estate
50% import goods from Manzhouli Port are timber. Manzhouli Import Timber Process Industrial Estate has now more than 10 timber processing enterprises. 50% of the timber products and semi-products are sold to Dalian and Tianjin for export. The process wastes or by-products are transported to Zalantun and other places to serve as raw materials for pulp production. Most of the products are transported outside by roads.

(2) Changfu Group
Changfu Group has invested in Chen Qi to produce liquid milk, with most of the products sold to Russia, Mongolia and inland, and part of the products sold to Southeast Asia.

(3) Zalainuoer Coal Mining Company
Zalainuoer Coal Mining Company produces fluid oil and other products, most of which are sold to Hailar District and other areas farther than Hailar.

(4) Fulun Paper Company and Chenming Paper Company
Fulun Paper Company produces shopping bags. Chenming Paper Company mainly produces cultural paper.

(5) Non-ferrous Metal Mineral Resources Development Project of Xinbaerhu Qi,
The project produces silver, lead, zinc and mineral powder. The products are mainly sold to inland areas.

(6) Hailar Vegetables and Fruits Export Production Base
The base mainly engages in process, storage and preservation of vegetables and fruits.

In addition, the improvement of regional traffic conditions will be favorable to absorb new investments and new enterprises.

The improvement of the transport and communication will provide good conditions for the above enterprises. While the expansion of the enterprises is implemented, new environmental problems will be generated, and total pollutant discharge increased.

It is suggested that the new building and expanding of the enterprises in the project area should strictly implement the system of EIA, to ensure the pollutant discharge in compliance with the standards. The current water quality of the Hailar River in the drought period is serious; the comprehensive control plan has been developed. The water quality will be obviously improves as various treatment projects have been initiated in succession.

As about 13km of the road will be built passing across the erka wet land, the building of the road will naturally benefit the development activities at the fringe of the wetland. The development may not directly reduce the area of the wetland, but it will surely impact the function of the wetland, will reduce the activity area of animals in wetland. Strictly policy must be made by the government to restrain the development. This policy will cover the protected scope of the wetland. No development is allowed within the scope. Limited requirement will also be given to the development at the fringe of the wetland to ensure the environment impact is acceptable. As known, this policy is under planning nowadays.

4.9 Traffic Safety Analysis

The current highway from Hailar (north) to Manzhouli (port) is about 206km, with 90% being Class III highway. The pavement structure is under bituminous surface treatment, and the bearing capacity is insufficient. After nearly 10 years of operation and impacted by destruction of catastrophic flood in 1998, the highway has had serious diseases such as pavement ageing, depression and net crack, etc., with weak anti-disaster capacity and poor service level as a whole, difficult to guarantee the passage safety of large goods vehicles, especially in the spring. With the economic development and ever increasing of urbanization, there are a total of 20km highway sections within Bayankuren (capital of Chen Qi), Zalainuoer Mineral Area and Manzhouli City, having formed streets in urban areas. In addition, the crosswise interference along the current highway line is less, the running speed is fast and the pavement is relatively narrow, and vicious traffic accidents have happens frequently. The statistics of traffic accidents at Hailar-Manzhouli of State Highway 301 in 1998 – 2002 is shown in Table 4-9-1.

Table 4-9-1 Traffic Accidents at Hailar-Manzhouli of State Highway 301 in 1998 –2002

Interval		ChenQi-West Wuzuer	West Wuzhuer - Manzhouli	Total
1998	Quantity (times)	48	19	67
	Loss (10000RMB)	4.5	6.4	10.9
	Death (persons)	11	8	19
1999	Quantity (times)	50	14	64
	Loss (10000RMB)	3	3.95	6.95
	Death (persons)	12	-	12
2000	Quantity (times)	65	25	90
	Loss (10000RMB)	17	1.3	18.3
	Death (persons)	14	-	14
2001	Quantity (times)	30	5	35
	Loss (10000RMB)	5	1	6
	Death (persons)	13	1	14

2002	Quantity (times)	53	7	60
	Loss (10000RMB)	6	1.5	7.5
	Death (persons)	9	-	9

After the expansion of Hailar-Manzhouli highway section, the highway will be of Class I, the communication conditions will be greatly improved, traffic safety be enhanced and trffic accidents be reduced.

Table 4-8-2 Basic Situation of State Highway 301 Suifenhe-Manzhouli

Name of section	Section length (km)	Current status		Situations of proposed engineering									
		Technical class	Pavement structure	Technical class	Pavement structure	Starting time	Ending time	Total invest. (0.1b RBM)	Foreign loan	Domestic loan	MOC Subsidy	Local subsidy	Note
Heilongjiang section													
Total	850.4							20.1					
Suifenhe-Mudanjiang	154.8	Class II	Cement concrete										
Mudanjiang-Hailin	13.8	Express	Cement concrete										
hailin-Acheng	259.5	Class I, II, under construction	Cement concrete	Express	Cement concrete	2003	2006	13.3					Basically domestic financing
Acheng-Daqing	156.8	Express	Cement concrete										
	15.6	Class II	Cement concrete										
Daqing-Lindian	44	Class II, under construction	Cement concrete	Express	Cement concrete	2003	2004	6.9					Basically domestic financing
Lindian-Qishi	125.6	Class I	Cement concrete										
Qishi-Gannan	3.7	Class I	Cement concrete										

	76.6	Class II	Cement concrete										
Inner Mongolia section													
Total	610.705							53.03	9	15.6	24.03	4.4	
Ganan –Yakeshi	315.443	Class II	Bitumen concrete	Class I	Bitumen concrete	2004	2005	26.2		11.8	11.3	3.1	314km
Yakeshi-Hailar	67.09	Class I, under construtio n	Bitumen concrete	Class I,II	Bitumen concrete	2003	2005	6.83		3.8	3.03		81.32km
Hailar –Qianshao	196.969	Class II, III	Cement concrete	Class I	Bitumen concrete	2004	2006	20	9		9.7	1.3	189.2km
Qianshao-Manzhouli	18.8	Class I	Bitumen concrete										
Manzhouli-Guomen	12.403	Class I	Cement concrete , bitumen concrete	Class I									

CHAPTER 5 ERKA WETLAND ENVIRONMENTAL IMPACT ASSESSMENT

Erka Wetland is located within Hulunbeier City, Inner Mongolia, with east longitude of 117°45′~118°16′ and north latitude 49°17′~49°41′. The total area is 52800 ha.

5.1 Erka Wetland Current Status Assessment

5.1.1 Landform

The landform of Erka Wetland is mainly comprised of lakeshore plain, alluvial plain, river flood plain, sand land and sand hill, high plain, etc. The lakeshore alluvial plain is distributed in the south of the region. The two sides of Binzhou Railway are river alluvial plain by the Hailar River, which are then submerged by Dalai Lake water and transformed into flat area with sand as the main content. The alluvial plain is mainly distributed in the wide delta formed by the Erguna River and the Hailar River and the flat area on the east side of the Erguna River, being sandy plain areas. The landform of river flood plain is mainly distributed nearby the Dalan'eluomu River, with low relief and developed marsh. The sand land and sand hill are mainly distributed in the south part of the area, the north side of the Hailar River, and the northeast part of Cuogang Pasture. The sand land to the north of the Hailar River is within alluvial plain of the Hailar River. The sand dunes and sand hills are distributed in belt pattern, mostly stabilized by vegetation; the edges have obvious sand hills with low vegetation coverage. The high plain landform is only distributed at Haolinte Hill (or named Tuweiba Mountain) on the north side of Binzhou Railway.

5.1.2 Soil

The soil in the area includes mainly salinized meadow soil, salinized Castanozems soil, meadow bog soil, alkalized meadow soil, meadow alkali soil, meadow Castanozems soil, alkalized Castanozems soil, Aeolian soil, and sandy Castanozems soil.

In the areas to the south of Binzhou Railway and the west of the Xinkai River are mainly salinized meadow soil, scattered with salinized Castanozems soil and meadow bog soil. The northern area to the east of the Xinkai River is mainly alkalized meadow soil, scattered with meadow alkali soil. In the southern area with high relief, there are mainly distributed meadow Castanozems soil, salinized Castanozems soil and alkalized Castanozems soil. On the north side of the Hailar River, are mainly sandy Castanozems soil and Aeolian soil. The river flood plain have mainly meadow soil and bog soil.

5.1.3 Hydrology

The main rivers in the region are the Hailar River, the Erguna River and the Xinkai River. The Hailar River originates from the west foot of Jieleqilaoshan of Daxinganling Mountains in the

Yakeshi City. It flows from east to west, accepting the water from other rivers along the line, and into Hunlunbeier Highland when nearby Yakeshi. When flowing near to Abagaitu Mountain in the north of Zalainuoer, it merges with the Dalan'eluomu River, and turns direction to the northeast. This is then called the Erguna River.

The small lakes in the area are mainly distributed in the terrace on the north side of the Hailar River and the east side of the Erguna River. The lakes are parallel to each other, and vertical to the Erguna River. There are more than 10 lakes with the area of over 1km^2, including Benpo Lake, Yihenuoer, Chagannuoer, and Galute, etc. In addition, there are also some seasonal lakes along the Hailar River and the Erguna River.

5.1.4 Landscape ecology patterns

Erka Wetland landscape is mainly comprised of wetland landscape and sand wetland landscape.

5.1.4.1 Wetland landscape

Wetland landscape is the most important landscape in Erka Wetland. The wetland ecosystem includes the Hailar River, the Erguna River, flooding lands and surrounding lakes. A large area of river-type, marsh- type and lake-type wetland is formed at the joint of the Hailar River and the Erguna River. The wetland is continuously distributed, with large area and less patches. The wetland has rich aquatic vegetation, marsh vegetation, meadow vegetation and salinized meadow vegetation, etc., with integrated ecosystem structure and normal ecological functions. It has been the settling, breeding and migration habitat of birds, as well as the a major stop for the migration of birds. The animal and plant diversity and landscape diversity here are high. The wetland landscape can be classified by vegetation form and wetland type into riverbank shrub forest wetland landscape, reed marsh landscape, reed and weeds marsh wetland landscape, salinized meadow landscape, river wetland, and lake wetland, , river and lake lowland salina.

(1) Riverbank shrub forest wetland landscape

Riverbank shrub forest wetland landscape is mainly distributed in the flooding plain to the north of the Hailar River, and on the two sides of the Erguna River. It is the main landscape type in Erka Wetland, distributing in narrow belt and crumby form among the flooding wetland and sand dunes along the rivers. Beyond the riverbank shrub forest wetland on the north side of the Hailar River, are sandy shrubs and then Stipa krylovii grassland, with the main vegetation of Salix microstachya var. bordensis (Nakai) C.F.Fang.

(2) Reed marsh landscape

Reed marsh wetland is mainly found on the wide river flooding plains to the south of the Hailar River, ranging from Erka Guard to the east of Tuweiba Mountain. It is distributed in crumby form in the river and lake dense areas, and has a distribution of single dominant species to the

north side of Tuweiba Mountain. The area has dense reed and wide water area, with good conditions for the breeding of birds. However, the over-fishing has resulted in negative impact on the inhabitation and breeding of birds. The main plant type is reed community, and there are also submerged aquatic vegetation, floating aquatic vegetation, marsh vegetation, and other kinds of vegetation.

(3) Reed and weeds marsh wetland landscape

The reed and weed meadow is distributed mainly in three major lots. The first lot is located to the south of Binzhou Railaway and to the east of Zalainuoer. The second lot is located to the north of Binzhou Railway and to the south of the Hailar River. The third lot is located to the north of Cuogang Pasture. These three lots all have large-area reed and weed meadows continuously distributed, with flat and wide topology, and are important pastures.

(4) Salinized meadow landscape

The salinized meadow landscape is mainly distributed in the numerous lakes and lakeshore lowlands to the north of the Hailar River and to the east of the Erguna River. The salinized meadow vegetation is mainly comprised of mesophytic perennial grasses.

(5) River landscape

The main river landscapes include the Hailar River, the Erguna River and the Xinkai River, etc. The Hailar River belongs to the downstream river in the region. It is called the Erguna River at Abagaitu. The Xinkai River interlinks the Hailar River and Dalai Lake. The Erguna River is the border river between China and Russia. The Hailar River and the Erguna River are most important surface water bodies in the region, with rich water, and wide and deep stream channel and sailing courses. There grows mainly Salix micranthus on both sides of the rivers, with good natural conditions.

5.1.4.2 Sand Landscape

The sand landscape is widely distributed. One sand ribbon lies on the alluvial plain to the north of the Hailar River and is parallel to the Hailar River. Another sand ribbon lies to the south of the Hailar River and is also parallel to the Hailar River, being the west end of Hailar Sand Ribbon. In the sand landscape, bare sand land and stabilized and semi-stabilized sand land are inter-distributed. The patches are numerous in number and the landscape has high degree of fragmentation. According to vegetation type and landform composition, the sand landscape can be classified into three types, i.e. sand Mongolian scotch pine landscape, sand shrub forest landscape, and bare sand landscape.

(1) Sand Mongolian scotch pine landscape

Sand Mongolian scotch pine landscape is only distributed on the sand lands on the north side of the Hailar River, about 1km to Cuogang Pasture. It has the characteristics of the grassland, with

high degree of closing. The shrub vegetation and grassland vegetation are developed.

Sand Mongolian scotch pine (pinus sylvestris var mogolica) was once distributed very wide on this sand land in the previous days. Duo to cutting and over-grazing, the sand Mongolian scotch pines have basically disappeared in this area, despite for some lots on the west side of Hailar Sand Ribbon.

(2) Sand shrub forest landscape

Sand shrub forest landscape is widely distributed on both sides of the Hailar River, basically in the continuous form, but also with fragmental patches. The area has fluctuating sand dune landform, with well-grown sand shrub forest and sandy herbaceous plants. As the area has high groundwater level, relatively humid climate, natural rehabilitation of vegetation in the sand lands as well as stabilization of sand is possible, as long as over-grazing is controlled.

(3) Bare sand landscape

There is not much bare sand landscape in the region. It is concentrated on the sand ribbons nearby Cuogang Pasture and on the south side of the Hailar River, basically distributed continuously. It is generally inter-distributed with sand shrub forest landscape. The patches are numerous and fragmental and basically distributed on semi-stabilized sand ribbons. The annual herbaceous plants on the sand lands are basically eaten by cows and sheep, making the sand dunes difficult to be stabilized. The main plant types on the bare sand ribbons are annual herbaceous plants, such as Agriophyllum pungens, Corispermum and Xanthium sibiricum Patrin ex Widder.

5.1.5 Plant resources

5.1.5.1 Compositions of phytogroups

Based on the survey on Erka Wetland, there have been found 257 species vascular plants, respectively belonging to 57 families and 165 genera. Among the plants, there are 1 family, 1 genus and 2 species of ferns; 2 families, 2 genera and 2 species of gymnosperms; and others (angiosperms). The number of Gramineae species is maximum (38 species), with Compositae, Leguminosae, Rosaceae and Ranunculaceae next to it. The genus of Artemisia has maximum number of species (12 species), and the genera of Potentilla, Carex, Allium, Polygonum and Poa have 6~9 species respectively.

Table 5-1 Erka Wetland Wild Plant Phytogroup Compositions

No.	Family	Genus	Species	No.	Family	Genus	Species
1	Equisetaceae	1	2	30	Hippuridaceae	1	1
2	Pinaceae	1	1	31	Umbelliferae	5	5
3	Ephedraceae	1	1	32	Primulaceae	1	1
4	Salicaceae	1	2	33	Plumbuginaceae	1	1
5	Ulmaceae	1	1	34	Gentianaceae	3	3
6	Moraceae	1	1	35	Asclepiadaceae	1	1

7	Urticaceae	1	1	36	Convolvulaceae	2	2
8	Santalaceae	1	1	37	Convolvulaceae	3	3
9	Polygonaceae	2	10	38	Labiatae	5	5
10	Chenopodiaceae	8	14	39	Scrophuriaceae	2	2
11	Amaranthaceae	1	2	40	Orobanchaceae	1	1
12	Portulacaceae	1	1	41	Lentibulariaceae	1	1
13	Caryophyllaceae	6	8	42	Plantaginaceae	2	2
14	Ranunculaceae	9	15	43	Rubiaceae	2	2
15	Papaveraceae	1	1	44	Dipsocaceae	1	1
16	Cruciferae	4	4	45	Compositae	35	35
17	Crassulaceae	2	2	46	Typhaceae	1	1
18	Saxifragaceae	1	1	47	Sparganiaceae	1	1
19	Rosaceae	5	16	48	Potamogetonaceae	1	3
20	Leguminosae	13	20	49	Juncaginaceae	1	1
21	Geraniaceae	2	2	50	Alismataceae	2	3
22	Rutaceae	1	1	51	Butomaceae	1	1
23	Polygalaceae	1	1	52	Gramineae	28	38
24	Euphorbiaceae	1	1	53	Cyperaceae	4	14
25	Callitrichaceae	1	1	54	Lemnaceae	1	1
26	Malvaceae	2	2	55	Juncaceae	1	2
27	Elaeagnaceae			56	Liliaceae	3	10
28	Onagraceae			57	Iridaceae	1	1
29	Halorrhagidaceae				Total	165	257

The life-form compositions of the plant in the area include needle-leaved evergreen trees, broad-leaved summer-green trees, shrubs, semi-shrubs, perennial herbs, and annual and biennial herbs. The number of each species is as follows: perennial herbs (171 species, 66.54%), annual and biennial herbs (67 species, 26.07%), trees (2 species), shrubs (10 species), and semi-shrubs (7species).

The water ecological types are divided into water borne, hygric, humid mesophytic, mesophytic, drought mesophytic, medium xerophytic, and xerophytic. The mesophytic plants are richest with 85 species. This, in addition to humid mesophytic and drought mesophytic types accounts for 45.13% of the total.

There are a proportion of 56.81% of Pan Arctic, Palearctic and East Palearctic speciesin the area, indicating the characteristics of wetland vegetation. There are 24.9% grassland floras mainly with Dawuli-Mongolia species, which have been the main composition of grassland plants. There are also a proportion of East Asia and Europe-Siberia species. These indicate that broad-leaved forests of East Asia and Lingbei forests also affect the vegetation in this area. Therefore, the plant flora composition is complex.

There are 164 species of medicinal plants, including 32 species of common Chinese medicines. There are also 45 species of good meadows, 27 grasses (Gramineae), 16 fancy species, and 21 edible wild plants.

5.1.5.2 Overview of vegetation

Erka Wetland is not only large in area, but also with good conservation and diverse types. The wetland vegetations include hydraulic, marsh and meadow plants with 44 communities. Typical grassland vegetations are represented by Stipa grandis, and there are also two degradation systems, i.e. Stipa krylovii grassland and Gymnocarpus frigida grassland. Sandy land vegetations are plant complex of grass shrub area, semi-shrub area, forest and wetland. There are 5 sand grassland communities, 3 semi-shrubbery communities, 3 sand shrub communities, and Pinus sylvestris.

5.1.6 Wild animal resources

There is a record of 226 species of wild animals (vertebrates) in Erka Wetland, including 37 fishes, 10 amphibians and reptiles, 38 mammals and 141 birds.

(1) Fish and amphibians and reptiles

The water systems in the assessment area include the Hailar River, the Moergele River, the Xinkai River, Huhenuoer Lake, Benpo Lake and Erzi Lake. There are found 37 species of wild fish in the water system in the project area, belonging to 5 orders and 9 families, respectively being 3 families in Cypriniformes order (Cyprinidae, Cobitidae, Siluridae), Salmoiformes order (Salmonidae, Esocidae), Gadidae family of Cadiformes order, Petromyzonidae family of Petromyzoniformes, and Perciformes order (Eleoyridae,Channidae). The Cyprinidae family of Cypriniformes order is absolutely dominant. Except 2 species of Salmonidae family,2 species of Siluridae family, 3 species of Cobitidae family, 1 species of Channidae family and 1 species of Esocidae family, others all belong to Cyprinidae families.

The habitats in the assessment area are comprised of grasslands, rivers, lakes and sand dunes. According to the survey data, 5 species of amphibians, including Rana amurensis, Rana nigromaculata, Salamandrella keyserlingi, Bufo raddei and Rana chensinensis, are found and widely distributed in the assessment area. In some hillocks, Bufo gargarizans is also found. Reptiles are mainly distributed in sand dunes, including Eremias argus, Takydromus amurensis and, Lacerta vivipara, but with small numbers. There are two species of snakes, i.e. Elaphe dione and Agkistrodon ussuriensis.

(2) Mammals

There are 6 orders, 14 families and 38 species of mammals. Because the assessment area is mainly grassland and wetland landscape, the mammals are mainly with small ones and no large carnivorous and herbivorous animals. Among the 38 species of mammals, Rodentia and Carnivora orders have most species, accounting for more than one half. Insectivora and Chiropiera orders are next to them. The main mammals include Hemiechinus dauuricus, Ochotona Daurica, Marmota bobak, Meriones unguiculatus, Microtus brandti, and Vulpes

corsac, etc. In addition, some national Class II key protective animals, such as Procapra gutturosa, Lutra lutra and Otocolobus manul, are seldom seen currently, duo to human interference and over-hunting.

(3) Bird resources

The birds in the assessment area belong to east grassland sub-area, Mongolia-Xinjiang area of Palaeoarctic realm, with typical species of east grasslands settle and breed here. These species include Anser anser, Cygnus Cygnus, Tadorna ferruginea, Anthropoides uirgo, Otis tarda, Syrrhaptes paradoxus, and Melanocorypha mongolica, etc. Because the area is neighbored with Daxing'anling Mountains sub-area, some representive species in Daxing'anling sub-area have soaked into Erka Wetland. In addition, some species in Changbai Mountain sub-area have disseminated to the north. Some summer migratory birds are also found. This decided that the birds here have the characteristics of both Mongolia-Xinjiang area and northeast area. The main body of the birds is comprised of summer migratory birds and resident birds.

Among the 141 species of birds recorded in the project area, palearctic species and dispersed species account for 61% and 39% respectively. If classified by ecological patterns, water fouls account for 47.5%, Non-Passeriformes 73.8%, and prey birds 10.6%.

