

Transmission Line Reconstruction Project Hrazdan to Shinuhair Corridor, Armenia



Environmental and Social Impact Assessment (ESIA)

Final Report

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CC	Construction Contractor
EBRD	European Bank for Reconstruction and Development
EMF	Electric and Magnetic Fields
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESREE	Electricity Supply Reliability and Energy Efficiency Project
HVEN	High Voltage Electric Networks
kV	Kilovolt
IUCN	International Union for Conservation of Nature
KWh	Kilowatt-hour
MW	Megawatt-hour
MENR	Ministry of Energy and Natural Resources of RA
MNP	Ministry of Nature Protection of RA
MOC	Ministry of Culture of RA
MOTC	Ministry of Transport and Communication of RA
NGO	Non-Governmental Organization
OHL	Overhead Line
PAP	Project Affected Person
PCR	Physical Cultural Resources
PPE	Personal Protection Equipment
R2E2 Fund	Renewable Resources and Energy Efficiency Fund
RA	Republic of Armenia
RAP	Resettlement Action Plan
ROW	Right of Way
RPF	Resettlement Policy Framework
SEA	Strategic Environmental Assessment
SEI	State Environmental Inspectorate
SNCO	State Non-commercial Organization
TOR	Terms Of Reference
UNDP	United Nations Development Program
WB	World Bank
WWF	World Wide Fund for Nature

1. Executive Summary

1.1 Introduction

The Project plans to completely replace the 225 km long 220 kV transmission line from Hrazdan substation (in the north-east of Armenia) to Shinuhair substation (in the south of the country) in order to enhance the reliability and capacity of the transmission network and to close the power supply gap in Armenia. The existing line has been commissioned in 1956. It is at the edge of its life span and technically not up-to-date.

Very few details are known about the technical features of the line. The detailed design including final land survey is shifted to the construction contractor and will be part of the tender documents.

The new transmission line will mostly run parallel to the old one (50 m distance). It will mainly follow the existing Right of Way (ROW) with deviations to bypass settlements, cultural sites, difficult terrain etc.

On the basis of the existing environmental situation and the technical planning of the transmission line, FICHTNER determined and evaluated the environmental and social impacts during construction and operation of the proposed transmission line. The impact assessment focused on the ecological aspects of the Project and on the effects for the local population especially because of needed land for towers and involuntary displacement of houses from the Right-of-Way corridor. In a second step, appropriate mitigation measures, alternative routings and monitoring measures were considered to reduce possible adverse impacts.

One basis for the study consisted of intensive field surveys conducted by the environmental expert and the socio-economist of FICHTNER in February 2011. Additionally to the field survey, an evaluation of possible ecological and social impacts was performed by interpretation of satellite maps. Public Consultations were held in March /April 2011.

1.2 Institutional and Legislative Framework

National Legislative Framework:

Following independence in 1991, the environmental legislation of the Republic of Armenia (RA) was reviewed, with the aim of developing a more comprehensive State policy towards ecological protection and sustainable use. To this end, a series of laws have been developed, including regulations relating to protected areas, a land code (both 1991) and a forest statute (1994). From 1999 to today, a number of national laws of RA were implemented to regulate the protection of the environment, land acquisition for state needs and the Environmental Impact Assessment (EIA) procedure. Recommendations with regard to Aarhus Convention are made.

International Requirements

Following World Bank Guidelines are triggered by the Project and have been taken into specific consideration:

- OP/BP 4.01 + Annexes ‘Environmental Assessment’
- OP/BP 4.04 ‘Natural Habitats’
- OP/BP 4.12 + Annexes ‘Involuntary Resettlement’
- OP/BP 4.10 ‘Indigenous Peoples’
- OP/BP 4.11 ‘Physical Cultural Resources’
- Handbook for Preparing a Resettlement Action Plan, IFC Environmental and Social Department
- International Finance Corporation’s Performance Standards on Social & Environmental Sustainability, 2006
- World Bank/IFC General EHS Guidelines
- World Bank/IFC General EHS Guidelines for Electric Power Transmission and Distribution, 2007.

Other international guidelines used for the environmental assessment of the project are:

- ICNIRP Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (UP TO 300 GHz) (International Commission on Non-Ionizing Radiation Protection)
- CIGRE 1998: High Voltage Overhead Lines – Environmental Concerns, Procedures, Impacts & Mitigation.
- Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters

The legal framework of the Republic of Armenia does in the essence correspond with the international regulations and safeguards. Gaps however do exist in enforcement of the regulations. There is still a considerable lack of institutional capacities for implementation, monitoring and evaluation. The lack of access to legal support, especially for weaker sections of the society may create further gaps concerning implementation of compensation and resettlement impacts.

1.3 Analysis of Alignment Alternatives

Four Project alternatives have been considered related to their scope of environmental interference and involuntary resettlement