Among 141 species of birds, there are 6 species of national Class I key protective birds, i.e. Grus leucogernaus, Grus japonensis, Grus monacha, Otis tarda, Ciconia ciconia and Ciconia nigra. There are 6 species of national Class II key protective birds, i.e. Platal leucorodla, Cygnus cygnus Cygnus, C. columbianus, Aquila rapax, Aquila heliaca, Milvus migrans, Buteo hemilasius, Buteo buteo, Buteo lagopus, Aegypius monachus, Circus cyaneus, Circus aeruginosus, Circus cyaneus, Pandion haliaetus
Falco cherrug, Falco rusticolus, Falco peregrinus, Falco amurensis, Falco tinnunculus, Grus grus, Grus uipio, Anthropoides uirgo, Numenius borealis, Nyctea scandiaca, Athene noctua and Asio flammeus.

1) Seasonal distribution of birds

The migratory birds account for absolutely most of the birds in the assessment area. According to statistics, the number of migratory and non-migratory (resident) birds respectively accounts for 91.5% and 8.5% of all the birds. Because the area is wide in territory and scarce in population, and has rich baits, the summer migratory birds have the biggest proportion (about 68%), the travel birds have the proportion of 21%or so, and others are winter migratory birds and resident birds.

2) Ecological geographic distribution

There three kinds of birds in the assessment area, i.e. water fowls, birds of prey and singing bird. According to habitat types, it can be discussed as follows.

a. Water sheds

Swimming bird is typical bird type in the habitat. The Aythya fullgula, Cygnus Cygnus, Anas cygnoides, Aythya ferina, and Tadorna ferruginea, etc. are acting in the watershed, mainly distributed in the shore environment of the water wetlands such as Huhenuoer Lake, Erzi Lake, Benpo Lake and the Morigele River, etc.

b. Lakeshore and river-shore marshes

The water fowls are main representatives in this habitat, although there are some swimming fowls (river ducks) and near-water Passeriformes order birds. Common species are: Grus leucogeranus, Grus japonensis, Grus grus, Ardea cinerea rectirostis, Platal leucorodla, Vanellus vanellus, Anser anser, and some river ducks and Motacilla, etc. These kinds of habitats have no bankers, are with shallow water, and are generally sinker marshes.

c. Reed and willow shrub forest marshes

The ecological birds composition is most complex, because there are not only the feeding places but also breeding and sheltering sites. The swimming fowls include: Anas poecilorhyncha zonorhyncha, Anas platyrhynchos platyrhynchos, Cygnus, Anas cygnoides, Anser anser, etc. The water fowls include: Grus leucogernaus, Grus japonensis,Grus monacha, Grus monacha, Grus uipio, Ardea cinerea rectirostis, Ardea purpurea manilensis, Botaurus stellaris, and Capella megama, etc. Other birds include: Locustella, Panurus biarmicus, Circus cyaneus, and Asio flammeus, etc.

d. Grassland

The typical birds are Melanocorypha mongolica, Eremophila alpestris, Alauda arvensis, Charadrius, Oenanthe oenanthe, Otis tarda, Anthropoides uirgo, Buteo hemilasius, Aquila rapax, and Buteo lagopus, etc.

e. Sand dune shrubs

This habitat is distributed nearby Cuogang Pasture, mainly with sand dunes and having some shrubs. The reprehensive birds are Lanius collurio, Cuculus canorus, Caprimulgus indicus, Perdix dauurica, and Riparia riparia, etc.

f. Residences

This kinds of habitats include residential areas and nearby farmlands. The main species are some human-accompanying species, such as tree sparrow, house sparrow, Petronia petronia, Hirundo rustica, Hirundo daurica, Apus apus, Pica pica, Upupa epops, and Corvus, etc.

g. Ice covered lakes in the winter

In the winter nearby ice-covered rivers, lakes or ice eyes, there are Nyctea scandiaca and other birds finding food.

3) Migration and grouping of birds
Because the area is the important dak for migrating water fowls in Northeast Asia and Australia, and considering that there is large area of well-developed wetland ecosystem, the migratory birds are the main bird composition in the assessment area.

a. Winter migratory birds
The winter migratory birds stay here from October each year until May next year. Among the winter migratory birds, the migration of Nyctea scandiaca and Buteo lagopus, etc. is sporadic, while that of Calcarius lapponicus, Plectrophenax nivalis, and Cardurlis hornemanni is grouping.

b. Traveling birds and summer migratory birds
Traveling birds and summer migratory birds account for most of the migratory birds. Main traveling birds include: Numenius borealis, Calidris temminckii, Calidris ruficollis, Anas acuta acuta, Aythya fullgula, etc. They are all grouping migration.

The migration of summer migratory birds has the following characteristics: despite that some migrate here for breeding, a good many stop for a short time and will continue to fly to the north. Examples are Cygnus, Anatidae and many cranes.

5.2 Erka Wetland Environmental Impact Analysis

5.2.1 Impact on ecological integrity of wetland

The wetland in the region is concentrated with distribution of biodiversity. The special conditions of the wetland are essential conditions for the living of water fowls and fish. The wetland also plays irreplaceable roles in self-restraining water source, purifying water quality, controlling soil desertification and salinization, preventing flood disasters, and maintaining the stability of ecosystem, etc.

The main impacts of the highway construction on the wetland are reducing the area of wetland by going through the wetland; decreasing the connectivity of the wetland.

The perturbation of construction machineries and constructors and the discharge of the pollutants in the Construction Period will disturb the structure and function of wetland ecosystem in the construction area, pollute the water body, destruct and disturb the wetland vegetation and soil. The perturbed scope of soil is basically within 50~100m along the highway.

Suppose that the impact area is within 200m on both sides of the highway, the total impact area will be 528ha, or 0.62% of the total area of Erka Wetland.

The following alleviation measures are adopted in project design:
 The line has to go through Erka Wetland due to the limitation of local geographical position. The shortest route, which divided the wetland into two parts, has been chosen in the design stage, and there will not be any other highways in Erka Wetland.
 Bridges will be set up over all the rivers (ditches), which have water in drought seasons, and some culverts will be built. On the basis of Feasibility Study, 1 big –sized bridge and 3 middle-sized bridges are added, and the original big-sized bridge will be lengthened by 20%.
 Rubbles with diameter 10-30cm will be blanketed in the underside of the roadbed in the highway section with soft earth and silts.

5.2.2 Impact on vegetation

The scope of perturbation on the wetland vegetation and soil by temporary land occupation of the proposed highway will be within 50~100m along the line. The resuspended dust from earthwork and stonework excavation and from vehicle transportation will naturally deposit on the leaf blades of surrounding plants, block the leaf stoma, affect respiration and photosynthesis of the plants. The construction machinery exhaust contains NOx and other gases, which can the destruct of leaf tissues of sensitive plants and cause discoloration and harm spots. The construction resuspended dust and tail gas can only influence the plant growth in the current year. This is short-term and reversible impact. After the end of construction, the vegetation of temporary land occupation begins rehabilitation; the topsoils will be recovered on roadside ditches, side slopes and earth borrowing surface, as the project design requires. This will facilitate rehabilitation of vegetation. The impact of construction temporary land occupation will disappear when the vegetation is restored to be consistent with surrounding vegetation.

The plant communities of the same ecological characteristics are maintained on the south and north sides of the project line. Therefore, the project line will not have obstacle impact on regional plant migration basically, unable to cause the decay of regional plant population. The perturbation scope on wetland vegetation will be within 50~100m of the project line. Suppose that the impact area is within 100m on both sides of the highway, the total impact area will be 264ha, or 0.31% of the total area of Erka Wetland.

5.2.3 Impact on wild animals

The animal resources in the project area are mainly fish, amphibians and reptiles, mammals and wild birds.

5.2.3.1 Construction Period

(1) Fish, amphibians and reptiles

During the Construction Period , the construction of bridges will have direct unfavorable impact on the varieties and quantities of amphibians, reptiles and fish along the line, making them migrate to surrounding areas with less interference and adapt to and live in the new environment.

(2) Mammals

In the region of Erka Wetland, there are few large and medium wild animals. The construction of the highway during the Construction Period may affect the ways of migration, scope of feeding and the habits, but as the large and medium mammals have been few, the impact of highway construction on them should be low.

(3) Birds

The mechanical noise, human activities and vegetation destruction in the Construction Period will all affect the habitation and breeding of birds in the construction zones and nearby areas, making obvious change of varieties and species of the birds in the region. The construction of bridges and highway will seriously destruct the habitats of the birds in the area. The occupation and destruction of habitats, human activities and construction noise, etc. will directly fright and disturb the birds in the area, force them to avoid the construction zone and migrate to other places. In addition, the bridge construction, grouting and piling, and river cut-off, etc. can bring quantities of soil into the water body, leading to the increase of water turbidity nearby the construction area and the deterioration of water quality. The aquatic organisms in the lakes and then part of the waterfowls may be affected, due to the food chains. However, this impact is only in short term, the quality will be gradually restored, and the impact will be gradually eliminated after the end of construction.

5.2.3.2 Operation period

(1) Fish

The highway line will go through the wetland for a length of 13.2 km. According to local hydrological conditions, 8 big and medium bridges and some culverts will be set up. The bridges will adopt circular piers to reduce the obstruction on the water flow. The design flow area of the bridge accounts for 94~95% of the total length of bridge. It will have no obvious negative impact on the hydrology at the wetland section, and thus only have small impact on the fish.

(2) Amphibians and reptiles

The amphibians and reptiles are widely distributed in the project area, and their own activity scope is small. The bridges and culverts built over the rivers and ditches in the wetland area can serve as the passage of the amphibians and reptiles for their inter-communication. Therefore,

the operation of the project will not lead to the migration obstacle of activities of the amphibians and reptiles and the resulted species decay.

(3) Mammals

There are a very small number of large and medium wild animals along the highway line. Among the large and medium mammals that are acting along the line are most domestic breeding animals, such as horse, cow and sheep, etc., which activities can be guaranteed by setting up bridges and culverts and specific passages to alleviate the negative impacts. In addition, the impact on the domestic animals may become less when they get used to the new environment in some time.

(4) Wild birds

After operation of the highway, the traffic noise will permanently affect the animals nearby. The noise from the running vehicles can directly scare and disturb the birds and other animals in the region, having certain impact on their habitation and breeding. This may force some birds to flee away from the region, resulting in reduction of animal varieties and quantities along the line. The bird impact is within the scope of 100m along the highway, the impact area about 264ha, or 0.5% of the total wetland area.

It is suggested that marks of prohibiting sound horns set up at the highway section, so as to reduce the scaring and disturbing of the wild animals.

5.2.4 Impact on Hydrology

The highway goes through Erka Wetland on the north side of Zalainuoer Mineral Area at K540-K553. The main rivers in the area are the Hailar River and the Xinkai River.

(1) The Hailar River

The design flooding frequency for the bridge spanning over the Hailar River is flood in a century (extra big flood in 1998). Considering the error in the calculation, the length of bridge is increased by 20%, i.e. setting up a 480m bridge, with 24~20m.

(2) The Xinkai River

The highway section that crosses the Xinkai River is located at the intersection of the river and lake, with large water surface. Considering that the project should not reduce the water surface and is able to split part of water flow of the Hailar River, the length of 620m is set for the bridge.

(3) Wetland

The low relief of the wetland section can lead to the confluence of the Hailar River and the Xinkai River at the wetland. In order to facilitate interchange of the waters on both sides of the roadbed, in addition to respectively set up bridges over the Hailar River and the Xinkai River,

bridges will also be set up over the rivers and ditches that have water during the drought seasons. The spans will be properly longer. The total length of the bridges is 1640m, accounting for 12.4% of the total length of this section. Besides, about 10 culvert are set within the wetland as additional measure. These briges and culverts can meet with the flood drainage requirements of the Hailar River and the Xinkai River. Refer to Table 5-2 and Figure 5-1.

Table5-2 Bridges and culverts set-up in Erka wetland section

No.	Central post No.	Patterns	Size
1	K541+650	Plate-covering	1-4□2.7
2	K541+980	Round pipe	1-Φ1.5
3	K542+130	Prestressed concrete simple-support cored slab bridge	3□20
4	K542+750	Box	1-6□3
5	K542+980	Prestressed concrete simple-support cored slab bridge	3□20
6	K543+250	Round pipe	1-Φ1.5
7	K544+100	Box	1-6□3
8	K544+400	Box	1-6□3
9	K545+220	Prestressed concrete simple-support cored slab bridge	24□20
10	K546+500	Prestressed concrete simple-support cored slab bridge	4□20
11	K547+260	Plate-covering	1-4□3
12	K547+840	Prestressed concrete simple-support cored slab bridge	4□20
13	K548+060	Prestressed concrete simple-support cored slab bridge	4□20
14	K549+020	Plate-covering	1-4□3
15	K550+000	Plate-covering	1-4□3
16	K550+900	Prestressed concrete simple-support cored slab bridge	6□20
17	K551+620	Prestressed concrete simple-support cored slab bridge	30□20
18	K552+674	Round pipe	1-Φ1.5

5.2.5 Impact on the quality of the wetlands

The main wetlands in Hulunbeir include Dalai Lake Wetland, Huihe Wetland, Erka Wetland, Huhenuoer Wetland and Hailar Wetland.

(1) Analysis of area

The area of the main wetlands close to the project is shown in Table 5-3.

Table 5-3 Situations of Main Wetlands in the Project Area

No.	Name of the wetland	Occupied area (ha)	Percentage (%)	The distance from this proposed project (Kg)
1	Dalai Lake Wetland	740,000	65	19
2	Huihe Wetland	346,848	30.4	32
3	Erka Wetland	52,800	4.6	Cross over
4	Diturbed wetland	264	0.02	--

As seen from Table 5-2 Erka Wetland only has 4.6% of the total wetland area in the region. The impact area of this project is 386ha, only accounting for 0.75% of the area of Erka Wetland and 0.035% of the total wetland area.

(2) Analysis of quality

Dalai Lake Wetland is a wetland ecosystem with the main components of lake, river, marsh, shrub and reed pond formed by Dalai Lake water system. It has 9 species of national Class I protective birds, and 43 national Class II protective birds.

Huihe Wetland is a wetland ecosystem comprised of the Huihe River and numerous small lakes. It has 8 species of national Class I protective birds, and 28 national Class II protective birds.

Erka Wetland is comprised of the Hailar River, the Xinkai River, river flooding land and surrounding lakes. It has 6 species of national Class I protective birds, and 26 national Class II protective birds.

Compared with Dalai Lake wetland and Huihe Wetland, the geography and hydrology of Erka Wetland have no special characteristics.

(3) Summary (refer to 8.2.6 and 8.3.6)

1. Hulunbeier has a big area of wetlands, among which Erka Wetland accounts for 4.6% of the total. Most wetlands (Dalai Lake Wetland and Huihe Wetland) have been listed as protection zones.
2. Compared with other wetlands, the geography, hydrology, and animals and plants of Erka Wetland have no special characteristics.

3. The impact area of this project only accounts for 1.5% of the area of Erka Wetland.
4. The construction of the project will bring about negative environmental impacts on Erka Wetland. But the impacts are relatively small and can be minimized by adopting proper environmental protection measures.

5.2.6 Experts' comments and suggestions:

Three experts were invited during the preparation of the EIA Report and the following comments and suggestions were given.

1. Comments by MS. Tao Li (senior engineer)

□1□Cygnus Cygnus

Large-sized swimming birds, national Class II key protective bird. They are discovered in the west and south sides of Benbo Lake. Reed field is their breeding ground. The noise from the construction of the highway and the bridges and from the operation of the highway will have impact on them.

They seek food in the shore and reed field. Their main foods are the stems, leaves and seeds of aquatic plants. The construction of the highway can increase the turbidity of the water body chiefly and has little impact on the growth of aquatic plants, so it does not disturb the food sources of Cygnus Cygnus.

□2□Anthropoides uirgo

Large-sized water fowls□national Class II key protective animal.

They inhabit in wide grassland, meadow bog, reed-swamp, reed pond, lake, river valley, semi-desert and lake meadow in plateau, and sometimes in farmland. In most time they live in small group or a family but in couple only during the breeding stage. They often live in shallow water field or nearby Chinese wildrye with high relief. No Anthropoides uirgo was found during the investigation along the line. Local herder proved that a small amount of them were seen. The construction and operation of the highway will disturb them and make them migrate to places far away from the highway.

Their main food is small-sized fish, shrimp, frogs, polliwogs, aquatic insects, tender lives of plants, grass seeds and crops like corn and wheat which are being fed when they are walking. Because of the multiplicity of their food, the impact on their food seeking should not be much influenced by the destroying of water transportation due to the project construction.

Their breeding stage is from April to June. They usually do not build nests and thus lay eggs directly on the naked but dry alkaline soil in Chinese wildrye. Sometimes they build nests in the

grass near water or in the swamp. They breed once a year with 1-3 eggs laid (2 eggs in most cases). The highway construction may have some impact on the baby birds hatching, so proper education such as forbidding picking up eggs and hunting illegally is needed for the construction team. The hatching places should be avoided as could as possible unless there are no other choices.

□3□Otis tarda

National Class I key protective animal, which is in the list of red paper for endangered bird. The population is very small mainly due to grassland exclamation, human disturbance, herding and illegal hunting. They belong to large-sized terrestrial birds living in wide grassland, meadow and semi-desert area, and sometimes emerge in the river shores, lake shores and nearby wet or dry meadows, but have not been found during the EIA investigation of this time.

The natural disposition of Otis tarda is cowardice, so it is difficult to be close to them but easy to disturb them and drive them faraway from the construction zone. Of course, this kind of influence is temporary. The operation of the highway will produce noise which will compress the activity space of the birds to the area beyond 300m away from each side of the highway, and this kind of influence is long-term.

The main foods for Otis tarda are tender leaves, sprouts, tender grass, seeds and grain of plants, as well as locusts, grasshoppers and frogs, etc. Constructions of the project and the land occupation will destroy the surface vegetation and the food sources of them. However because of the multiplicity of their food, the impact on their food seeking is not too much.
The breeding stage of Otis tarda is May to July. Their nests are in the shallow cote on wide grasslands, or in natural sunken cotes, or built by parent birds. So we can find that the construction time May to October will have impact on them.

The old Highway 301 is a place with many human activities, perhaps this kind of birds have already left this area, as they usually live in the areas with few human activities. No Otis tarda was seen during the field survey and we can conclude that the impact on them is not very large.

2. Comments of Professor Li Qingfeng

(1) Falco rusticolus

Middle-sized bird of prey, national Class II key protective animal. The local Falco rusticoluses are winter migratory birds and can be seen in winter occasionally.
This kind of birds is mostly distributed in Erka Wetland, and the west and south sides of Dalai Lake, with scarce quantity.

(2) C. columbianus

Large-sized bird of prey, national Class II key protective animal.
They habit in wide plain, meadow, hungriness and wasteland grassland in highland and foothill and mainly act in the daytime.

The main food sources are citellus, gerbil, pika, hare, phrynocephalus, takydromus, snake, birds, baby antelope, rotten flesh and the body of animals.

The breeding stage is April to June. Their nests are in cliffs, the top of hilllock or rock, sometimes on the ground or in the dry grass stack and in the hill slope. They are migratory birds or Travelling birds.

Their nests are usually in higher places so that the highway construction almost will have no impact on their breeding. But running vehicles and the construction at night may have some short-time impact on their habitation.

□3□Buteo hemilasius

Large-sized bird of prey, national Class II key protective animal. They habit in open swampland and sandbank area. They always live alone, fly in the sky or stand in a high place on the ground being on watch for quarry. The natural disposition of Buteo hemilasius is wit and difficult to approach. However, they are not afraid of vehicles, will not fly away even when the vehicles are only 10m away. They are easy to be induced and killed. Therefore, construction workers and the divers should be properly educated to prohibit hunting these birds.

The main food sources are hare and rodents. When breeding, their nests will be high above the ground, thus their seeking food and breeding will not be affected by the construction of the project.

Integrating the two experts' comments on the impact of the project on water fouls, it can be concluded that the highway construction will have some impact on the habitats and breeding activities of Cygnus Cygnus and Anthropoides uirgo. To most grass birds of prey, the main influence is that their habitation will be disturbed by the reciprocation of the vehicles. But when considering the little amount of traffic flow at night, the impact on birds is limited. As most key protective birds have multiplicity in their food source, the impact on food seeking due to the plants destroying along the line is very small. But the highway construction will have the effect in dispersing the bird along the line temporarily.

3 Martin Willianms (international environmental cosuotant)

(1)As Erka Wetland is not permanently fully flooded – during dry periods, there are small lakes and pools, and patches of grassland/reed beds – the consultant suggested creating artificial

pools that would permanently hold water. However, a discussion with project officials and consultants revealed this is impractical. Hence, it would seem the best mitigation measure would be protection of existing small lakes/pools along the project route through Erka. Management may be advisable, if this can improve these habitats.

(2)Eco-tourism could be developed at these protected lakes and pools. If successful, this could result in benefits to wetlands extending well beyond the project area – by demonstrating that protected wetlands (with protected birds and other wildlife) can generate money; and through education, encouraging people to help protect wetlands and their wildlife. As well as targeting tourists from outside the area, a reserve (or reserves) with visitor facilities could become a valuable place for local people. Both giving them an opportunity for recreation (at Erka, we met two local men who were watching birds, and taking photos), and helping with conservation/environmental education, especially for school children.

(3)It would seem essential to ensure that there are no highway-related developments that damage the wetland – especially on the fringes, on land that is rarely or never flooded.

(4)In case power lines or telephone cables are later strung beside the highway: measures will be needed to ensure birds do not fly into them (and perhaps die).

(5)Care is required with the highway section crossing the Hailar River. Similar measures to those at Erka can be introduced during the construction phase; this should not be too troublesome as this stretch of highway is short.

(6)The EIA suggests that after the highway is constructed, there should be mitigation for destruction of vegetation through planting some local tree and shrub species, and sowing grass seeds. This seems wise; wildlife would perhaps benefit most if there are concentrated areas of trees/shrubs. As noted during a discussion, tree planting by the roadside may be inadvisable, as it may result in greater problems with snowdrifts.

The experts have some suggestions on the environmental protection measures as follows:
(1) Management should be strengthened in the Construction Period. Before the construction, construction access roads should be constructed and construction vehicle route properly defined to forbid their arbitrary driving. During the construction, the construction scope should be specified and any constructive activities should be controlled strictly within the scope, and the destruction of vegetation around the construction areas is prohibited. In the Construction Period, the forest and plants on the requisitioned lands especially the plants in sandlot should be protected as far as possible.

(2) After the end of construction, each part of the destroyed area due to the project construction should be leveled, loosened by plough as soon as possible. In proper seasons, tree species and grass seeds, which are suitable to the local ecological environment, should be cultivated to recover the natural landscape. Toward the destroyed arbors and shrubs due to the construction, compensation rules should be established and should reflect the practical loss. In-situ or allopatric compensation is regarded as the best method.

(3) During the highway construction, all the construction activities should avoid the wild animal's habitation and the behavior disturbing or destroying the wild animal's living area is not allowed. Excessive catching and hunting wild animals is forbidden. The construction time should avoid the season like gale in the spring. The construction efficiency should be enhanced to shorten the construction time. It is also important to minimize the destroying of natural vegetations.

(4) When the highway construction is finished, unified arrangement, clearance and renovation are needed for the temporarily occupied lands and the affected areas due to the construction. According to the different land situation and local ecologic environmental plan along the highway, corresponding measures are asked to taken to recover the vegetations and prevent desertification. The measures taken should be differentiated by the different types of occupied land when recovering the vegetations and prevent the desertification. If it was farmland before, it should be reclaimed to farm; if it was grassland before, the emphasis is to recover the previous vegetations; if it was fixed or semi-fixed sandlot, the main task should be recovering the previous vegetations. Mechanical sand barrier is the main way for flowing sandlot, in combination with shrubs and herbs growing in sand, so as to recover the previous vegetations, prevent the desertification, while improving the ecological environment along the highway.

(5) Eco-toutism could be developed at the part of the road in wetland, measures should be considered for this.
Development at the fringe of the wetland should be well controled to protect the wetland.

5.3 Conclusions and Suggestions

1. The landform of Erka Wetland is mainly comprised of lakeshore plain, alluvial plain, river flood plain, sand land and sand hill, and high plain, etc. The soil in the area includes mainly salinized meadow soil, salinized Castanozems soil, meadow bog soil, alkalized meadow soil, meadow alkali soil, meadow Castanozems soil, alkalized Castanozems soil, Aeolian soil and sandy Castanozems soil. Erka Wetland landscape is mainly comprised of wetland landscape and sand wetland landscape.
2. Based on the survey on Erka Wetland, there have been found 257 species of vascular plants, respectively belonging to 57 families and 165 genera.

3. There is a record of 226 species of wild animals (vertebrates) in Erka Wetland, including 37 fishes, 10 amphibians and reptiles, 38 mammals and 141 birds.
4. Measures should be taken during the project design period to lower the construction impact on the integrality of Erka Wetland, vegetations, wild animals and the hydraulic conditions.
5. The area of Erka Wetland is a small portion of Hulunbeier Wetland, so the characteristics of hydraulic conditions, geography, animals and plants do not have particularity compared with other wetland. The construction of the project will bring unfavorable impact on Erka Wetland. But since the impact is relatively small, proper environmental protection measures may minimize the impact.

CHAPTER 6 WATER AND SOIL CONSERVATION SCHEME

6.1 Harm of Water and Soil Erosion Caused by Highway Construction

In the construction of the highway project, on the one hand, the land is imposed and the original facilities of water and soil conservation are damaged and, on the other hand, a lot of earth and stone is excavated, moved away, and filled up in the project construction. That may easily cause water and soil erosion. Concretely speaking, that may damage the original facilities of water and soil conservation (such as forest land, grassland, terraced fields, etc.) and the local ecological environment to a certain extent, make environment deteriorated, result in the vicious circle of the ecological system, and aggravate the original water and soil erosion. In the zones with larger slope rates and bad geologic structures, the bare side slopes are often produced at excavating surfaces and filling sites after excavating so that the collapses and slippery slopes are easily caused by rainwater beating. Because of improper construction and using over volume of explosives for blast work implementation, stratums become loose and then the collapses and slippery slopes are produced. Discarded residues from the construction occupy farmland and cause water and soil erosion. In the construction, a lot of earth and stone is excavated and stacked at random, and the remainder is dumped at random too. Upon strong raining, they are carried to the downstream to occupy farmland, damage land, reduce the soil fertility, thread people life, deposit and raise river bed, increase flood and water-logging disaster, silt up reservoirs, and make water resources deteriorated more and more severely.

6.2 Current Situation of Water and Soil Erosion

(1) Rating standard of water and soil erosion

The *Classifying and Rating Standard for Soil Erosion Intensity* (SL190-96) is implemented.

Table 6-1 The Classifying and Rating Standard for Soil Erosion Intensity

Grade	Average erosion modulus ($t/km^2 \cdot a$)
Insignificant erosion	<500
Light erosion	500~2500
Moderate erosion	2500~5000
Intense erosion	5000~8000
Extremely intense erosion	8000~15000
Severe erosion	>15000

(2) Current situation of water and soil erosion in the project areas

According to the announcement of "*Major Prevention Divisions for Water and Soil Erosion in the Inner Mongolia Autonomous Region*", the areas involved in the project to be implemented belong to the major prevention divisions for water and soil erosion in the announcement issued by the People's Government of the Inner Mongolia Autonomous Region.

The type of water and soil erosion in the areas involved in the project is the wind-force erosion. The background values of the soil erosion modulus are 3800 t/km^2·a for the desert zone of Xin Zuo Qi, 1100 t/km^2·a for Chen Qi, 1000 t/km^2·a for Manzhouli City, and 1000 t/km^2·a for the other zones of Xin Zuo Qi, respectively.

The area of water and soil erosion in the highway construction areas is 466.5 hm^2□38.4% of the total area of the project construction areas. The current situation of water and soil erosion is given in Table 6-2.

Table 6-2 The Current Situation of Water and Soil Erosion in the Project Construction Areas Unit□hm^2

Administrative Division	Wind Erosion Grade			Sum up
	II	III	IV	
Manzhouli	28.2			28.2
Xin Zuo Qi	86.1	57.5	6.9	150.5
Chen Qi	248.6	39.2		287.8
Total	362.9	96.7	6.9	466.5

6.3 Analog Experimental Formula and Parameters

(1) The highway construction area

Based on the different types of the factors and status of turmoil of surface water and soil conservation, the analog area measuring method and the analog material calculation, and the following experimental formula are used:

$$M_S = F \cdot A \cdot P$$

$$M_S' = F \cdot (A-1) \cdot P$$

where□M_S -- annual erosion amount in the projection period (t/a);

M_S' -- annually increased erosion amount in the projection period (t/a);

F -- accelerated erosion area (km^2);

A -- accelerated erosion coefficient (3.5 for plain area, 6.0 for wind and sand area, 4.5 for hill area, and 6.0 for middle and lower mountain area, respectively);

P -- original landform soil erosion modulus (t/km^2·a).

(2) Discarded residue from engineering

Based on the analog analysis of discarded residue run off along the lines of highways to be built and already built, the experimental formula of the ratio of running off over discarding is used for the discarded residue from the project construction:

$$M_S = \sum_{i=1}^{n} M_{si}$$

$$M_{SI} = \sum_{j=1}^{n} w_J \times \eta_{I-J}$$

where M_S — total running off amount of engineering discarded residue in the projection period;

M_{Si} — running off amount of discarded residue in ith year;

W_j — amount of engineering discarded residue in jth year (0 1-j n);

η — the ratio of running off over discarding of engineering discarded residue within the projection year range and, based on the analog investigation, the ratio of running off over discarding for the lower mountain area is 1%;

i — the projection year of water and soil erosion

j — 0 1 …n, n the year range of water and soil erosion.

6.4 Total Amount of Newly Increased Water and Soil Erosion

Based on the construction plan of the principal engineering design requirements of the project and the integral evaluation of the factors in the construction areas, such as geology, landforms, vegetation, and rainfall, etc., the water and soil erosion amounts are determined for each area of the project, and the total amounts of newly increased water and soil erosion are calculated. Based on the calculation of the water and soil erosion amounts for the above areas, the projection value of the newly increased water and soil erosion amount is 97772.4 tons. Refer to Table 6-3.

Based on the analysis of the origins, types and distributions of water and soil erosion in the project construction for the recommended lines, and the calculation of the area occurring water and soil erosion and the projection of the water and soil erosion intensity, the soil erosion amount to be potentially produced during the Construction Period is determined as 128803.8 tons, the original landform soil erosion amount 31031.3 tons, and the newly increased soil erosion amount 97772.4 tons.

Table 6-3 The Statistics of the Total Amounts of

Newly Increased Water and Soil Erosion of the Project

Geographic area	Administrative divisions	Length (km)	Area occurring water and soil erosion (hm^2)	Produced amount of water and soil erosion (t)	Current erosion amount (t)	Newly increased erosion amount (t)
Plain area	Chen Qi	107.38	562.02	66590.9	18498.8	48092.1
Hill area	Xin Zuo Qi	39.97	218.34	32921.7	6494.0	26427.7
	Manzhouli	41.568	203.12	29291.2	6038.6	23252.6
Sub-total for the plain areas		107.38	562.02	66590.9	18498.8	48092.1
Sub-total for the hill areas		81.538	421.46	62212.9	12532.6	49680.3
Total		188.918	983.48	128803.8	31031.3	97772.4

It is indicated that the water and soil erosion intensities during the construction are 6~10 times of the values before the construction. Therefore the prevention of water and soil erosion will be very important during the Construction Period. By using timely and tightly excavating lands and pilling up roadbed, on the one hand, the water and soil conservation factor my be increased to reduce water and soil erosion; and, on the other hand, some peripheral water and soil conservation measures should be adopted to prevent water and soil erosion to be produced by the construction from impacting the external places. However, in 3~5 years after the highway is put into operation, because of improving the drainage equipment and recovering the vegetation (including man-made greening and naturally recovery) the water and soil erosion intensities which have been increased during the Construction Period shall be recovered to the level as before the construction. And because the road surface is classified to the high level highway and greening work of road appearance is going to be done, water and soil erosion along the highway line shall be less intense than the level before the construction. Therefore, the increase of water and soil erosion during the Construction Period will be very hard to be absolutely avoided. However it will be only transient. From the long-term view, the highway construction will be finally favorable to reducing the local water and soil erosion.

6.5 Measures for Water and Soil Conservation

Based on the ecological environmental impact analysis, in 3~5 years after the highway is put into operation, because of improving the drainage equipment and recovering the vegetation the water and soil erosion intensities which have been increased (the level of 6~10 times) during the Construction Period shall be recovered to the level as before the construction. However, the prevention measures for water and soil erosion should be taken during the Construction Period to minimize water and soil erosion impact during the project construction.

6.5.1 Scheme of water and soil conservation

Table 6-4 List of the Measures for Water and Soil Conservation in Construction along the Highway

Phase	Measures for water and soil conservation	Detailed practice	Supervision and implementation institutions
Design Phase	Submission of a detailed water and soil conservation design to corresponding institutions	⌘ Construction schedule ⌘ Measures for water and soil conservation engineering ⌘ Engineering Quantitative Table ⌘ Design Drawings	The Highway Headquarters
Flat ground excavation	Prevention of washing and brushing of converging water from the upper reaches of excavating surfaces	⌘ Building temporary water-blocking ditches (60 x 60 cm trapezoid ditches) at places of more than 5 m from the upper reaches of excavating slope surfaces	Bidding Contractors
	Stabilization of side slopes	⌘ Adapting grass-planting protection on the side slopes with no more than 4.0 m of heights of earth base and road base side slopes Building walls with starch-laying piece stones in bad areas	
	Other	⌘ In excavation of road base and earth borrowing yards with surface soil, surface soil should be centrally laid aside and properly treated to facilitate to fill back surface soil of the excavating surfaces after the construction and to recover vegetation. In construction during rain season,	

		rustic cloth covers should be prepared for the bare waste earth and stone yards to prevent from producing strong water and soil erosion in flood season. Sludge to be produced from bed-cleaning of wetlands and building of bridge punching stakes should be prohibited from directly entering river courses and wetlands and properly treated.	
Earth-filling road sections	The surplus earth and stone at the other places along the line should be used as far as possible. If purchasing, they should choose those mineral points where there are the approvals granted by the institutions of mineral management, forestry, public security, and environmental protection, etc., and business licenses formally issued. If self-mining, they should apply for the mining permits. The mining without the permission has to be absolutely prohibited.	⌘ Building 60 x 60 cm side ditches with starch-laying piece stones outside the slope-protection roads away from the embankment slope feet, and periodically cleaning sludge and sand deposited inside the ditches ⌘ In the excavation of earth and stone, not damaging the landscapes along the line should be considered, and a hilltop should be completely excavated as the end. After the excavation, the excavating surfaces should be covered with the mellow soil layer and surface soil moved away before the excavation, and the original vegetation should be recovered. ⌘ The side slopes of the excavation surfaces should not be too big. And the treatment should be undertaken for the unstable side slopes.	The Highway Headquarters Mineral and forestry responsible departments

Earth borrowing yards and waste earth yards	It should be used for the vertical allocation of road base as far as possible, not be stacked at random and dumped to the nearby flood lands, be moved to the specific stack sites for storage, be combined with farming and afforestation. And the improved facilities for water and soil conservation should be developed.	⌘ The earth borrowing side slopes should be bigger than 1:1 ⌘ After earth is borrowed, the earth borrowing yards and their surrounded places should be cleaned up, leveled, filled back with mellow soil and, then, herbage should be mixedly seeded. ⌘ The earth borrowing yards should be filled back with surface soil. The soil should be porous. The thickness of the soil layer should be more than 30 cm. The soil types should be grass marshland soil and chestnut soil.	Design institute Local government Corresponding Institutions Bidding Contractors

	Some volume may be locally used, or stacked along the roadsides for planting trees.	⌘ Building the residue-blocking dams (or residue-blocking walls) the section of which is normally rectangular or trapezoid. ⌘ The earth and stone should be stacked in trapezoid forms and rammed as firmly as possible. The top should be flat and neat to facilitate to fill back with mellow soil and recover vegetation and re-plough. ⌘ The discarded earth and stone residues should not be dumped to any places other than the specific waste earth yards. ⌘ The reclamation should adopt soil coverage measures. ⌘ The earth-covering measures for re-plough of the terraces have to be adapted.	
Temporary engineering, such as construction pavements and material supply sites	Building the water-blocking ditches and side ditches to avoid washing and brushing the mud-rock road surfaces.	⌘ The water-blocking ditches should be built on the upper side of the temporary road slopes surfaces ⌘ The side ditches should be built on the both sides or single side of the temporary road surfaces ⌘ The bottom width of the water-blocking ditches and side ditches is 50 cm, the ditch depth 50 cm, and the side slope 1:1	
Greening engineering	Recovering vegetation	⌘ Planting strongly drought-resistant and adaptable bushes on the terraces of the road cutting side slopes of the earth-excavating road sections; planting grass on the dirt road	Design institute The Project Headquarters

		cuttings of sandy soil and crashed stone; and building surface-protection walls in the road cutting side slopes of the rock road sections. ⌘ Adapting arched skeleton grassing protection, grassing inside the arched rings, for the soil side slopes of the earth-filling road sections with the height of more than 4.0 m; adapting dry-laying piece stone protection for the water-inundated road sections with the designed water level of less than +0.5 m; and adapting the greening ways of turf slope protection for the lower embankments with side slope earth- filling height of less than 4 m. ⌘ Afforestation on the both sides of the road bases. In the previous year of the afforestation, leveling land and digging tree holes before the rain season; planting trees mainly in spring and fall seasons, pruning roots of nursery stocks before the plant; After the plant, timely irrigating, hilling up, applying fertilizers, pruning, and preventing from plant diseases and insect pests. ⌘ Planting bushes in the central isolation areas, the heights of which are about 1.6 to 1.7 m, and planting lawns on ground.	Bidding Contractors

		⌘ For greening of mutual grade separation, adapting combination of trees, bushes and flowers, and grass, artistically spaced and interspersed in heights; for the curved road sections, planting trees on the outsides.	
Arrangement of thee Construction Period	rationally arranging the construction orders	The construction should be undertaken section by section to reduce the lines to be occupied by the construction. In the earlier construction, the road base engineering should be completed with the protection engineering tasks, including slopes protection, drainage, retaining walls, afforestation and grassing, simultaneously. The earth engineering of the next road section should begin upon the finish of the road base engineering and protection engineering of the previous road section.	Bidding Contractors

6.5.2 Implementation plan of water and soil conservation scheme

(1) Organization/leadership and supervision/management

The Highway Headquarters is in charge of organizing and implementing the water and soil conservation scheme of the project to coordinate the water and soil conservation scheme and the major engineering, to ensure the synchronous implementation, complement at same period, and simultaneous check and acceptance for each of the water and soil conservation design and facilities and the major engineering. The Highway Headquarters should entrust the corresponding design institutions to undertake the engineering drawing design of water and soil conservation. And the corresponding design contents and requirements should be determined in the form of the contract in the construction bidding. In implementation, The Highway Headquarters should supervise the implementation of the water and soil conservation implementation scheme by the bidding and construction institutions, participate and guide the check and acceptance work of the water and soil conservation facilities, entrust the qualified

inspection and control agent to undertake the inspection and control, and, simultaneously, accept the supervision of the local forest and water administrative authority institutions.

(2) Technical and financial assurance measures

In the construction bidding, the emphasis should be given to the comparison of the technical quality and awareness of environmental protection and water and soil erosion of the construction teams. The construction contractors should adopt diverse effective measures to prevent unnecessary soil erosion occurring during utilizing and occupying lands and to prevent the materials excavated by the engineering construction and other waste residues from depositing in rivers and wetlands.

The measures listed in the water and soil conservation scheme should be designed by the qualified design departments and shall become the construction basis of water and soil conservation of the next phase as long as they are approved by the corresponding authority agents. The contents of water and soil conservation should be considered in the phases of the bidding design and engineering drawing design. During the Construction Period, the construction units should undertake the construction rigorously according to the design and the construction inspection and control agents should undertake the inspection and control for the construction, including the water and soil conservation. After the water and soil conservation work is completed, it should be examined by the water and soil conservation institutions, and finally checked and accepted along with the major engineering.

According to the requirements of the construction progress, the measures of the water and soil conservation engineering should be implemented by the construction contractors who are in charge of the corresponding individual engineering; the vegetation measures may be undertaken by the experienced units that are entrusted by the owners. If any projects are sub-contracted to the other contractors, the sub-contractors should undertake the implementation of the corresponding water and soil conservation scheme.

The design schemes for each of the individual water and soil conservation measures should be all examined and approved. And the construction units have to carry on the construction rigorously according to the design requirements. After the construction is completed, the check and acceptance work should be done according to the design requirements.

The implementation institutions and the construction units should allocate the necessary funds to the technical trainings and the monitoring and research of water and soil erosion, etc., and select the professional technical persons of water and soil conservation to participate the construction inspection and control work.

The investment for water and soil conservation work should be incorporated into the investments for the engineering project. Some costs are the cross ones for other engineering components, such as greening work of filling side slopes, transportation and stack of temporary discarded residues, etc. All capital for water and soil conservation should be incorporated into the total budget of the project through the construction drawing design.

CHAPTER 7 ENVIRONMENTAL IMPACT ANALYSIS OF PHYSICAL DISTRIBUTION CENTER

7.1 Engineering Analysis

7.1.1 Origin of the engineering

Manzhouli Port, the second largest port in China, has set up a border check station, but has no goods transfer and unloading facilities. The trucks from Russia are not allowed to go beyond Hailar, and those that will be transported to other places in China should be moved onto Chinese trucks. After the construction of Haihar-Manzhouli Highway, with the growth of trade volume, it is necessary to set up a physical distribution center (PDC). Considering that Hailar is located at the central position among the 5 ports of Russia and Mongolia borders, the PDC is determined to be set up at Hailar, located at Haidong Industrial Estate. The State Highway 301 goes through the estate, and Binzhou Railway goes by it. The geographical position of the PDC is illustrated in Figure 7-1.

7.1.2 Land acquisition and construction scale

The total land area occupied by the PDC is 24.6ha. In light of the designed annual treatment capacity of 0.8~1 million t of handling capacity of the Center in the short term (the design year is 2013), it has calculated preliminarily that area of land acquisition of the Center would be 80000m^2.

The construction area of house buildings is about 9,000 m^2, including comprehensive offices, various storages (heating warehouse, refrigerated warehouse and simple storage), motels and auxiliary facilities, etc. The storages shall be ordinary storage with 8m heights piling three-layer of goods. The height of refrigerated warehouse is 3.6m. The layout of the plant area of PDC is illustrated in Figure 7-2.

Areas of various structures (including loading platform, loading yard and parking lot, etc) are about 8,000 m^2. The main buildings are shown in Table 7-1, and main equipment in Table 7-2.

Asbestos products will not be used in the structures of physical distribution center (PDC). The Haidong PDC will not set a commodity checking institution as there are already such kind of institutions in Hailaer and Manzhouli. The trade adminstration department has set two commodity checking institution at Hailaer and Manzhouli. All inport merchandise will be under checking at Manzhouli, while all export be checked at Hailaer. Quarantine operation is adopted at both places as a most important part of the checking process.

Table 7-1 Summaries of Main Buildings

No.	Construction content	Construction scale (m^2)	Investment estimation (10000RMB)	Note
1	Comprehensive offices	600	120	Considering three floors, while building one floor in first stage
2	Storage (heating)	2000	240	
3	Simple storage	4000	220	
4	Refrigerated warehouse	300	135	
5	Boiler and pumping rooms	150	12	
6	Power transform/ distribution room	140	11.9	
7	Garage	750	52.5	
8	Gateman and platform scale rooms	150	12	
9	Motel, restaurant and other service facilities	1000	150	Considering three floors, while building one floor in first stage
10	Loading platform	1000	30	
11	Container stockpiling yard	1600	48	
12	Parking lot	2400	72	
13	Roads	3000	90	
14	Pipelines and master drawing		100	
	Total		1293.4	

Table 7-2 Summary of Main Equipment

No.	Name of equipment	Quantity (piece or set)	Investment estomation (10000 RMB)
1	3-D shelf	800	44
2	Stacker	1	80
3	Front hoist	1	30

4	Forktruck for lifting container	1	15
5	Tray	1000	25
6	Manual forktruck	2	7
7	Small battery forktruck	2	10
8	Tray packer	1	10
9	Electronic platform scale	1	9.5
10	Surveillance equipment	1	20
11	Fire control equipment	1	30
12	Heating equipment	1	18
13	Equipment for power transform and distribution	1	40
14	Boiler equipment	1	20
15	Computer administration system		100
	Total		458.5

7.1.3 Pollutant generation and prevention and control measures

(1) Wastewater

a. The wastewater from the offices, motel and restaurant will be 20t/d (supposing 100 people, and daily sewage discharge of 0.2 t per person), with the main pollutants of COD, BOD_5, SS and oil. The wastewater from the restaurant will be treated to separate oil.

b. The discharge of cleaning wastewater and washing wastewater from the gas station will be about 3t/d. The main pollutants are oil, COD and SS. Oil Separation Tank will be set up in the gas station to perform oil separation treatment.

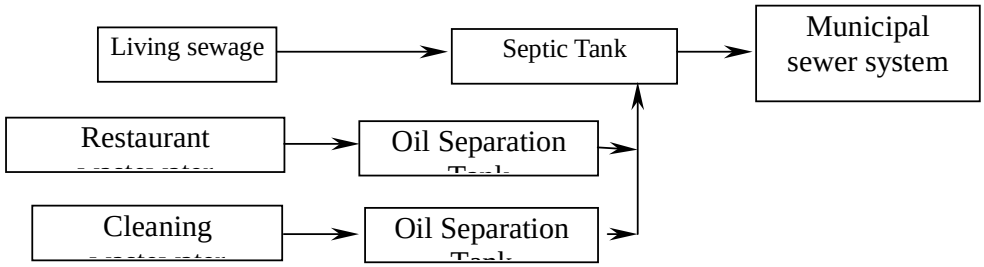


Figure 7-3 Wastewater Treatment Flow Chart at the Physical Distribution Center

c. In order to prevent oily wastewater or wastewater with toxic substances from discharging by accident, a special emergency site will be set in the PDC. Cofferdams will be established around the site. Slow slope in the way from and to the site will be set, being convenient for the vehicles and preventing the wastewater from flowing outside the vehicles. The floor should be flushed after the oil-carrying vehicles enter and leave the emergency site. The oily wastewater will be discharged into the pipes after treatment by the oil-insulating pools. The flushed

wastewater from vehicles carrying toxic materials will be discharged into the emergency tanks and then entrusted to qualified agents to treatment.

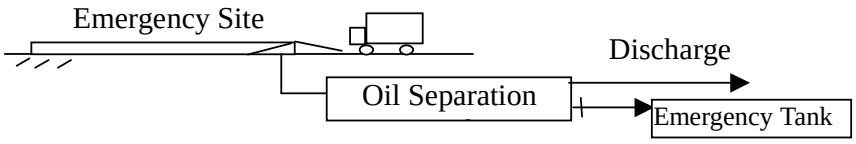


Figure 7-4 Emergency Site Wastewater Treatment Diagram

The treated wastewater can meet with Class III requirements of *Wastewater Comprehensive Discharge Standard* (GB8978-1996), i.e. COD□500mg/l, oil□20mg/l, and SS□400mg/l. The wastewater is discharged into the sewer system of the industrial estate and treated by Hailar Municipal Wastewater Treatment (MWWT) Plant. The final wastewater discharge can meet with Class I requirements of GB8978-1996.

(2) Waste gas

a. In the combustion waste gas from the boilers, the main pollutants are smoke dust and SO_2.
b. There is small amount of loss of hydrocarbons during gas filling process in the Gas Station.

The emission of waste gas from the boilers should meet with the standard for Class 2 areas in *Boiler Air Pollutants Emission Standard* (GB13271-2001).

(3) Noise

The main noise sources are boilers, forktrucks or vehicles. The noise source intensity is 80~90dB(A).

The equipment with low noise will be selected and the layout is reasonably planned to guarantee that the plant boundary noise can meet with Class III of *Industrial Enterprises Plant Boundary Noise Standard* (GB12348-90).

(4) Solidwaste

a. The living garbage of the employees in the PDC.
b. Waste packaging materials and leftover materials during the loading and unloading processes of goods.

The solidwastes will be collected by classifications, and the waste packages, leftover materials are recovered or sold to the outside. The solidwaste that cannot be utilized will be periodically collected and disposed by environmental sanitation department.

7.1.4 Main Environmental Impact Factors Analysis

The environmental impact matrix is used to analyze the impact types and degrees of environmental impact factors of the PDC in the Construction and Operation Periods. See Table 7-3.

Table 7-3 Environmental Impact Matrix of the PDC in the Construction and Operation Periods

Item		Construction Period		Operation Period	
		Material transport	Construction of the PDC	Operation in the PDC	Transportation running
Social environment	Socio-economy	○	○	□	
	Labor employment	○	○	□	□
	Migration				
	Communication and transportation	●			■
	Land use	●	●	□	
Natural environment	Topology and landform		●		
	Soil		●		
	Surface water			■	
	Air environment	●	●	■	■
	Noise environment	●	●	■	■

Note: □/○: Long-term/short-term positive impact; ■/●: Long-term/short-term negative impact; Blank: interaction unobvious or undetermined.

7.2 Overview of Haidong Industrial Development Estate

(1) Foundation

On September 29, 2002, Inner Mongolian Autonomous Region approved to establish "Hulunbeier City Haidong Industrial Development Estate" (briefly called Haidong Estate hereafter). The estate is located at the eastern suburb of Hailar District, with 6.0km away from the downtown area and a taotal land use of 26.0km^2.

(2) Topology

The estate lies in the Hailar River basin where the surface relief is high in the east and south and low in the west and north, the maximum elevation difference 9m, and the maximum frozen soil depth 2.42m. The Hailar River flows by the northern end of the estate. The groundwater in the estate is very rich, with the buried depth of 5~50m. The groundwater quality can meet with national drink water standard. The area is comprised of alluvial, slope-wash and wind-deposited sand, grit and clay, with good geographical conditions.

(3) Planning scope

The land use of Haidong Estate is to the south and north sides of State Highway 301, ranging from 1268km of State Highway 301 in the east to 1276km in the west, and from 38.4m to the north of Binzhou Railway in the south to 100m to the south of flood protection dike of the south bank of the Hailar River in the north. The total land use area is 26.0 km^2.

(4) Residents and enterprises distribution

The estate topology is flat and wide, with State Highway 301 and Binzhou Railway going through the middle part and south end of the estate respectively in east-west direction. There are currently two villages, i.e. Fuzhu Village and Lianhe Village, with a total population of more than 1300. There are some village-owned enterprises and private enterprises surrounding the villages, and there are also a few enterprises, including chlor-alkali factory and organic fertilizer factory, etc. distributed to the south side of the estate. Most of the land in the estate is un-utilized wild grass ground.

(5) Overall planning

The State Highway 301 divides the whole estate into southern and northern zones. The overall planning of Haidong Estate is illustrated in Figure 7-4.

To the south of State Highway 301 are Class I Industry Processing Zone, Class II Industry Processing Zone, Physical Distribution Storage Zone and Comprehensive Service Zone. The Storage Zone is located on the north side of Binzhou Railway and distributed along the line. Others are basically processing zones.

To the north of State Highway 301 are administrative, commercial and cultural centers of the estate, including Residential Zone, Administration Zone, Commercial and Service Zone, High-Tech R&D Zone, Recreation Zone and Comprehensive Service Zone.

The storage land use can be divided into three parts and is distributed to the north of Binzhou Railway. The total area of storage land use is 111.72ha, accounting 4.4% of the total land use.

7.3 Environmental Impact Analysis

7.3.1 Social environmental impact

(1) Impact on the economy

Hailar District is the political, economic, cultural and social activity center of Hulunbeier City. Manzhouli City is an important port city of Hulunbeier, locating at the center of Northeast Asia Circle comprised of northeastern China, Siberia region of Russia, Mongolia, Japan, Korea and

DPRK, and at the joint of external and internal markets, thus being the pivot of the development of northeastern economy and tourism.

After the construction of the PDC, it can provide services of goods transfer and storage, favorable to the border trade between China and Russia and Mongolia. The construction of this PDC will bring about long-term favorable impacts for the regional economy.

(2) Impact on labor employment
The construction of the PDC will increase the following employment opportunities:

a. Constructors of the PDC;
b. Additional employment opportunities for the purchase of materials in the Construction Period;
c. Additional employment opportunities duo to the development of communication and transportation.

(3) Impact on migration
The current site for PDC is blank, without need of migration and removal for the center.

(4) Impact on communication and transportation
The designed annual treatment capacity of the PDC is 0.8~1 million t in the short term (the design year is 2013). Duo to the goods transportation, there will be an increase of 100~150 vehicles (calculated by large freight vehicles) of daily traffic flow.

7.3.2 Water environmental impact

The wastewater is discharged into Hailar MWWT Plant, with the treatment capacity of 20000t/d, through the municipal sewer system. After the central treatment, the wastewater can meet with Class I requirements of *Wastewater Comprehensive Discharge Standard* (GB8978-1996) and is finally discharged into the Hailar River.

Considering that the wastewater generation from this project is small, it will have only small impact on the water quality of the Hailar River.

7.3.3 Air environmental impact

One boiler will be added in the project. The emission of waste gas from the boilers will meet with the limit values for the Second Phase stipulated in *Boiler Air Pollutants Emission Standard* (GB13271-2001). The main pollutants include smoke dust, SO_2 and NO_x.

The emission of this project is small and will have small impact on the regional air environment. It is suggested that central heating be adopted, since there have been a plan in Haidong Estate to set up heating pipes utilizing Hailar Thermoelectric Plant.

7.3.4 Noise environmental impact

(1) Construction Period

The main machineries for construction include excavators, bulldozers and transport vehicles, with the noise source intensity of 80~90dB(A). The impact scopes of various machineries in the daytime are all within 50m. The noise will be below 70 dB(A) beyond 50m, and below 60 dB(A) beyond 100m.

The impact scope at night is greater. The noise will be 55 dB(A) only beyond 100m for most construction machineries, and it can reach 55 dB(A) only beyond 300m for land levelers, mechanical loaders and other high-noise machineries.

There plant area of the PDC is wide blank space, without sensitive sites such as residences. The construction noise will not have serious impact on the environment.

(2) Operation Period

The noise sources of the PDC in the Operation Period are mainly operational noise of boilers and pumps, etc. and running noise of transportation vehicles.

The following control measures are suggested for the control of noise:

a. Performing reasonable layout, to make the high noise sources as far away from the plant boundary as possible;
b. Selecting production equipment with low noise generation;
c. Controlling the high noise equipment by insulation and attenuation measures;
d. Notifying the maintenance staff to repair as soon as possible in case of occurrence of abnormal noise.

By adopting the above measure, the noise impact on the engineering area can be reduced to ensure the compliance with the national plant boundary noise level limits.

7.3.5 Solid waste impact

The final disposal of solidwastes includes three kinds of methods, i.e. incineration, recovery and reuse, landfilling. The arbitrary piling of the solidwastes will lead to soil environmental pollution. The solidwastes will possibly infiltrate into the groundwater with the rainfall, and further affect the growth of aquatic and terrestrial animals and plants.

The solidwastes generated from the engineering include waste package and living garbage, etc. The solidwastes will be collected by classifications. The wood boards, paper boards and other recoverable goods will be collected for sale, while the garbage that cannot be recovered will be collected and disposed periodically by municipal departments.

It is suggested that specific storage facilities or piling sites be set up in the plant area. The storage sites of solidwastes should be indicated with conspicuous marks.

7.3.6 Indirect impact

After the PDC is put into use, the goods handling capacity will increase, and the traffic flow in the region will increase. The main environmental protection targets from the PDC to Hailar-Manzhouli Highway line are shown in Table 7-4.

Table 7-4 Main Protection Targets from the PDC to Hailar-Manzhouli Highway

Section alongside		Environmental protection target	Relationship to the highway	Main sensitive environment
Hulunbeier Grassland		Hezuo Village	6m to the sides of highway (150 households, about 600 people)	Air environment; Noise environment
River	Hailar River	River water quality (Class III water body function)	The highway crossing the river by bridge	Surface water environment; Eco-environment

(1) Overview of Yakeshi-Hailar highway

The State Highway 301 will go through Haidong Estate. Currently, the Yakeshi-Hailar section of State Highway 301 is under construction, planned with 25.5m-wide hardening pavement and 4 intersections at the estate.

The Yakeshi-Hailar Highway starts from the west outlet of Yakeshi City and ends at Hailar Bei, with a lenth of 82.969km. The main technical indicators are shown in table 7-5.

Table 7-5 Main Technical Indicators of Yakeshi-Hailar Highway

Main technical indicator	Unit	Quantity
Calculated running speed	km/h	100
Roadbed width	m	25.5
Pathway width	m	15.0
Pavement class		High class highway

(2) Water environmental impact

The starting point of Hailar-Manzhouli Highway is about 15km to Haidong PDC. It spans over the Hailar River with a 360m-long big-sized bridge.

The tail gas from the freight vehicles could be washed by the rainfall into the Hailar River. As the PDC-induced traffic flow is not high (100~150vehicles/d), and the river water flow in the rain seasons is great, the impact on the water body is small. It will also stop immediately after the rain stops, thus belonging to short-term impact.

(3) Air environmental impact

After the construction of the PDC, with the increase of transportation vehicles, the emission of vehicle tail gas wills somewhat increase. According to the projection of traffic flow and PDC-induced traffic flow in *the Feasibility Study Report of Yakeshi-Hailar Highway*, the source intensity of NO_X is 0.33mg/m.s. The air environmental projection is performed using the formula in Section 4.3.2, and the results are shown in Figure 7-5.

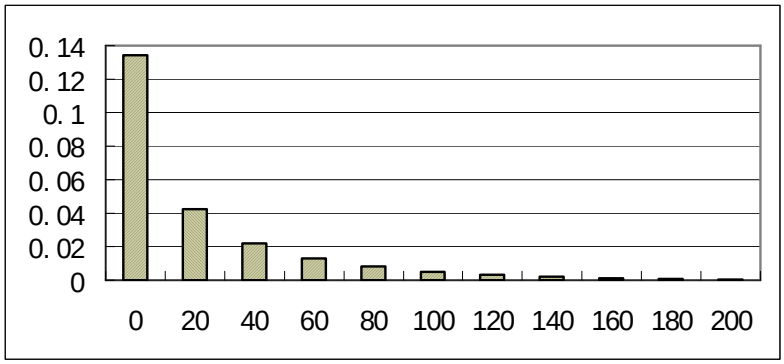


Figure 7-5 Air Environmental Impact Projections at Tuanjie Village (2013)

It is seen from the above figure that the impact of NO_x concentration on Tuanjie Village will be mainly nearby the highway (roadside ~ 40m). The projected NO_x concentration nearby the highway at Tuanjie Village section will not exceed Class 2 of GB3095-1996 in the Operation Period (target year 2013).

(4) Noise environmental impact

According to the projection of traffic flow and PDC-induced traffic flow in *the Feasibility Study Report of Yakeshi-Hailar Highway*, the noise environmental projection is performed using the formula in Section 4.4.2. The results are shown in Figure 7-6.

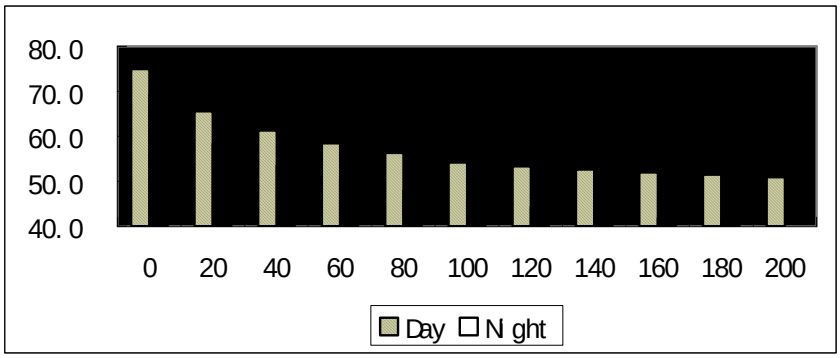


Figure 7-6 Noise Environmental Impact Projections at Tuanjie Village (2013)

As seen from the projection results, after the construction of the PDC, the noise level in the daytime at the residential houses of Tuanjie Village on the side of the highway will be near to the national standard value, while that at night exceed the national standard. Therefore, the residential houses within 35m to the highway sides should be removed. According to on-site reconnaissance, 5 households will be removed, and the total removal cost 100,000RMB.

(5) Eco-environmental impact

The transportation line goes across the Hailar River, the two sides of which are currently 100~150m wetlands. The wetlands belong to flood plain wetlands and are distributed in belt form. These wetlands have no particularities compared with those at other sections. Under normal transportation conditions, there will be no negative impact on wetland eco-environment in Hailar.

CHAPTER 8 MEASURES FOR ENVIRONMENTAL PROTECTION

8.1 The Situation of Existing Loan Projects by the World Bank in Inner Mongolia

The Trade and Transportation in Inner Mongolia Project is the 3rd highway project utilizing the World Bank loan. The previous two projects are respectively highway project of three provinces already completed and Laoyemiao-Jining Speedway under construction. The experience in EIA and environment protection of these two projects is important for the smooth implementation and efficient management of this proposed project.
IMCD regards that the following points had important role in the implementation of mitigation measures and would like to continue the good practice in the next project.

1. During the bidding, the environment protection scheme and measures should be included in the bidding documents in order to require the contractor to conform the items relevant to accomplishing the environmental protection measures.
2. The corporation of the project should contact with local health and anti-epidemic institutions before the contractor and the constructors entering the construction sites in order to better publicize and carry out the countermeasures about health and anti-epidemic. By this means, epidemic diseases may be well prevented.
3. The encampment of construction needs necessary disinfecting, washing and sanitation checking. The garbage from constructors needs classification according to the environmental requirements.
4. Each construction department should arrange one professional vice manager responsible for the environmental protection work. He will accomplish the environmental protection scheme and measures, read-in the Project Season Report, and complete the daily record of their environmental protection work.

8.2 Measures for Environmental Protection in Design Phase

8.2.1 Social environment

(1) The lines avoid passing major environmental sensitive sites (Hailar District, Chenbaerhu Qi, Zalainuoer Mineral District, and Manzhouli City)

(2) The pavements and tractor roads should be considered in the engineering design to facilitate herdsmen walk and tractors passage and thus reduce the impacts of the highway on mutual isolation (refer to Table 4-1-2).

8.2.2 Surface water environment

(1) The bridges and culverts should be rationally built to prevent blocking water stream and ensure surface runoff, and prevent resulting in flood disasters (refer to Table 2-8).

(2) The domestic sewage and production wastewater in the service areas should be treated. It is suggested that the oil-insulating treatment for wastewater containing oils be performed, and the septic tanks for domestic sewage be built. The process flow diagram recommended is shown in Figure 8-1.

8.2.3 Ambient air

(1) The temporary facilities, such as blending stations, bitumen mixing stations, should be built, according to the local dominant wind directions and sub-dominant wind directions, to the leeward and at places beyond 200 m away from the sensitive sites, such as resident areas, hospitals, etc. (K404+000, K409+700, K493+400, K505+500, K557+800). And the blending stations should have good sealing property.

(2) It should be prohibited to build the temporary facilities, such as blending stations, bitumen mixing stations, in Huhenuoer Lake (K430+000-K438+000), Benpo Lake (K526-K532), and Erka Wetland (K540+000-K553+200).

8.2.4 Noise environment

(1) The materials sites, blending stations, and bitumen mixing stations should be built away from resident areas, hospitals, Huhenuoer Lake, Benpo Lake, and Erka Wetland (K404+000, K409+700, K493+400, K505+500, K557+800, K430+000-K438+000, K526-K532, K540+000-K553+200) at distances of more than 200 m.

(2) The traffic signs to prohibit vehicles from using horns should be established in the areas, such as resident areas, hospitals, Benpo Lake, and Erka Wetland (K404+000, K409+700, K493+400, K505+500, K557+800, K430+000-K438+000, K526-K532, K540+000-K553+200).

(3) There are one hospital and four villages along the lines. The measures (e.g. migration) shall be adapted to reduce the impacts of noise. The villages exceeding noise standards of the long term in 2030 are given in Table 4-4-10.

8.2.5 Eco-environment

(1) In the engineering design, the balance of earth and stone should be reached as far as possible, the mountain areas should be selected as waste earth yards, and occupation of grasslands should be avoided. The earth borrowing yards shall occupy grasslands of high

yields as less as possible. And the protection embankments shall be built in the grassland areas to reduce the land occupation.

(2) To protect the grassland tourism resources, it is suggested that the earth borrowing yards and waste earth yards should not be allocated within the fields of vision along the lines and should be allocated on the mountain rear sides, and that soil should be extracted as level as possibly and, then, the recovery measures should be taken and grass should be planted (refer to Figure 2-8 and Table 2-11).

(3) The protection engineering of the road bases and the drainage engineering of the highway should be rationally designed to prevent soil erosion and water and soil loss.

8.2.6 Erka Wetland

(1) The centralized construction sites, such as mortar blending stations, should not be established in the wetland area. The required materials shall be transferred from the construction sites located in other road lines.

(2) In the construction of the road surfaces, the schedule and construction machines should be rationally arranged to avoid construction at nights and centralized construction of the large-scale machines.

(3) The temporary land in the wetland area should be occupies as less as possible to reduce the impacts of the construction on the ecological environment of the area as far as possible.

(4) Cross section should not be allocated at the wetland area to prevent vehicles from going down the line.

(5) The signs not to use horns should be established in the road section after the highway is put into operation.

(6) Before the construction, construction access roads should be constructed and construction vehicle route properly defined to forbid their arbitrary driving.

8.3 Measures for Environmental Impact Prevention in the Construction Period

8.3.1 Social environment

(1) Migration

The dismantling and moving volumes of the project will be small. Houses and buildings of 358 m^2 shall be required to dismantle and move (refer to Table 4-1-1). Before the construction of the project begins, the Office for Land Imposing and Dismantling and Moving should be founded.

The national compensation policies on land imposing and dismantling and moving shall be propagated. The resettlement problems for herdsmen who will be imposed their lands shall be resolved and the buildings to be dismantled and moved shall be compensated. In the migration process, the customs and religious belief of the minority nationalities should be respected.

(2) Shift of Power Transmission and Communication Lines

Before the construction of the project, the coordination work with the power and communication institutions should be actively undertaken.

In the mark sections of the power transmission line shifts, the safety supervisor should be assigned for each mark section. The obvious safety warning lines should be established in the construction sites. And the symbol lights attracting eyes should be installed at nights. The local herdsmen, travelers, and livestock should be prohibited to enter the construction sites.

(3) Local Communication and Transportation

1. Before the construction begins, the local roads to serve as the transportation passageways should be consolidated and remade or the pavements should be built through.
2. In the construction periods, if the roads are required to be partially blocked, the pavements should be built to be connected with the original roads.
3. In the construction periods, if the local roads are damaged, they should be repaired upon the end of the construction, or the reparation should be paid to the locals who shall repair them.
4. The transport vehicles should avoid the local traffic rush hours, reduce their environmental impacts on noise and air in the areas along the lines, and reduce the traffic accidents.

(4) Land Utilization

a. The construction management should be enhanced. The construction practices should be undertaken in the designated construction areas. And the random occupation of grasslands should be prohibited;
b. The construction vehicles shall go on the designated roads and be prohibited to go on the grasslands at random.

(5) Cultural Relics and Historical Sites along Lines

According to the initial investigation, along the reconstruction project route, there are no cultural relics found in the construction. If any cultural relics found in the construction, the building work must be interrupted with the cultural relics control departments noticed. The building work must not continue until the excavation and arrangement are completed.

In the active coordination of the highway building department and the relics protection department, action in accordance with the national laws for protecting cultural relics, the project construction will not produce effects on the cultural relics concerned along the route.

There have to be the articles on the cultural relic conservation and normal work procedures in the tender invitation proposals of each road section of the project. And there should also be the corresponding articles on the supervision and inspection and control of the cultural relics in the tender invitation proposals of the inspection and control.

8.3.2 Surface water environment

(1) Bridge and Culvert Engineering

There are a few rivers along the highway lines to be constructed. They are seasonal rivers. The construction in the cofferdam method should be adapted to effectively prevent turbid water quality produced by the construction, and construction refuse from falling to the rivers to pollute water bodies.

The mud residues excavated from excavation of the bridge piers, and wastewater from washing and brushing construction materials (e.g. sand and stone washing and brushing) should not be re-discharged into rivers. The temporary precipitation pools should be built to precipitate them, and mud residues should be put at the low-lying sites outside the river embankments.

(2) Machine Work

a. Sewage from construction machines which contains oil should be collected and then treated (collected into waste plastic tanks and then transferred out for treating), and should not be discharged into the water bodies.

b. The stack sites for the construction materials, such as bitumen, oil materials, chemical substances, etc., should be located outside the riverbeds and equipped with canvas for temporarily covering purpose.

(3) Construction Camping Grounds

a. The construction camping sites should not be located beside the water bodies. The sewage from constructors needs collecting and discharging into the cesspit; the feces can be composted as fertilizers for the meadow. The sewage can water the meadow, and arbitrary discharging of wastewater without strict management is forbidden.

b. Each construction worker is required to have the medical and anti-epidemic examination before they enter the construction area. The sanitation and anti-epidemic work should be enhanced in the construction camping sites during the rain season to prevent disease spreading.

c. It should be prohibited that the waste stuff and construction materials are discarded and stacked beside water bodies and wetlands to prevent pollution and block of the water bodies.

8.3.3 Ambient air

(1) Materials Transportation

a. The roads of the materials sites should be frequently sprinkled to maintain the road surfaces moist. When wind speed is higher than 5 m/s, the transportation and load and unload of powdered materials should not be performed.
b. The materials transportation roads and construction sites should be periodically sprinkled (twice a day, each in morning and afternoon respectively), especially near the plaster blend stations, and the road surfaces should be timely cleaned to prevent a secondary raising dust.
c. When transportation of unpackaged materials goes through the grasslands and resident areas, the measures to prevent transportation raising dust should be taken, and the transport vehicles should be going at a speed of less than 40 km/h on the roads; the transportation in a lump way should be adapted for lime, and powdered materials should not be over loaded. The raw materials to easily produce a raising dust, such as cement and lime, etc., should be stored in an airtight work shed, or a windbreak and waterproof measure should be taken for their storage.
d. The vehicles for transportation of construction materials should be covered to reduce falling apart as far as possible. The transportation of powdered coal ash should be loaded and transferred in a wet way.
e. When going through the areas with a higher population density and the sensitive sites□K404+000□K409+700□K493+400□K505+500□K557+800□K430+000-K438+000□K526-K532□K540+000-K553+200□, the vehicles of materials transportation should decrease their speeds to reduce the impacts of raising dust. Also the signs of speed limits should be established at the sensitive sites/areas where the vehicles of materials transportation go through.

(2) Construction Work

a. The advanced blend equipment for bitumen and concrete should be adapted. And the bitumen melting and mixing should be done in airtight containers. The bitumen preparation in an open simple way should not be used.
b. In the construction of road bases, individual layers should be timely rammed and sprinkled to reduce dust. And the construction pavements and unpaved roads should be frequently sprinkled to reduce dust pollution.

8.3.4 Noise environment

1. It should be done to rationally arrange the construction activities, shorten the construction periods as far as possible, and reduce the impact time of construction noise. The construction machines with big noise should be avoided being simultaneously used in the same area, especially those sites near the noise sensitive sites, i.e. only one machine being used at a time interval within a road section of 50 m. The piling and demolition work shall

not be allowed at night (from.10:00 pm to 6:00 am) The following machines shall be limitedly used at nights: loading machines, vibrators, pounded drilling machines, and concrete mixers with a higher noise.

2. Because there are resident areas, hospitals, Benpo Lake and Erka wetland road sections (K404+000, K409+700, K493+400, K505+500, K557+800, K526-K532, K540-K553+200) near the lines, the construction machines with a strong noise should not be used at nights (from 10:00 pm to 6:00 am).

3. The workers operating the construction machines and on-site construction persons should control their working hours or take personal protection measures (e.g. with safety helmets and earplugs).

4. The main transportation lines should be away from the sensitive sites, including villages and hospitals, as far as possible.

8.3.5 Eco-environment

(1) Do not expand earth borrowing volume and range of the earth borrowing yards at random, and decrease the excavation surfaces as far as possible; earth should be discarded according to the designed capacity of the waste earth yards, and do not exceed the range.

(2) After the finish of the construction, the temporary construction bridges should be timely removed, and the construction pavements should be cleared away and removed and vegetation should be recovered.

(3) At the earth borrowing yards, the farming mellow soil of the original land surface should be piled up aside and stored before the excavation and, then, filled back and removed after the finish of the construction to recover the original land surface. The construction duration is three years and the annual effective construction duration is only about six months. Because there exists severe wind erosion in the areas, it is suggested to divide up the excavation and assign a part to each in the regional sites and, for the excavated region, to timely carry on leveling work, to cover topsoil, to recover vegetation, and not to wait for the end of the whole engineering to do so.

(4) The residue blocking dams should be built at the waste earth yards. The discarded earth should be stacked in a trapezoid way, the stocked earth and stone should be dammed firmly and the top of the stocked earth should be leveled as far as possible to decrease rain washing and brushing. The blind pipes should be installed and the outer edges should be pilled up with cobble gravels to eliminate permeating water. When the construction is performed at the waste earth yards, topsoil should be firstly stacked aside, discarded earth

should be timely and firmly pressed and, after discarded, the top surface should be filled back with mellow soil, with a covering thickness of 30-50 cm, to satisfy the basic requirements of plant growth.

(5) At the materials sites, the stripped vegetation and topsoil should be separately stacked before exploiting. The exploiting ways which minimally change the landforms, such as the whole exploiting or parallel exploiting, etc., should be adapted to avoid producing deeper pitfalls and bigger excavating slopes and to facilitate filling repeat-soil back and recovering vegetation after the work is completed.

(6) For the temporarily occupied lands, the vegetation and farming land recovery should be undertaken as soon as possible after the engineering is completed. It should be done to use while leveling, greening, and re-farming. For greening work, the locally appropriate plants should be mainly chosen. For seeds, the sheep grass seeds may be adapted. It is suggested that grass seeds be sowed in mid June since there are light winds and good water conditions in the season to ensure a higher germination percentage.

(7) In the construction, the normal driving routes should be determined to prevent vehicles from husking grasslands and persons from trampling at random.

(8) The diverse pollutants to be produced during the construction should be properly dealt with to prevent serious pollution of ecological environment.

(9) In the sandy land area of the eastern coast of the Hailar River, a grass square frame sand-firm method shall be adapted on roadside slopes and side ditches. It is suggested to carry on the closed afforestation on sandy lands along the road lines.

(10) The propagation of the corresponding regulations to the construction persons should be enhanced. The actions to destroy ecological environment, such as fishing and hunting, etc., should be absolutely prohibited.

(11) Trees on temporarily occupied lands shall not be cut down as far as possible.

8.3.6 Wetland eco-environment

(1) In the construction, diverse temporary land should be occupied as less as possible.

(2) In the construction, land should be occupied as less as possible, the normal driving routes should be determined to prevent vehicles from husking grasslands and persons from trampling at random, and diverse pollutants to be produced during the construction should be properly dealt with to prevent serious pollution of ecological environment.

(3) In the construction of the wetland sections, the temporary construction bridges and construction pavements should be built in the properly selected construction durations, and they should be timely removed and cleaned after the construction is completed.

(4) The construction camping sites should not be built in the Erka Wetland. It is absolutely prohibited to discard and stack waste stuff and construction materials beside the wetland to prevent pollution of the wetland.

(5) The environmental management and supervision institutions should be established and strengthened, and the whole process of the project construction should be permeated with the environmental inspection and control; The national and local laws, regulations, rules, and technical requirements and standards should be observed, and the ecological rules for the construction persons of the project areas and management and operation persons after the project completion should be developed as well. The major contents of the ecological rules include observing the regulations on the natural resources protection and ecological protection, and not undertaking activities which result in disadvantageous impacts on the regional ecological environment, such as farming, fishing, hunting, etc.

(6) In the wetland mark section, at least one engineer of inspection and control should be designated to be in charge of the inspection and control work of environmental protection work.

(7) The construction scope should be specified and any constructive activities should be controlled strictly within the scope, and the destruction of vegetation around the construction areas is prohibited. In the Construction Period, the forest and plants on the requisitioned lands especially the plants in sandlot should be protected as far as possible.

(8) All the construction activities should avoid the wild animal's habitation and the behavior disturbing or destroying the wild animal's living area is not allowed. Excessive catching and hunting wild animals is forbidden. The construction time should avoid the season like gale in the spring. The construction efficiency should be enhanced to shorten the construction time. It is also important to minimize the destroying of natural vegetations.

8.3.7 Solid wastes

(1) It is suggested that garbage cans should be put in every construction area to collect domestic refuse to be generated.

(2) Because of small amounts and simple components of domestic refuse, it may be centrally and periodically transferred and land filled on site.

(3) It is suggested to coordinate with the local administrative institutions on construction rubbish to be generated from dismantling and moving along the highway lines. The appropriate sites of the second party should be determined. In dismantling and moving and road destroying, the surface removing stuff should not be stacked along the lines. Coordinated with the environmental inspection and control in the construction, the proper stack sites should be chosen. The leftover waste materials to be generated in the construction shall be dealt with by the construction units themselves.

8.4 Measures for Environmental Impact Control in the Operation Period

8.4.1 Surface water environment

(1) The integrated sewage treatment facilities should be installed in the service areas. It is suggested to adapt the cycle process for wastewater treatment to ensure that wastewater discharged out reaches the second level standard in *Farmland Irrigation Water Quality Standards* (GB5084-1992). The sewage treatment flow diagram suggested is shown in Figure 8-1.

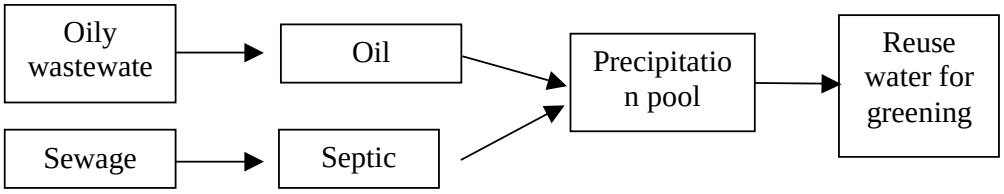


Figure 8-1 Sewage Treatment Process Diagram

(2) The highway fee collection stations should fully play their roles and simultaneously function the inspection and control. It should be absolutely prohibited that those vehicles with any revelation, unpackaged overloading go on the highway to prevent missing goods on the highway from polluting water bodies and wetlands.

8.4.2 Ambient air

Grass shall be planted on the both sides of the highway to clean and absorb pollutants in the vehicles exhausts and, simultaneously, to beatify the environment and improve the landscapes along the highway lines.

8.4.3 Noise environment

(1) Measures for Traffic Noise Prevention and Comparison and Selection

The common noise prevention and control measures are as follows: sound insulation barrier, greening, building removal, sound insulation windows, and engineering avoiding, etc.

According to the ambient noise value of sensitive points, the adoptive noise environmental protection measures will be as follows:

Table 8-1 Noise Environmental Protection Measures

NO.	Sensitive site name Post No.	Sensitive site type	Distance to line center (m)	Year	Value exceeding the standard dB(A)		Noise prevention and control measure
					Day	Night	
1	Haotetaohai K404+300	Residen-tial area	44	2030		4.5	The residences near the road install sound insulation windows.
2	The 5th Production Team K409+700	Residen -tial area	46	2030		2.3	The residences near the road install sound insulation windows.
3	West Wuzhuer K493+400	Residen-tial area	76	2030		2.9	The residences near the road install sound insulation windows.
4	Mineral Area Hospital, north enclosure K557+800	Outside hospital in-patient buildings	240	2015	-	4.1	Planting six line trees between the road and the hospital
				2030	5.37	6.27	

(2) Management Measures during the Operation Period

a. Those vehicles exceeding the nationally allowable noise standards should not be allowed to go on the highway. *The Allowable Noise Standards for Motor-Driven Vehicles* (GB1495-79) is listed in the following table:

Table 8-2 Allowable Noise Standards for the motor-driven vehicles (GB1495-79)

Vehicle Type		Allowable Standard dB (A)
Truck	8t□Truck<15t	89
	3.5t□Truck<8t	86
	Truck<3.5t	84

Light Cross-Country Vehicle		86
Bus	4t□Total Weight<11t	86
	Total Weight<4t	83
Car		82

b. The bass horns should be used for all vehicles on the highway. And it should be prohibited to use horns at nights.
c. The traffic management should be enhanced. When vehicles pass through the noise sensitive sites or areas, including Haotetaohai and its fifth production team, West Wuzhuer, Yihe, Mineral Area Hospital, Erka Wetland, and Benpo Lake, it should be prohibited for the vehicles to use horns.
d. The highway maintenance should be enhanced to maintain the road surfaces at an optimal status.
e. The construction planning along the highway lines should be controlled. The sensitive buildings, such as resident houses, schools, and hospitals, should not be built within 200 m.
f. As mentioned at chapter 4, trees should be planted at the right side of the road when passing by the Mineral Hospital to reduce the noise impact.

8.4.4 Eco-environment

(1) The routine management work for vegetation recovery along the lines should be undertaken: periodically going on a tour of inspection of vegetation recovery and adapting corresponding remedial measures for the sections with bad recovery situation. Each part of the destroyed area due to the project construction should be leveled, loosened by plough as soon as possible. In proper seasons, tree species and grass seeds, which are suitable to the local ecological environment, should be cultivated to recover the natural landscape. Toward the destroyed arbors and shrubs due to the construction, compensation rules should be established and should reflect the practical loss. In-situ or allopatric compensation is regarded as the best method.
(2) When the highway construction is finished, unified arrangement, clearance and renovation are needed for the temporarily occupied lands and the affected areas due to the construction. According to the different land situation and local ecologic environmental plan along the highway, corresponding measures are asked to taken to recover the vegetations and prevent desertification. The measures taken should be differentiated by the different types of occupied land when recovering the vegetations and prevent the desertification. If it was farmland before, it should be reclaimed to farm; if it was grassland before, the emphasis is to recover the previous vegetations; if it was fixed or semi-fixed sandlot, the main task should be recovering the previous vegetations. Mechanical sand barrier is the main way for flowing sandlot, in combination with shrubs and herbs growing in sand, so as to recover the

previous vegetations, prevent the desertification, while improving the ecological environment along the highway.

(3) The propagation and education of environmental protection and corresponding legality should be strengthened to increase awareness of ecological environmental protection and cultivate good habits to conscientiously maintain ecological environment.

(4) The functions of the quarantine and obstruction of the border and customs should be further enhanced to stop invading of the invading species, to enhance the entrance check work of diverse traffic facilities (trains, vehicles, etc.), baggage carried by tourists, and diverse goods, and to prevent accidentally bringing foreign living things.

(5) For the part at Erka of the road, eco_tourism measures should be undertaken. These measures include setting parking area, building path into the wetland and setting instruction boards, etc.

8.4.5 Solid wastes

(1) It is suggested that garbage cans should be put in the service areas to centrally collect domestic refuse. After the domestic refuse is collected by the environmental health institutions, it shall be transferred to the nearby refuse transfer station and then further transferred from the station to the refuse treatment sites. The transportation from the refuse transfer station to the refuse disposal sites should be done by the airtight refuse transport vehicles in order not to result in significant impacts on the surrounded environment.

(2) Because vehicles go through the both sides of the roads along the lines, white refuse will be generated which will result in impacts on the landscape and environment of the both sides of the roads along the lines. It is suggested that the refuse of the both sides of the roads along the lines be periodically cleared away and transferred by the environmental health institutions.

8.4.6 Traffic management

(1) Strengthen the traffic management and provide good driving conditions. Periodically and randomly perform check of vehicles noise and exhausts. If those vehicles do not satisfy the noise and exhaust emission standards, they should be prohibited to go on the roads.

(2) Perform public propagation and education to let public know the vehicle noise and atmospheric pollution and corresponding regulations and policies.

8.4.7 Dangerous goods risks

(1) Implement the report and management system for the vehicles transporting the dangerous goods. Vehicles have to hold the travel permit to be signed and issued by the communication and transportation management institutions in order to go on the roads.

(2) The transport vehicles should be equipped with airtight and solid containers and obvious symbols and fire devices. The carriers should receive the necessary working training.

(3) The transport vehicles should be operated under directing and dispatching by the traffic management persons. Under the meteorological conditions (rain, fog, etc.) under which traffic accidents easily occur, those vehicles should not be allowed to go on the roads.

(4) If possible, also carry on the dynamic monitoring for the vehicles transporting the dangerous goods to facilitate to quickly decide the responses when accidents occur and to timely inform the local fire departments and environmental agencies.

8.5 Strategy protection measure

The Hulunbeir municipal goverment is now planning to set up a general protection plan of Erka Wetland. The plan aims to determine the scope of the protection area, strengthen the management of land using, and will give limits to human’s behavior and economic development within or near the area. The building of this road will be also taken into consideration when making the plan.

Chapter 9 Alternatives of the Project Construction

9.1 Determination of Starting and Ending Points

9.1.1 Starting point of the line

The starting point of this project is the end of Yakeshi-Hailar Highway (the west side of Aobao Mountain).

9.1.2 Finishing point of the line

Manzhouli new highway port is one of China's biggest land ports; it is also the end of State Highway 301. The determination of finishing point at this port will facilitate highway network linkage with Russia, speed up circulation of border goods trading and international material communication, and fully play the trunk function of the state highway.

9.2 Comparison of Construction Alternatives

In the feasibility study, two line corridors have been proposed. According to on-site investigation on the main control points, and on the basis of consultation with local governments and related departments along the line, five possible construction alternatives (A, B, C, D, E) have been identified. These alternatives are: Bayankuren bypass the town section (Option A Line), Huhenuoer Lake section (Option B Line), partly utilizing old roads (Option C Line), along Binzhou Railway line (Option D Line), and Manzhouli bypass section (Option E Line). In the Positive Line, part of the sections will be newly built and most part of sections will utilize the old roads in the line of strike.

9.2.1 Bayankuren bypass the town section (Option A Line)

Option A Line lets the line passing Chenbaerhu Qi bypass Bayankuren Town from the south. The length of the section (AK line) is 13.00km, starting from AK00+000 (Positive Line K412+000.00) to end post AK13+000.00 (Positive Line K425+669.01). This is comparable to the positive Line length of 13.67km. Therefore, the length of Option A Line is 670m shorter than that of Positive Line. As the through-traffic line, either Option A Line or the Positive Line should be newly built with 24-m integrated-type roadbed.

Table 9-1 Comparisons between Positive Line and Option A Line

Item		Positive Line	Option A Line
Engineering Comparison	Engineering Geology	Both located at the flood plain of the Hailar River and the second bottom; Both with the soil composition of mainly powder and fine sand.	
	Mileage□Km□	13.669	13.000
	Occupied land□ha□	73.06	67.06
	Roadbed earthwork□m^3□	383236	356811
	Water drainage conservation□m^3□	9003.57	8466.25
	Pavement□m^2□	287046	272832
	Small-sized bridge□m/bridge□	15/1	15/1
	Culvert□Set□	9	9
	Interchange□Set□	1	1
	Pathway and passenger overpass□Set□	2	2
	Link wire□Km□	2	2
Economic comparison		Estimated cost is 131.796 million RMB	Estimated cost is 127.249 million RMB
Environmental comparison		The distance from the Hailar River is not near; the flooding has less impact on the on roadbed. It is favorable to the northward development of Bayankuren Town. Positive Line is 670m longer than Option A Line, causing more occupational land.	Option A Line is 670m shorter than Positive Line, causing less distance from the Hailar River; the flooding is easy to have impact on the roadbed. Option A Line revolves Bayankuren Flood Prevention Dam.
Recommendation		Recommended	

The engineering quantities of Option A Line and Positive Line are almost equal. The

cost of Positive Line is 4,547,000 RMB higher than Option A Line. However, because Option A Line revolves Bayankuren Flood Prevention Dam, local communication departments and Chenbaerhu Qi government wish to adopt the Positive Line.

9.2.2 Huhenuoer Lake section (Option B Line)

The option is proposed based on the cut-off of the line. Option B Line starts from the north side of Chen Qi, passing through the north of Bayankuren Town and Chagandaobu, and joins with the Positive Line at 15km to Huhenuoer Lake. It starts from BK00+000 (Positive Line K416+000) and end with BK33+958.541 (Positive Line K454+000), with total length of 33.958km, compared with 38.669km of the Positive line. Option B Line should be newly built with 24-m integrated-type roadbed, while Positive Line may partly utilize the old roads.

Table 9-2 Comparison between Positive Line and Option B Line

Item		Positive Line	Option B Line
Engineering Comparison	Engineering Geology	go across a length of 4.3m muddy area; partly utilize the old roads.	go through a length of 10.2km marsh and muddy soil area; should be newly built with 24-m integrated-type roadbed
	Mileage□Km□	38.669	33.958
	Occupied land□ha□	76.41	74.19
	Roadbed earthwork□m^3□	526.21	499.36
	Water drainage conservation□m^3□	25.35	18.02
	Pavement□m^2□	423.65	424.07
	Small-sized bridge□m/bridge□	33.5/1	33.5/1
	Culvert□Set□	6	6
	passenger overpass□Set□	7	3
Environmental Comparison		Fully utilizing old roads; Not conflicting with the plan of Huhenuoer Lake Tourism and	Conflicting with the plan of Huhenuoer Lake Tourism and Resort Area.

	Resort Area.	
Recommendation	Recommended	

Hulunbeier City Tourism Bureau ahs planned Hulunbeier as grassland tourism and resort area, with the north side of Huhenuoer Lake as the core zone. This tourism area is ecological tourism area, the adoption of Option B Line would destruct the whole tourism area. Former State Planning and Development Commission (SPDC) have approved the plan of the tourism and resort area, and the preparatory wok has been thoroughly carried out. Considering this factor, and also considering that local government do not support the line, this option is proposed without comparison of the same depth.

9.2.3 Cuogang – Zalainuoer Mineral Area section (Option C Line)

(1) Option C Line

This optional line is proposed based on the curve cut-off of line. Affected by Zalainuoer gob and development plan, the highway line can only go by the north side of Zalainuoer Mineral Area, i.e. the junction of the Xinkai River and the lake. The recommended line goes from Cuogangyakou to the west, and the alternative line goes to the south from Cuogangyakou along the old road, passing through south side of Cuogang Pasture, crossing the Hailar River and Binzhou Railway, then going along Binzhou Railway line until Hubei Village, crossing to the right of Binzhou Railway at Hubei Village, passing Gaolintege, joining with the positive line at 2km to the east of intersection of the Xinkai River and the lake, and finally linking with the Positive Line.

The option line is 57.674km long, starting from CK00+000 and ending at CK57+674.15. The length of corresponding Positive Line is 37.5km. Option C Line is 20.174km longer than the Positive Line. The previous 45km of Option C Line can utilize old roads as separate roadbed, while the corresponding Positive Line should newly build 24-m integrated-type roadbed.

(2) Comparisons between Positive Line and Option C Line

Table 9-3 Comparisons between Positive Line and Option C Line

Item		Positive Line	Option C Line
Engineering comparison	Mileage□Km□	37.5	57.674
	Occupied land□ha□	293.64	447.82
	Roadbed earthwork□m^3□	2512502	4438716

	Water drainage conservation□m^3□	100733.9	68885.16
	Pavement□m^2□	771532	1198767
	Soft base treatment□Km□	19.349	9.324
	Extra-sized bridge, big-sized bridge □m/bridge□	486.5/1	397/1
	Middle-sized bridge□m/bridge□	173/2	355/6
	Small-sized bridge □m/bridge□	182.7/8	95/4
	Culvert□Set□	19	31
	Separation cross□Set□	-	2
	Pathway and passenger overpass□Set□	-	11
Economic comparison		Estimated cost is 483.874 million RMB	Estimated cost is 692.617 million RMB
Environmental Comparison		.5.1km across seasonal water zccumulation and serious swampiness area of wetland	12.8km across the marshland with seasonal water accumulation and serious swampiness area of wetland
Recommendation		Recommended	

a. Comparison of engineering work

Option C Line partly utilize old roads, but the zigzag line is 20.174km longer than the Positive Line, and with more cost of 0.209 billion RMB. It will also need to newly build two bridges over Binzhou Railway.

According to comparison of engineering work and investment cost, the Positive Line is better than Option C Line.

b.Comparison of eco-environment

□. Line position

The Positive Line deviates the old roads from Cuogangyakou and goes straight to the west, bypasses the north side of Benpo Lake, goes westward to the wetland, spans

across the Hailar River, and passes through Erka Wetland at the intersection of the Xinkai River and the lake.

Option C Line goes to the south from Cuogangyakou, passing through south side of Cuogang Pasture, crossing the Hailar River and Binzhou Railway, then going along Binzhou Railway line until Hubei Village, crossing to the right of Binzhou Railway at Hubei Village, passing Gaolintege, joining with the positive line at 2km to the east of intersection of the Xinkai River and the lake, and finally linking with the Positive Line. The option line is 57.674km long, starting from CK00+000 and ending at CK57+674.15. The length of corresponding Positive Line is 37.5km. Option C Line is 20.174km longer than the Positive Line.

 Economic comparison

In comparison of cost of investment, Positive Line can save about 210 million RMB than Option C Line.

. Eco-environment comparison

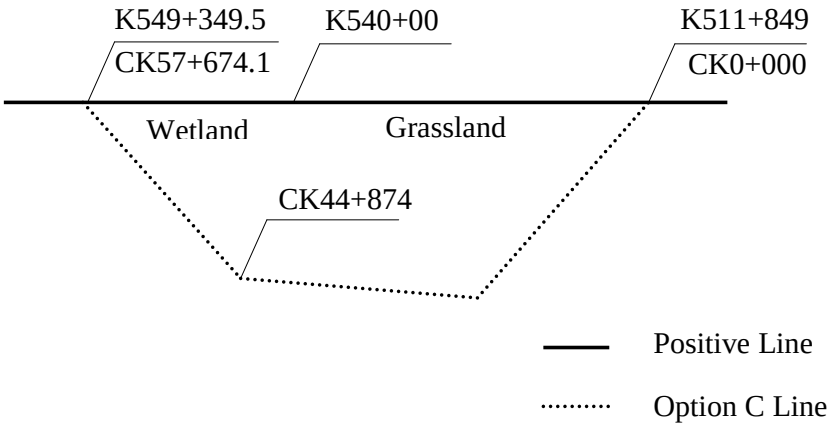


Figure 9-1 Schematic Map of Positive Line and Option C Line

The section of Cuogang – Zalainuoer Mineral Area is compared in two parts. See Figure 9-1 and Table 9-4.

Table 9-4 Subsections Comparison of Cuogang – Zalainuoer Section

No.	Positive Line		Option C Line	
1	K511+849 - K540+000	Newly built Grassland and lake	CK0+000- CK44+874	Expanding of old roads Grassland

2	K540+000- K549+349.502	Newly built Wetland	CK44+874- CK57+674.150	Newly built Wetland

 Comparison of Positive Line (K511+849-K540+000) and Option C Line (CK0+000- CK44+874)

The Positive Line section K511+849-K540+000 is 28.15 km long, being newly built highway. The line goes through the pastures in the west of Cuogang and bypasses the north side of Benpo Lake at nearby K530.

Option C Line section CK0+000-CK47+000 is 44.87 km long, utilizing and expanded old Highway 301.

Considering the new area of land occupation, the Positive Line requires a new land occupation area of 67.56ha, while Option C Line needs 53.8ha. The Positive Line occupies 13.76 ha more area than Option C Line. Additionally, duo to the utilization of old roads, Option C Line may have less environmental impact than Positive Line in the Construction and Operation Periods.

 Comparison of Positive Line (K540+000-K549+349.502) and Option C Line (CK44+874-CK57+674.150)

After Positive Line goes into the wetland, until the east side of the Hailar River, the highway section is about 4.5km long. It is the second bottom on the east side of the Hailar River, with relatively flat topology, distributed with less-fluctuating stabilized sand dunes. The willow shrubs (including Salix viminalis L., etc.) are the main vegetation, and under the willow shrubs and among the shrubs are rich mesophytic weeds. There are seasonal accumulated water at local enclosed-flow low lands and ditches, and the section with accumulated water is 300m long. At the section about 400m to the east bank of the Hailar River, are willow shrubs and Carex marshes, growing with dense willow shrubs and herbages. The section has seasonal water accumulation, starting from the Hailar River Bridge and on the west bank of the Hailar River, and ending at the outlet of wetland. In this section area, there are distributed Phragmites australis marsh, Carex marsh, Deyeuxia angustifolia, Agrostis gigantean and weeds marshes. The length of this section is about 4.8km.

Option C Line goes into the wetlands after crossing Binzhou Railway on the west side of Hubei Village. It passes Gaolintege (Tuweiba Mountain) and joins with the Positive Line at 2km to the east of intersection of the Xinkai River and the lake. It is 12.8 km from Binzhou Railway to the joint with Positive Line. The landform of this section is river and lake flood plains among the Hailar River, the Xinkai River and

Erzi Lake. The topological relief is low and the marsh wetlands develop well, distributed with many small river ditches, river branches and small lakes. There is a large scope of water accumulation in the section area, and the river ditches, river branches and some small lakes even have perennially accumulative water. The main plants include Phragmites australis (Cav.)Trin.ex Steudel, Carex marsh, Deyeuxia angustifolia, Agrostis gigantean and weeds marshes. These vegetations are inter-growing and dense, and have been the habitats of many birds. The section will also goes through the drink water source of Manzhouli City, with the water source wells and water transmission pipes distributed in the scope from the north part of Gaolintege (Tuweiba Mountain) to the side of the Hailar River.

In comparison of the characteristics of wetland sections that Positive Line and Option C Line pass, the Positive Line is 9.3km long from the wetland to the joint with Option C Line. Among this section, 5.1km has seasonal water accumulation and serious swampiness, others are terraces of the east bank of the Hailar River with relatively high relief and have slight swampiness. Option C Line is 12.8 km long from the wetland (after crossing Binzhou Railway) to the joint with Positive Line. The whole section is marshland with seasonal water accumulation, and distributed with river ditches and river branches. The swampiness is serious.

The length of the two optional sections is basically the same, but Option C line has more serious swampiness, poor construction conditions and goes through the drink water source of Manzhouli City. Therefore, the Option C has more negative impacts than Positive Line, including impacts on wetland landscape structure, wetland natural connectivity, wetland vegetations, wetland animals, and drink water source.

 Comprehensive comparison

In comparison of Positive Line (K511+849-K540+000) and Option C Line (CK0+000- CK44+874), Option C Line has less environmental impact. In comparison of Positive Line (K540+000-K549+349.502) and Option C Line (CK44+874-CK57+674.150), Positive Line has less environmental impact. Considering that Option C Line would go through Erka Wetland with serious swampiness and would go through the waster source of Manzhouli City, in comprehensive comparison, Positive Line will have less impact than Option C Line.

Comprehensively considering the engineering, economy and environment factors, Positive Line is superior to Option C Line.

9.2.4 Along the railway line (Option D Line)

This option is proposed according to the orientation of railway line. Option D Line starts from Fengdou Seed Multiplication Farm on the east side of Hailar, passing through the area between Hailar and the airport, crossing the Yimin River at the south to Team 1 of Heping, going along the West Mountain protective forest until reaching Xiaoliang. From Xiaoliang to Cuogang Town, the option line is basically parallel to Binzhou Railway. It passes through Daliang, Wugunuoer, Wulanqiu, Wangong, Qiuling and Heerhongde, and joins with Option C Line at the south side of Cuogang Pasture. Afterwards, it is the same as Line C, finally joining with the positive line at 2km to the east of intersection of the Xinkai River and the lake.

The Option D Line is 170.28km long, and the corresponding Positive Line is 169.4km long. The Option D Line is 1 km longer.

In comparison of the engineering geology, the two options belong to two different corridors. The recommended Positive Line is located on the north side of the Hailar River and Option D Line on the south side of the Hailar River. The Option D Line is located on the sand belt at Hailar-Cuohgang distributed from the east to west, and thus the sand prevention engineering work would be great. In addition, most of the Option D Line area is currently semi-stabilized sand land, with sandy plants growing well. The implementation of Option D Line will lead to destruction of vegetation and further the desertification. Option D Line is along the railway and near to Hailar District. It is favorable to the form of the highway circling Hailar District. But 120km of the total line is sand dune with severe desertification. The ecology is fragile. The outbound distance is somewhat large since there is scarce material along the line.

Therefore, from both aspects of engineering geological conditions and environmental impact, the recommended line is the best option.

Table 9-5 Comparisons between Positive Line and Option D Line

Item		Positive Line	Option D Line
Engineering	Mileage□Km□	169.4	170.28
	Geographical position	Located on the north side of the Hailar Rive	Located on the south side of the Hailar Rive

ng compariso n	Engineering Geology		Having sufficient construction materials along the line, with short transportation distance; Better geological conditions than the Option C Line	The construction materials being insufficient andthe import distance bei-ng long
	Occupied land (ha)		50.80	32.28
	Roadbed earthwork	Earthwork(Km^3)	482.17	191.36
		Stonework(Km^3)	84.32	-
	Water drainage conservation（Km^3）		24.12	16.35
	Pavement（Km^2）		302.15	183.95
	Big-sized bridge （m/bridge）		-	-
	Middle-sized bridge（m/bridge）		86.5/1	-
	Small-sized bridge （m/bridge）		-	-
	Culvert（m/Set）		10	2
	Separation cross（Set）		-	-
	Pathway（Set）		1	-
Economic comparison			Bringing along economic dev-elopment of the cities and towns along the line; Supported by local governme-nt	Having only some small railway stations along the line, not able to bring along economic dev-elopment as the PositiveLine;Not supported by local government.
Environmental comparison			Part of the old Highway 301 can be used and the environmental conditions are better than Option D Line.	About 120km of the e-ntire line having sandy landform, with fragile ecology; If Option D Line is implemented, the vegetations will be destroyed severely and the desertification

		will become tenser.
Recommendation	Recommended	

9.2.5 Manzhouli bypass section (Option E Line)

The recommended line goes through the north of Manzhouli City, deviates from the old line at 4km to the east of Manzhouli City, passes by the north side of the Oxidization Pond, and links with Manzhouli Port Road by level cross. The Option E Line goes along State Highway 301, and passing through the downtown of Manzhouli.

Option E Line and the recommended line are both located in the hilly areas and the mountain front slopes. They have similar engineering geology, mainly with andesite and reduced stone soil.

In comparison of the cost of investment, Option E Line can save about 55 million RMB than Positive Line.

Option E Line is 1.16km shorter than Positive Line and can use the old Highway 301. But many sections have turned into urban streets along the line, with great transverse disturbance. Therefore, Positive Line is recommended after comparison.

Table 9-6 Comparisons between Positive Line and Option E Line

Item		Positive Line	Option E Line
Engineering comparison	Mileage (km)	13.75	12.59
	Occupied land (ha)	73.33	56.66
	Roadbed earthwork(m^3)	657376	158971
	Water drainage conservation(m^3)	12846.55	18573.69
	Pavement (m^2)	287469	197236
	Middle-sized bridge (m/bridge)	69.5/1	

	Culvert (Set)	15	15
	Pathway and passenger overpass (Set)	1	
Economic comparison		Estimated cost is 144.203 million RMB	Estimated cost is 88.979 million RMB
Environmental comparison		New highway without transverse disturbance	Fully utilizing existing State Hi-ghway 301,Many sectionshaving turned into urban streets alo-ng the line, with great transver-se disturbance.
Recommendation		Recommended	

9.2.6 The Feasibility of utilizing old State Highway 301

Most of sections from the starting pint to Cuogangyakou of Hailar-Manzhouli Highway will utilize old State Highway 301 or basically be in the same line of strike as the original highway.

The recommended Positive Line disports with old Highway 301 at Cuogangyakou section, and goes straight to the west. Option C Line partly utilizes old Highway 301, deviates the old road at 6.8km to the east of Zalainuoer Railway Station, and goes through Erka Wetland to the north of the Mineral Area. Both the Positive Line and Option C Line avoid Zalainuoer Mineral Area. The following reasons determine that the highway line cannot go through Zalainuoer Mineral Area along the old road:

(1) Poor underground conditions of old Highway 301
The mine of Zalainuoer Mineral Area was built in 1902. Currently, the subsidence zone of the area is big, and the subsidence zone is even moving downward. In the scope of Zalainuoer Mineral Area, the old Highway 301 spans, from west to east, the boundary of 4 mines respectively in Beixie Mine, Tiebei Mine, Lingdong Plan Area and Tienan Plan Area.

According to *Report on the Loss from Coal Mine Subsidence in Zalainuoer Mineral Area*, the old Highway 301 passes through North Subsidence Zone and Tiebei Subsidence Zone. In North Subsidence Zone was caused by exploitation at Beixie Mine Fields of Xishan Mine, with maximum subsidence 5.9m, maximum level move 1.4m, maximum sloping distortion 73.6mm/m, maximum level distortion 28.4 mm/m and -26.1 mm/m. In Tiebei Subsidence Zone, the maximum subsidence is 3.0m, maximum level move 0.6m, maximum sloping distortion 28.5 mm/m, and maximum level distortion 10.8 mm/m and -10.3 mm/m. The geological condition in the Mineral

Area section is complex. The geological conditions of old Highway 301 at Zalainuoer Mineral Area section cannot guarantee the passing of First Grade Highway. The distribution of coal mining and subsidence zones at Zalainuoer Mineral Area is illustrated in Figure 9-2.

Table 9-7 Coal Mining at Zalainuoer Mineral Area and the Status of Old Highway 301

Section	Coal mining	Impact on highway	Measures to adopt
500m to the east of Qianshao Intersection TO Dalan'eluomu Square area	Beixie Mine gob, adopting hydraulic silting and roof control	Small subsidence	
Dalan'eluomu Square TO 800m to the east of the Square	Beixie Mine stoping area lying on the north side, adopting caving roof control	Having relatively serious impact on surface moving and distortion, with big subsidence	Keeping protective coal wedge, controlling the impact boundary of surface moving and distortion at 1m to the foot of levee slope of highway (Beixie Mine once submerged by floods in 1998)
3km to the west of the Xinkai River TO the Xinkai River	Tiebei Mine area, adopting caving roof control	Having relatively serious impact on surface moving and distortion, with big subsidence	Keeping protective coal wedge, controlling the impact boundary of surface moving and distortion at 1m to the foot of levee slope of highway
To the east of the Xinkai River	Under planning, not explored yet		Keeping protective coal wedge

(2) Insufficient space for highway land use

The existing Hailar-Manzhouli Highway was built on natural roads on the grassland. It was expanded according to Grade 3 highway criteria in 1994. To the nouth side of it lies the water transmission pipeline of the second water source of Manzhouli in the section of Zhalainuoer Mineral Area. The pipeline is about 10m to the highway slope base at the nearest distance. The Binzhou Railway is on the sorth side of the highway. The space between old Highway 301 and Binzhou is reserved for the expanding construction of complex line of Binzhou Railway. The proposed highway is of Grade

1, with 24m-width pavement, and the current pavement width cannot meet with the land use width requirement of Grade 1 Highway.

9.2.7 Comparison of Construction Project with "No Construction Option"

The necessity of projection construction is as follows:

a. The proposed project is one part of the plan of "Five North-South Lines and Seven West-East Lines" of China's state highways, as well as the important component of the first west-east line of Inner Mongolia's plan for "Three West-East Lines, Nine North-South Lines and Twelve Exits". It is also the main passage connecting Hulunbeier City and other provinces and regions in the east of China. The construction of the project is necessary for the improvement of the state trunk highway system and adaptation to the state strategy of Great Western Development.
b. Manzhouli is China's biggest land route port. The proposed project will directly connect with Manzhouli Port, and link current highways and highways under construction in Hulunbeier and three provinces in Northeast China to form a highway (or express) network. This will promote port development, flourish border trading, and facilitate formation of international great land passage in northeast Asia.
c. Hulunbeier has rich tourism resources. The proposed project will bring about the development of tourism and local economy.
d. The current highway is of Grade 3, and has been seriously harmed duo to multiyear operation and destruction of natural disasters. The implementation of this project will enhance the grade of the highway, and thus meet the increasing need of regional traffic flow.

The implementation of this project will have some social environmental, water environmental, ambient air, noise environmental, and eco-environmental impacts in the Construction and Operation Periods, which have been discussed in previous chapters. The implementation of this project will attract traffics from highways in surrounding areas. This additional traffic flow has been considered in the Feasibility Report.

"No Construction Option" means no implementation of rebuilding and expanding construction of Hailar – Manzhouli Highway. Compared with the Construction Project Option, this option will not have environmental impact problems in the short term. But in the long term, with the growth of traffic flow, the section may become the "bottleneck" of the state trunk highway. The increasing of traffic flow and the deterioration of disease of original highway will lead to more traffic accidents and more human harms and economic loss. Also, the traffic jam will cause air and noise

pollution on the environment in some sections.

Therefore, the Construction Project Option is better than “No Construction Option”.

Table 9-8 Comparisons of Construction Project and “No Construction Option”

Item	Construction project	No Construction Option
Engineering comparison	Rebuilding Grade 1 highway, with total length 189.718km, big-sized bridges 1326m/4 bridges, middle-sized bridges 525.5m/7 bridges, small-sized bridges 352m/18bridges.	-
Economic comparison	It costs 2.1345 billion RMB (1) Improving state highway system; (2) Promoting port development, flourishing border trade economy; (3) Developing tourism and local economy; (4) Improving traffic conditions.	Nothing
Environmental comparison	(1) Acquisition of new lands, occupation of grassland and wetland; (2) Social, water environmental, ambient air, noise environmental, and eco-environmental impacts in the Construction Period; (3) Attracting nearby traffics, having ambient air, noise environmental, and eco-environmental impacts in the Operation Period.	(1) Keeping current status, with no more environmental impacts in the short term.; (2) Affecting the integral level of state highway and possibly leading to “bottle-neck” (3) Original highway unable to meet with traffic requirements, constraining economic development in the long term; (4) Increased traffic accidents, leading to human harms and economic loss; (5) Traffic jam causing waste gas and noise pollution problems.
Recommendation	Recommended	

9.3 Conclusion of Alternative Analysis

Comprehensively comparing the engineering, economic and environmental aspects, this EIA suggested adoption of the Positive Line option, which is in consistence with the Feasibility Study.

Chapter 10 Public Consultation

As one of the important infrastructure constructions, the highway construction plays an important role in the society, economy and people's life. While bringing social and economic profits, it may result in some disadvantageous impacts on local resident life and ecological environment. In order to widely collect the opinions of the local cadres and masses against the highways to be constructed and gather the public concerning on building highway, the public opinions along the highway line to be built were investigated simultaneously with the environmental investigation along the line.

10.1 Investigation Scope, Contents and Methods

10.1.1 Investigation scope and object

The investigation scope mainly included those towns and villages located on the both sides of the highway to be constructed and directly impacted. The investigation objects included representatives of the task parties (such as responsible persons of town and village governments, affair offices, village committees, or resident committees), common masses (including farmers, herdsmen, parcel residents, etc.), and masses to be directly influenced by the highway (including dismantling and moving households) in order to make the investigation results more accurate.

10.1.2 Investigation contents

In the investigation, the following contents were collected:

(1) The investigation objects' concerning on the highway to be constructed;
(2) The investigation objects' concrete requirements and opinions against the line routes and design; and
(3) The local social and economic status, human and cultural features including folk customs.

10.1.3 Investigation methods

The investigation was performed mainly in the forms of holding meetings and providing questionnaires for the public consultation.

(1) Public Consultation Investigation Meeting

On the phases of the EIA TOR and EIA Report, the public consultation investigation meetings were held in Hailar, West Wuzhuer, and Manzhouli Cities, respectively. The meeting communiqués were published on the local newspapers and the EIA TOR or EIA Report was provided for public review in advance a week before the meetings.

(2) Public Consultation Questionnaire

First, the main issues of the highway construction project were introduced to the investigation objects, including basic background, project scale, line route, advantageous and disadvantageous impacts on the localities. Then, the investigation objects filled up the questionnaires or presented oral opinions voluntarily. Finally, the summary and analysis were performed after sorting out and submitting. The format of the public consultation investigation questionnaire is given in Table 10-1.

Table 10-1 The Public Consultation Investigation Questionnaire for Environmental Impacts of the Highway from Hailar to Manzhouli

Project Title		Hailar-Manzhouli Section of Shuifenhe-Manzhouli Highway						
Construction Site		Hailar-Manzhouli Section				Investigation date		
Investigation Type		Public Consultation			Inquirer			
Inquiree	Name		Sex		Age		Nationality	
	Education Level				Title		Position	
	Work Unit or Address							
Investigation Records								
Do you agree with the highway construction?		Yes		No		I do not know.		
Do you agree with the highway route scheme?		Yes		No		I do not know.		
Is the project favorable to the local economic development?		Yes		No		I do not know.		
Is the project favorable to the living quality improvement?		Yes		No		I do not know.		
Do you know the highway construction policies and the compensation policies for dismantle and move?		Yes		some		No		

Because of the highway construction it is demanded to occupy some of grasslands and farmlands and to dismantle and move some buildings. Do you have any objection to it?	Yes	No	I do not know.	
Do you obey the land-acquisition, dismantling and moving, and resettlement?	Yes	Yes, under some conditions	No	
In what way does the highway project mostly impact on you?	Noise	Vehicle exhaust gas	Flying dust	
Can you accept the environmental impact during the expected construction period?	Yes	Hardly	Do not care	
What measure do you suggest to reduce the environmental impact?	Highway greening	Sound barrier	keeping distance from the villages	
Any other comments and suggestions:				

10.2 Investigation Results

10.2.1 Public consultation investigation meeting

(1) Introduction to Public Consultation Investigation Meeting on the Phase of EIA TOR

The press communiqués of the public consultation investigation meetings were published on the “Hulunbeier Daily” and “Manzhouli Newspaper” on September 24, 2003, respectively. The public consultation investigation meetings were held in Hailar District, West Wuzhuer, and Manzhouli on September 29 and 30, respectively. There were 24, 15, and 18 people to attend the meetings in Hailar District, West Wuzhuer, and Manzhouli, respectively. The ages, educational levels, and nationalities of the public meeting attendances are given in Table 10-2.

Table 10-2 The Statistics of Participants at the Public Consultation Investigation Meetings

	Age	Educational Level	Nationality

Catalog	18-35	36-60	61 and up	Below Senior High	Senior or Vocational High	Vocational College	College	Han	Mongolian	Man
Number	26	30	1	2	14	28	13	37	17	3
Percentage (%)	45.6	52.6	1.8	3.5	24.5	49.1	22.6	64.9	29.8	5.3

(2) Introduction to Public Consultation Investigation Meeting on the Phase of EIA Report

The press communiqués of the public consultation investigation meetings were published on the “Hulunbeier Daily” of November 6, 2003 and “Manzhouli Newspaper” of November 10, 2003, respectively. The public consultation investigation meetings were held in Hailar District, West Wuzhuer, and Manzhouli on November 17 and 18, respectively. There were 28, 16, and 19 people to attend the meetings in Hailar District, West Wuzhuer, and Manzhouli, respectively. The ages, educational levels, and nationalities of the public meeting attendances are given in Table 10-3.

Table 10-3 The Statistics of Participants at the Public Consultation Investigation Meetings

Catalog	Age			Educational Level				Nationality		
	18-35	36-60	61 and Up	Below Senior High	Senior or vocational High	Vocational College	College	Han	Mongolian	Man
Number	25	36	2	3	24	25	11	40	19	4
Percentage (%)	39.7	57.1	3.2	4.8	38.1	39.7	17.4	63.5	30.2	6.3

(3) The Issues from The Public Consultation Investigation Meetings

The issues from two public consultation investigation meetings are addressed below:

a. There are the local herdsman mostly on the left side of the line and the grassland on the right side. It is expected to reserve the pathways for cows and sheep and grass-threshing cars.
b. Because there are many cows and sheep to go to the places where there are water resources along the line, it is suggested to reserve the pathways for them to avoid traffic accidents.
c. Because it is often strong raining in summer season and road surface is covered by water after raining, it is suggested reserve enough culverts.
d. Because the grasslands may be destroyed severely during the construction period, it is suggested to control land range occupied by the construction and to level the lands and sow grass seeds after the construction.
e. To protect the grassland tourism resources, it is suggested that the waste earth yards should not be allocated within the fields of vision along the line and should be allocated on the mountain rear, and that soil should be extracted as level as possibly and, then, the recovery measures(Refer to Table6-4) must be taken and grass mast be planted.
f. To protect the wetlands, it is suggested not to allocate the level crosses at the wetland areas to prevent vehicles from going down the line.
g. The costs for environmental protection (land-leveling, grass-planting and recovery, and pavement- and passenger-overpass-bridge-cleaning after the construction, etc.) should be included in the project budget.
h. Because of strong snow in winter season, it should be considered in the design to avoid snow remaining on the road surface.
i. It is suggested that some of small culverts are replaced by the plate-covering or big ones to facilitate herdsmen' traveling.
j. For herdsmen' dismantling and moving due to the highway construction, they would agree to do that if the houses are rebuilt.

They hope that the project can be implemented as soon as possible to improve the local traffic situation and promote the local economy.

The above issues were forwarded to the highway design institution. And the design institution will consider the public suggestions and carry on the associated adjustments on the original design phase. The number of culverts is increased form 104 in original design to 110, and the pathways and passenger overpasses from 30 to 47.

The associated solution suggestions against the concrete issues proposed by the public are described in the Chapter 8 on the environmental protection measurements of the report.

10.2.2 The Public Consultation Questionnaire

The two hundred questionnaires were distributed to people of the diverse social levels along the highway line. Their ages, educational levels, and nationalities are given in Table 10-4.

Table 10-4 Age Range, Educational Level, and Nationality of the People Surveyed

	Age			Educational Level				Nationality		
	18-35	36-60	61 and up	Elementary and down	Junior High	Senior High	Vocational College and up	Han	Mongolian	Others*
Number	38	149	13	9	32	84	75	122	61	17
Percentage (%)	19	74.5	6.5	4.5	16	42	37.5	61	30.5	8.5

Note: *including Man 6, Erwenke 6, Hui 3, and Korean 2.

Table 10-5 Public View on Environmental Impacts of the Highway Construction

No.	Issue	Answer Selection	Number	Percentage
1	Do you agree with the highway construction?	Yes	78	100
		No	0	0
		Do not know	0	0
2	Do you agree with the line Scheme of the highway?	Yes	78	100
		No	0	0
		Do not know	0	0
3	Is the highway construction favorable to the local economic development?	Yes	78	100
		No	0	0
		Do not know	0	0
4	Is the project favorable to the living quality improvement?	Yes	78	100
		No	0	0
		Do not know	0	0

5	Do you know the highway construction policies and the compensation policies for dismantle and move?	Yes	6	7.7
		Some	38	48.7
		No	34	43.6
6	Because of the highway construction it is demanded to occupy some of grassland and farmland and to dismantle and move some buildings. Do you have any objection to it?	Yes	34	43.6
		No	38	48.7
		Do not know	6	7.7
7	Do you obey the land-acquisition, dismantling and moving, and resettlement?	Yes	10	12.8
		Yes under some conditions	68	87.2
		No	0	0
8	In what way does the highway project mostly impact on you?	Noise	42	53.8
		Vehicle exhaust gas	20	25.6
		Resuspended dust	16	20.5
9	Can you accept the environmental impact during the expected construction period?	Yes	66	84.6
		Hardly	2	2.6
		Do not care	10	12.8
10	What measure do you suggest to reduce the environmental impact?	Highway greening	54	69.2
		Sound barrier	0	0
		keeping distance from the villages	24	30.8

From the table it may be seen that all of the people surveyed agreed with the highway construction project and line scheme, and thought the highway would be favorable to the local economic development and the living quality improvement; 7.7% of the inquirees knew the highway construction policies and the compensation policies for dismantle and move, 48.7% knew some, and 43.6% did not know; for occupying some of grassland and farmland and dismantling and moving some buildings because of the highway construction, 43.6% of the inquirees had objection, 48.7% did not

have, and 7.7% did not know; for the land-imposing, dismantling and moving, and resettlement, 12.8% of the inquirees obeyed that and 87.2% obeyed under some conditions; among the noise, vehicle exhaust gas and resuspended dust, 53.8% of the inquirees considered there is big noise impacted by the highway construction; for the environmental impact during the expected construction period, 84.6% of the inquirees would accept that, 12.8% did not care, and 2.6% hardly accepted; among the three measures to reduce the environmental impact, i.e. highway greening, sound barrier, and keeping distance from the villages, 69.2% of the inquirees selected the highway greening.

For the other comments and suggestions, 21 persons, 10.5% of the total inquirees, proposed some suggestions that piling earth matrixes should be done on sites, grasslands should be occupied as less as possible, grassland ecological protection should be emphasized, and pollution from traffic roads should be reduced.

10.3 Summary

(1) Through the public consultation investigation, the project significances and potential disadvantageous impacts and protection measures to be adapted were understood by the residents of the towns and villages which are located on the both sides of the highway line to be constructed; the public opinions and suggestions against the project were collected and forwarded to the design and operation management institutions simultaneously to ensure to be implemented.

(2) The project was supported and understood by the residents along the highway line. The public surveyed considered that the highway construction would be favorable to the local economic development and the living quality improvement.

CHAPTER 11 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM AND ENVIRONMENTAL PROTECTION INSTITUTIONS

11.1 Environmental Protection Program

11.1.1 Preparatory Period

(1) Feasibility Study Phase

The environmental protection program of the proposed highway in the Feasibility Study Phase, which is in progress, is shown in Table 11-1.

Table 11-1 Environmental Protection Program of Proposed Highway in the Feasibility Study Phase

Content	Implementation	Administration	Responsible and supervisory authorities	Implementation time
Engineering Feasibility Study	Chinese Highway Engineering Consulting and Supervision Company (CHECSC)	Inner Mongolia Communication Department	Ministry of Communication (MOC); State Planning and Development Commission (SPDC)	May, 2001 -- Dec.,2003
EIA	Chinese Research Academy of Environmental Sciences (CRAES)	Inner Mongolia Communication Department	State Environmental Protection Administration (SEPA); Environmental Protection Office of MOC; Inner Mongolia EPB	April, 2002 -- Feb., 2004

(2) Design Phase

Environmental protection program in the Design Phase is shown in Table 11-2. All the environmental protection requirements in the table have been (or will be) put into

effect in design.

Table 11-2 Environmental Protection Program of Proposed Highway in the Design Phase

Design content	Environmental protection requirements	Implementation	Administration	Implementation time
Horizontal design	(1) Keeping away from major environmental sensitive sites. (2) Less occupied grasslands, doing the best to protect grasslands.	CHECSC	Inner Mongolia Communi-cation Department	2002 -2004
Longitudinal design	(3) The project should coordinate with the Overall Development Plans of Hailar District, Chen Qi, and Manzhouli City along the line. (4) The line should keep away from Huhenuoer Lake Tourism and Resort Zone. (5) Reducing borrow, and protecting vegetation.			
Bridges and culverts engineering	(6) Protecting irrigation works. (7) Preventing runoff from being obstructed, to keep surface water unblocked. (8) Preventing flood disasters.			
Pathway and overline facilities	(9) Preventing obstruction to facilitate production and travel of herdsmen.			
Roadbed protection works	(10) Preventing soil erosion			
Highway drainage works	(11) Preventing soil erosion			
Borrow, waste yard design	(12) Easy to transport, reducing the impact on local roads. (13) Borrow and waste yards occupying as less high-coverage grasslands as possible, waste yards selected in mountain area.			
Water conservation engineering	(14) Roadbed protection, preventing water and soil losses. (15) Compensating vegetation loss.	Water conservation unit; Environmental protection design unit		
Soil and vegetation restoration	(16) Vegetation is restored, which is destructed by construction (17) Reclamation or growing grass for the land (including temporary land use, borrow yard, construction camps, etc.) occupied in construction period			

Greening engineering inside highway	(18) Protecting roadbed, preventing soil erosion (19) Compensating vegetation loss (20) Highway sight, side slope greening, central space greening of crossroads			
Service areas, management agencies and toll gates	(21) Setting septic tank and deposition tank, discharge of sewage and waste water reaching the standard. (22) Collecting solid waste and cleaning up regularly.			

11.1.2 Construction Period

Environmental protection program of proposed highway in the Construction Period is shown in Table 11-3. The environmental protection facilities in the table will be placed to bidding documents and contracts, etc., which will be implemented in construction and will be considered in final project examination as one of the assessment indicators.

Table11-3 Environmental Protection Program of Proposed Highway in the Construction Period (2005 ~2007)

Environmental problems	Environmental protection measures	Executive agency	Administration	Note
Environmental protection for construction	(1) Environmental protection design in th Construction Period (finished with drawing design simultaneously)	Contractors	Highway Bureau, Inner Mongolia Communi-cation Department Hulunbeier Communi-cation Bureau Chief Supervision Engineer Office	At least 1 supervision engineer takes charge of putting environ-mental protection into effect for each bidding lot.
Cultural relics protection	(2) No county-level or up cultural relics in the assessment area found. But once any cultural relic is found, construction must be stopped immediately, for cultural relic departments to excavated and clean up. The highway construction will be continued when approved by cultural relic departments. It is requested that the items related to cultural relic protection and normative operation have to be involved in the bidding documents for each section, which should also be involved in supervision bidding documents.			
Land resources	(3) The temporary land use (including construction pavement, material yard, construction camps, etc.) should not occupy high-quality grasslands as far as possible. If high-quality grasslands are used, cleaning and land improvement should be done once the construction finished. (4) Construction vehicles will run on designated roads.			
Water environment	(5) Sewage from construction camps is treated to reach discharge standard. (6) Preventing oil and chemicals, etc. from discharging into waters during bridge construction. It is not permitted to thrown away excavated slime sludge to waters or wetlands. (7) Building materials containing hazardous materials, such as bitumen and chemicals, are not permitted to stack near the waters and wetlands, and should adopt effective measurements to prevent rainfall washing.			

Ambient air	(8) Preventing resuspended dust in construction sites: watering at construction highway sections, lime soil mixing site, and major transportation pathways. Keeping material yards and mixing sites at least 200m far away from sensitive sites. (9) Powder materials should be sacked or packed. loose packed is prohibited, and stacked materials should be covered. Only wet fly ash is permitted to transport. (10) When sand, stone, earth, etc. are loaded to trucks, the loading height can not excess the height of truck's side board, with spilling strictly prohibited. (11) Bitumen mixing should adopt close-type equipments, bitumen-mixing sites are at least 200m far away from sensitive sites, and the sites should be located at the down wind of sensitive sites. The bitumen mixing sites are forbidden around K404+300, K409+700, K493+400, K526-K531+500, K505+500, K557+800, and K540+000-K553+200.			
Noise environment	(12) Construction hours are limited. Strong noise construction should be stopped from 22:00pm to 6:00am around Haotetaohai, Fifth team, West Wuzhuer, Yihe, Mineral Area Hospital, Erka Wetland, and Benpo Lake. (13) Material sites, mixing sites, bitumen mixing stations are at least 200m far away from sensitive sites.			
Solid waste	(14) Setting up garbage cans, and regularly clearing or treating/disposing after collecting (one place for each bidding lot). (15) Construction wastes and construction refuses, etc. can not be dumped to near the waters and wetland, and should be cleared or treated according to related rules.			

Ecology environmental	(16) The borrow depth in borrow yard (ground height) can not be lower than underground water level to facilitate vegetation rehabilitation. (17) Temporary land use, such as construction pathway and mixing sites, etc. has to be cleared, leveled and restored with vegetation once construction finished. (18) The construction vehicle driveway should be controlled, and various pollutants treated properly. The dissemination, training and supervision for construction workers should be strengthened. (19) Protecting wild animals and plants, and prohibiting hunting.			
Wetland	(20) Reducing temporary land use as much as possible. (21) Construction pathways and temporary bridges should be cleaned up in time after construction finished. (22) Prohibiting set-up of construction camps, mixing stations, etc. (23) Treating various wastes properly. (24) Environmental supervision is carried out by supervision engineer.			
Safety	(25) Construction vehicles should be stopped or reduced in the rush hour of local roads to reduce traffic jam and prevent traffic accidents. (26) Safety staff, safety label and caution lights should be set up in construction site.			
Existing Traffic	(27) Temporary access roads can be constructed when existing local roads are obstructed by the construction. (28) Local roads damaged in the Construction Period should be repaired by contractors. The contractors can also offer make compensation to local governments for the latter to repair in time after the construction finishes. (29) Covering the vehicles, and prohibiting dropping of materials and polluting of local roads along the line.			

Road facility	(30)Wastewater treatment facility should be set for the effluent from office, motel, restaurant and gas station. (31) Emergency facility also should be adopted. (32) Solid waste should be collected by classifications, and disposed by sanitation department.			

11.1.3 Operation Period

Environmental protection program of the proposed highway in the Operation Period is shown in Table 11-4. The environmental protection facilities in the table will be the base of compiling environmental protection program in the Operation Period and will be implemented.

Table11-4 Environmental Protection Program in the Operation Period for Proposed Hailar-Manzhouli Highway

Environmental protection work	Main content	Executive agency	Administration	Implementation time
Environmental management	(1) Daily environmental management. (2) Maintenance of environmental protection facilities.	Inner Mongolia Highway Bureau; Contractors	Environmental Protection Office, MOC; Inner Mongolia EPB; Hulunbeier EPB	2008 –2030
Water environment Environmental Hygiene	(3) Treatment of sewage from service areas. (4) Treatment of sewage from divisions and toll gates; septic tank and its treatment. (5) Cleaning up of solidwaste, garbage from garbage cans or cesspits in the service areas, divisions, and toll gates.			Completed before 2008 2008-2030 in normal operation
Air	(6) The emission of dedustors of heating boilers in service areas reaches the standard.			2008 –2030
Soil erosion; Road looks and landscape	(7) Greening maintenance inside the highway. (8) Maintenance of greening around overpass.			
Soil and water conservation	(9) Improvement of temporary land use in the Construction Period, and vegetation rehabilitation for landscape greening. (10) Improvements of borrow yard, and rehabilitation of vegetation.			
Land Use Management	(11)Supervise the developing activities at related area	Inner Mongolia Highway Bureau	Hulunbeier Municipal Goverment	2008-

11.2 Environmental Monitoring Program

In the 3- years-long constuction period and the first 3-years-long operation period, special environmental monitoring work should be carried out.

11.2.1 Environmental Monitoring Program in Construction Period

Environmental monitoring sensitive sites, items and factors, frequency and implementation organization, etc. are shown in Table11-5. And figure 11-1 shows the monitoring points planned.

Table11-5 Environmental Monitoring Program in Construction Period(2005-2007)

Monitoring site	Monitoring items				Note
	Surface water	Ambient air	Noise	Ecology	
Haotetaohai		□	□		(1)Inner Mongolia Communication Department. (2)The monitoring results are submitted annually to Environmental Protection Office and the construction unit.
Haotetaohai Fifth team			□		
West Wuzhuer		□	□		
Yihe			□		
Mineral Area Hospital			□		
Erka Wetland	□	□	□	□	
The Hailar River	□				
The Xinkai River	□				
Earth Borrow Yard				□	
Temporary land use				□	
Requirements for monitoring indicators and frequency	(1) Surface water: COD, PH, SS, oil, 1time/2months and 1 day per time in the Construction Period of bridges. Background value should be measured one month before construction period.				
	(2) Ambient air: TSP; 1 time/2 months, 1 continuous day monitoring per time.				
	(3) Noise: construction noise, 1day for every month, 2~3 times for each day. Random monitoring is available.				

	(4) Ecology: Erka Wetland indicators -- plant community (community height, community coverage, community biomass), animal monitoring, soil monitoring (pH□organic matter, heavy metal), insect pest monitoring. Borrow yard and temporary land use indicators -- plant community and soil monitoring. Before the start of construction, the background monitoring is performed (July and August), and during the construction, the monitoring is performed once a year. In the ecological monitoring, local environmental experts will be invited to join the ecological survey. The ecological quality will be independently published, and once the problems are found, emergency measures can be adopted timely.	

Note:"□" means the factors should be monitored (same below).

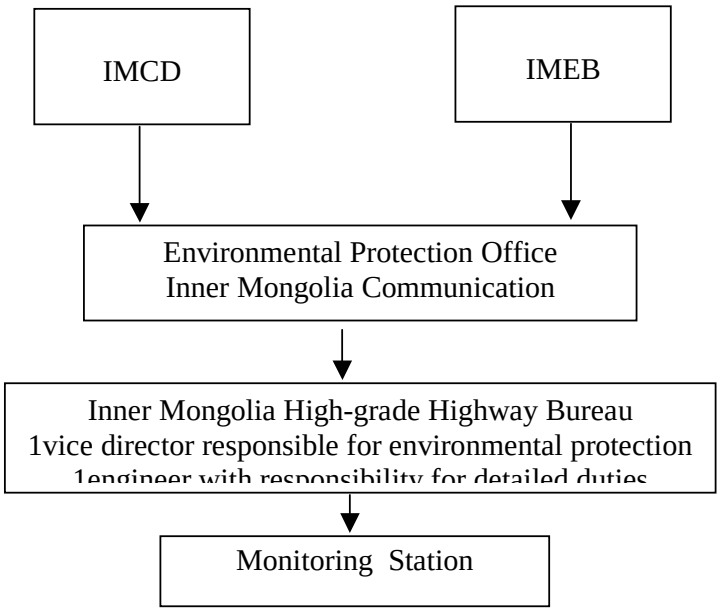


Figure 11-2 Chart for monitoring

11.2.2 Environmental Monitoring Program in Operation Period

Environmental monitoring sites, items and factors, frequency and implementation organization, etc. are shown in Table11-6.

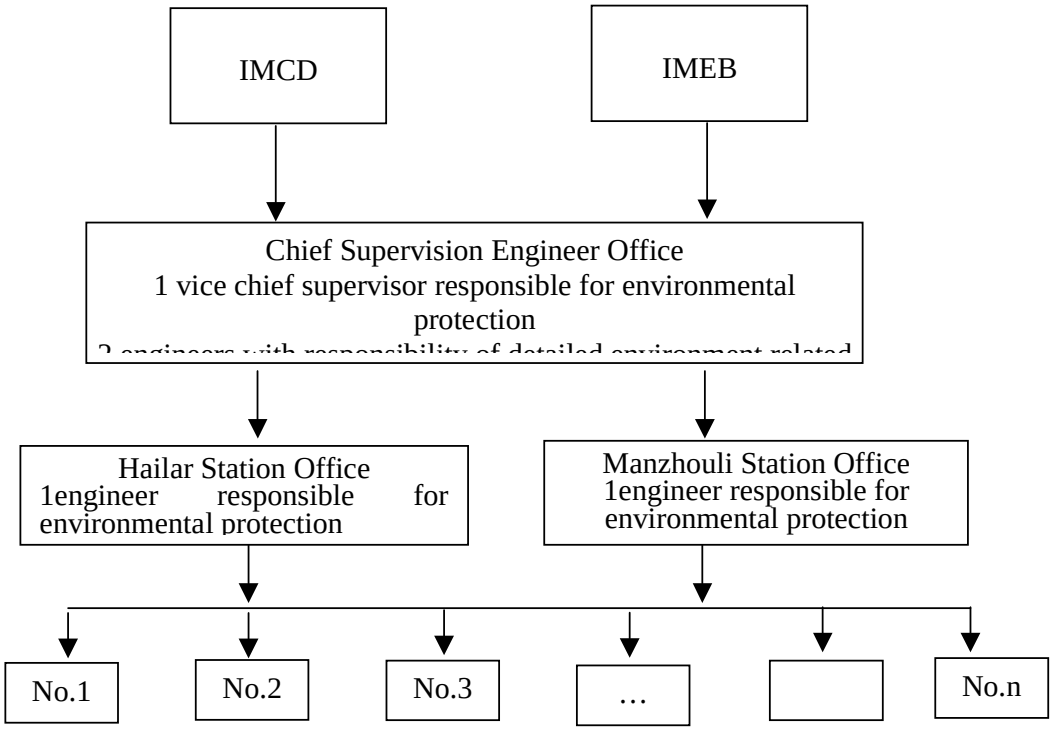
Table11-6 Environmental Monitoring Program in Operation Period (2008-2010)

Monitoring site	Monitoring item				Note
	Surface water	Ambient air	Noise	Ecology	
Haotetaohai		□	□		(1)Inner Mongolia Communication Department (2)The monitoring results are submitted annually to Environmental Protection Office.
Haotetaohai Fifth team			□		
West Wuzhuer		□	□		
Yihe			□		
Mineral Area Hospital			□		
Erka Wetland	□	□	□	□	
The Hailar River	□				
The Xinkai River	□				
Earth Borrow Yard				□	
Temporary land use				□	
Requirements for monitoring index and frequency	(1) Surface water: COD, PH, SS, oil, 1time per year, 1 day for each time. (2) Ambient air: TSP; 1 time per year, 1day for each time. (3) Noise: 1 time per year, 1day for each time, 1~2 times both in daytime and night. (4) Ecology: Erka Wetland -- plant community (community height, community coverage, community biomass), animal monitoring, soil monitoring (pH, organic matter, heavy metal), insect pest monitoring. Borrow yard and temporary land use -- plant community, soil monitoring. In the Operation Period, the monitoring is performed once a year. In the ecological monitoring, local environmental experts will be invited to join the ecological survey. The ecological quality will be independently published, and once the problems are found, emergency measures can be adopted timely.				

11.3 Environmental Protection Institutions and Personnel Training

11.3.1 Environmental Protection Institutions and the Functions in the Construction Period

The structure of environmental protection institutions in the Construction Period is shown in Figure 11-3



Note: One supervision team should be set up for each bidding lot, in which a supervision engineer is responsible for environmental supervision

Figure 11-3 Framework of Environmental Management Institutions in the Construction Period

The major functions of institutions in the Figure 11-3 are as follows:

(1) Chief Supervision Engineer Office: A vice chief supervisor is responsible for environmental protection decision related to Hailar - Manzhouli Highway in the Construction Period; Two engineers are responsible for environmental protection supervision, implementation organization, and summarization of monitoring data and related materials respectively for Hailar and Manzhouli sections. This office is directly accountable to Inner Mongolia Communication Department and Environmental Protection Office.

(2) The Highway Station Offices from Hailar to Manzhouli: An engineer will guide and take charge of environmental supervision, and environmental monitoring for each bidding lot, and directly deals with environmental protection affairs related to construction.

(3) Bidding lots: A supervision engineer will take charge of total construction process environmental supervision to ensure that the environmental measurements in the construction bidding documents will be implemented.

(4) IMCD and IMEB are responsible for the supervision of Chief Engineer office. IMCD is also in charge of the organizition of the Office.

11.3.2 Environmental Protection Institutions and the Functions in the Operation Period

The structure of environmental protection institutions in the Operation Period is shown in Figure 11-4

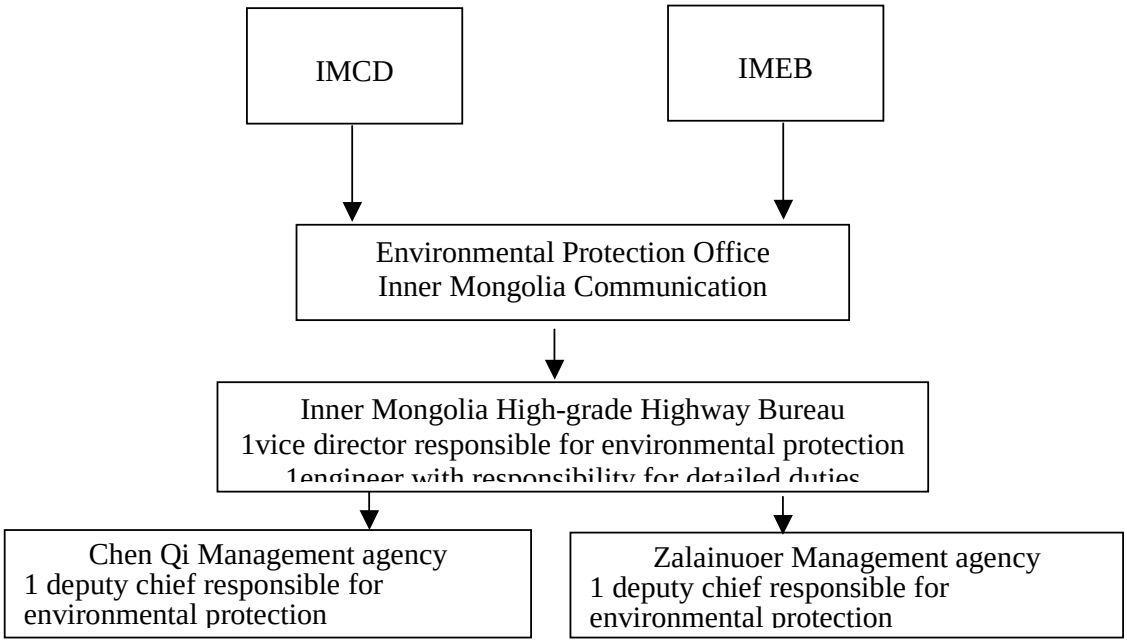


Figure 11-4 Framework of Environmental Management Institutions in Operation Period

The major functions of institutions in the Figure 11-4 are as follows:

(1) Environmental Protection Office, Inner Mongolia Communication Department: responsible for environmental protection management of highways in the autonomous area (including Hailar-Manzhouli Highway), setting up annual monitoring schedule and environmental protection measurement program, and formulating regulations and rules related to environmental protection of highway, etc.

(2) Inner Mongolia High-grade Highway Bureau: 1 vice director takes charge of high-grade highway (including Hailar-Manzhouli Highway), there are two sub-branches, Chen Qi

Management Agency and Zalainuoer Management Agency, for Hailar-Manzhouli Highway. One deputy chief of each agency directly takes charge of implementation of environmental protection program in operation period and assists Environmental Protection Office to carry out regular environmental monitoring.

11.3.3 Personnel Training Program

The staff who takes charge of environmental protection in Inner Mongolia Communication Department and related bureaus should be training based on the requirements and rules of national environmental management. Personnel training program for proposed Hailar-Manzhouli Highway is shown in Table 11-7. The staff, mentioned in the table, related to environmental management should have some professional environmental protection knowledge.

Table11-7 Personnel Training Program for Proposed Hailar-Manzhouli Highway

Classification	Trainee	Amount (person)	Duration	Cost (10,000 RMB)	Content
High-level study tour	(1) Staff in charge of environmental protection, Chief Supervision Engineer Office, and Environmental Protection Office of Communication Department, and highway companies	1-2	15days	20	(1) To study environmental protection management, regulations and standards related to highway at home or abroad (2) To study new technology and its development trends related to highway environmental protection
	(2) Directors, chiefs, managers related to environmental management, environmental supervision	2-3			
Environmental protection knowledge or environmental monitoring training	(1) Staff related to environmental supervision in the Construction Period (2) Contractors	15-20	30days	30	To study environmental supervision regulations and techniques; environmental

training workshop	(3) Staff from High-grade Highway Bureau	20			environmental monitoring regulations and techniques; environmental management regulations; environmental protection techniques, etc.
Total				50	

Note: The training should be arranged before the Construction Period.

11.4Implementation of Environmental Measures

In order to guarantee the smooth implementation of various environmental protection measures, in the Project Preparatory Period and Construction Period, the following measures should be considered:

a) The EIA reports and Action Plan should be dispatched to tendering units as the tendering documents. The tendering units will formulate the tendering documents according to the environmental protection program.

b) While Inner Mongolia Department of Communication signs the contract with the construction contractors, the Environmental Action Plan should be put as an annex to the contracts.

c) Each contractor should assign a person responsible for the environment. Before the construction, Inner Mongolia Department of Communication should organize the construction environmental protection staff to hold workshops to discuss and understand the environmental protection measures.

d) Before the construction, the construction environmental protection staff should provide environmental protection training to the construction workers.

CHAPTER 12 ENVIRONMENTAL PROTECTION EXPENDITURE ESTIMATE AND COST-BENEFIT ANALYSIS

12.1 Environmental Protection Expenditure Estimate

According to the environmental protection program, environmental monitoring program and personnel training, etc., the estimate of the environmental protection expenditures of the proposed project is shown in Table 12-1. All the expenditures will be accounted in corresponding documents ("funding source" column) to facilitate implementation. Considering that water drainage and roadbed engineering has been listed in the Feasibility Study Report as the main engineering expenditure, except for these two measures, the total amount of environmental protection expenditures will be 10.863 RMB, accounting 0.5% of the total investment of the project.

Table 12-1 Estimate of Environmental Protection Expenditures

Phase	Environmental measure	Expenditure (10^4RBM)	Funding source	Executive unit	□□
Design Phase	(1) Environmental protection design	50	Preparatory work fee	Environmental design unit	
	(2) Environmental protection program in the engineering design (Table 10-2)			Environmental design unit	
Construction Period	(3) Roadbed protection works	1560	Project engineering cost	Engineering contractors	Already listed in project main engineering
	(4) Water drainage works	5691			
	(5) Greening (planting)	177.8			
	(6) Water spraying at construction site	250			
	(7) Construction wastewater sediment tanks	10			
	(8) Materials transport	50			
	(9) Septic tank at construction camps	5			
	(10) Garbage cans or cesspits at construction camps, garbage clearing	15			
	(11) Safety marks and night lights at construction sites	15			
Environmental protection	(12) More sound insulation windows and greening to decrease noise if exceeding the standard	16	Reserved environmental cost or engineering cost	Environmental Protection Office of Communication Department	40000RMB /household

	(13) Sewage treatment in the service area	20	Civil work cost of the facilities along the line	Highway Administration Bureau Contractors	50000RMB /site
	(14) Septic tanks at management agencies, toll gates, maintenance stations	20			
	(15) Garbage cans at management agencies, toll gates, maintenance stations	10			
	(16) Maintenance of greening works within the highway line	30	Project engineering cost	Highway Administration Bureau Contractors	
	(17) Grass grids and seed sowing at temporary land use, earth borrow and waste earth yards	77.5			
Environmental monitoring and management	(18) Environmental monitoring in the Construction Period	115	Project engineering cost	Communication Department Environmental Protection Office	
	(19) Environmental management in the Construction Period	30			
	(20) Environmental monitoring in the Operation Period	15	Road maintenance cost	Environmental Protection Office of Communication Department OR Highway Administration Bureau	
	(21) Environmental management in the Operation Period	40			
	(22) Maintenance of Environmental facilities	50			
	(23) Personnel training	50		Communication Department	
	Total	8297.3	Accounting for 0.5% of total investment (excluding roadbed protection engineering and water drainage engineering costs)		

12.2 Environmental Protection Measures and Benefit Analysis

An analysis of the main environmental protection measures and the benefits is shown in Table 12-2. According to the table, the environmental protection measures recommended in this EIA are technically and economically reasonable and feasible.

Table 12-2 Main Environmental Protection Measures and Benefit Analysis

Recommended measures	Cost (10^4RMB)	Function	Benefit
Sewage treatment at the service area	20	The treated wastewater being discharged or reused for greening; protecting water environment	Protecting water environment and environmental hygiene
More sound insulation windows and greening to decrease noise if exceeding the standard	16	Reducing noise impact on residents, and improving their living conditions	Implementing *Noise Pollution Prevention and Control Law*
Solid waste treatment and septic tanks	30	The sewage amount being small and septic tanks able to meet with treatment requirements; Collecting and clearing solidwastes	Protecting environmental hygiene and water environment, to form high-quality environment along the highway
Water and soil conservation, land arrangement and vegetation rehabilitation at earth borrowing and waste earth yards and at temporary land uses	77.5	Having comprehensive functions of preventing soil erosion and protecting eco-environment	Preventing water and soil erosion, protecting land resources
Greening of highway and overpasses	177.8	Having comprehensive functions of preventing soil erosion, stabilizing roadbed, improving the eco-environment and ambient air, beatifying road landscape, etc.	(1) Stable roadbed having economic benefits (2) Improving regional eco-environment along the line (3) Economically reasonable and having good environmental benefits

CHAPTER 13 CONCLUSIONS

13.1 Current Environmental Status Assessment

13.1.1 Social environment

Hailar District and Manzhouli City in the project area are the economic and communication center in the east of Inner Mongolia, to be developed to the zone bringing along the surrounding economic development. However, the present economy along the line is still weak and the resources have not played their full roles.

(1) The main industry is livestock production, the per capita income at the average level of Inner Mongolia.
(2) The project area is multi-nationality settlement area, with Han, Meng, Man, Ewenke, Hui and Korean nationalities, etc.

13.1.2 Surface water environment

Affected by municipal wastewater discharge and eutrophication of Dalai Lake, the Morigele River, the Hailar River and the Xinkai River are in organic pollution at present, with COD concentration exceeding the national standard.

13.1.3 Ambient air

The ambient air quality in the assessment area is clean, with NO_2 and TSP meeting with Class 2 standard requirements.

13.1.4 Noise environment

The ambient noise is 45.6~63.5dB(A) in the daytime and 39.2~54.6 dB(A) at night at the residential areas along the project line, meeting with Level 4 standard.

13.1.5 Eco-environment

1. The natural landscape is mainly Hulunbeier typical grassland, distributed with large rivers, lakes and marsh wetlands.
2. The animal and plant resources are rich in the region. In Erka Wetland through which the project line goes, there are 6 species of Class I national protective birds, and 26 species of Class II national protective birds.
3. The land functions in the project area are mainly in natural conditions, with a few towns and residential areas. The land resources are rich.
4. The soil erosion grade in the project area: water erosion 1000~3800 t/km^2·a, mostly being slight grade. The soil erosion is mainly wind erosion, with the degree of Grade II~IV, and mainly with Grade II.

13.1.6 Wetland

(1) The highway line goes through Erka Wetland. The length of the wetland section is 13.2km.
(2) The soil in the wetland area includes mainly salinized meadow soil, salinized Castanozems soil, meadow bog soil, alkalized meadow soil, meadow alkali soil, meadow Castanozems soil, alkalized Castanozems soil, Aeolian soil, and sandy Castanozems soil.
(3) The landscape is mainly comprised of wetland landscape and sand wetland landscape.
(4) Based on the survey on Erka Wetland, there have been found 257 species vascular plants, respectively belonging to 57 families and 165 genera.
(5) There is a record of 226 species of wild animals (vertebrates) in Erka Wetland, including 37 fishes, 10 amphibians and reptiles, 38 mammals and 141 birds (including 6 species of Class I national protective birds, and 26 species of Class II national protective birds).

13.2 Environmental Impact Assessment of the Project

13.2.1 Social environment

The project construction will have good economic benefits, powerful anti-risk ability. The project is feasible.

(1) The construction of the project is the need of establishing the main framework of national highway network, state highway layout and Inner Mongolia highway network. It is also an important act of the central government to improve the infrastructure in Inner Mongolia. The project will have obvious social and economic benefits, play pivot roles in the regional development of commerce and trade, industry, agriculture and livestock production, communication and tourism, and bring along the economic development along the line.
(2) The land acquisition area will be 1083.65ha (pasture and wetland 66.1%; forest land 0.3%; bare land 17.3%; current roads 14.4%; dry land 0.6%; sand land 1.2%). The routing of the project line is reasonable, avoiding the cities alongside. Economic compensation and resettlement will be provided for land acquisition and demolition and moving. The life of the herdsmen will not be obviously affected.
(3) Effective engineering measures will be implemented to protect the water conservation facilities, surface water system and highway network along the project line, and facilitate the production and traveling of local herdsmen.

13.2.2 Surface water environment

(1) The rainwater of the bridge surface in the Operation Period of the project will not have major impact on the water quality in the Morigele River, the Hailar River and the Xinkai River. The current water quality of these rivers can be maintained.

Living sewage from service areas, management agencies, toll gates and maintenance zones and the vehicle washing water from service areas must be treated to meet with the national standards before discharge.

There will be very small risk possibility of accidents with serious impacts at the water bodies

and wetlands. But effective preventive measures should be adopted to avoid the accidents.

13.2.3 Ambient air

The wind speed is big, and the air diffusion ability is strong in the project area. The tail gas from the vehicles will have no obvious impacts on the ambient air quality in the Operation Period.

13.2.4 Noise environment

(1) In the Operation Period, the traffic noise will have obvious impact on the villages along the line. If the residential houses are near to the highway line, the ambient noise will partly exceed the standard value.
(2) If the measures in Table 8-1 are adopted, more sound insulation windows for residential houses if exceeding the standard, the ambient noise quality at the villages along the highway line will meet with the national standards in the long term.

13.2.5 Eco-environment

(1) The land acquisition for the project construction will not have obvious impact on the structure of land uses in the areas along the line. The permanent land occupation of the engineering will not have major impact on the biomass, and will have no influence on the types and characteristics of regional eco-environment.
(2) In the Construction Period, the land occupation by the engineering, the temporary land occupation and the land use of earth borrowing yards, etc. will bring about some loss of vegetation in a short term. The vegetation rehabilitation, reclamation of earth borrowing yards and planting of drought-proof forests, etc. can compensate and restore the original vegetation.
(3) The implementation of greening works, drought-proof forests and water conservation forest in the land use area of the project will facilitate the construction of green passage works in the region.
(4) The occupation of pastures in the project will worsen the decreasing trend of grass yield along the line. The adoption of land resource protection measures will minimize these impacts.
(5) After the highway is put into operation, the impact on wild animals and plants will be mainly in Erka Wetland section.

13.2.6 Wetland

(1) Erka Wetland has rich animal and plant resources. The operation of the proposed project will mainly affect the birds, but have less impact on fish, amphibians, reptiles and mammals.
(2) The impact scope of the highway on the birds will be within 300m on both sides, with the impact area of about 792ha, or 1.5% of the total wetland area. After the operation of the

highway, some birds may flee far away the highway line area. The adoption of effective engineering measures can minimize the impact.

13.2.7 Alternatives Comparison

According to the comparison of environmental impacts between alternatives for different sections, the Positive Line option has the smallest impact on the environment. This recommended option by the EIA is in consistence with the recommended option in the Feasibility Study.

13.2.8 EIA in the Construction Period

In the Construction Period, the sewage and garbage from the construction camps and the construction of bridges will affect the water environment. Large-scale mechanical operation, material transportation, lime-soil mixing and bitumen-mixture mixing, etc. will result in serious responded dust and noise pollution in the areas along the highway line. The large-scale earth borrowing will also destruct vegetation and deteriorate soil erosion.

Although the environmental impacts in the Construction Period are in short term, environmental measures must be adopted according to the environmental protection program (see Table 11-3) in the Construction Period, so as to minimize or alleviate the environmental impacts in the Construction Period.

13.3 Overall Conclusions

The construction of Hailar – Manzhouli Highway will have outstanding socioeconomic benefits and thus have been widely supported by the public. The routing of highway line is reasonable, with the route avoiding cities and towns such as Hailar District, Bayankuren Town, Zalainuoer Mineral Area and Manzhouli City. In the Operation Period, the impact of the project on the life of people is mainly noise impact. Duo to the geographical position, the line has to go through Erka Wetland, which may generate some impact on the wetland ecology. It is suggested that environmental prevention and control measures be implemented in accordance with the environmental protection program, including implementation of highway conservation works, water drainage works, overall greening scheme, rehabilitation of vegetation in temporary land uses, and demolition and moving of nearby houses. This can effectively protect human living environment in the area along the line, and control the impacts on soil erosion and the birds.

In a word, the construction of this proposed project is feasible in respect of environmental protection.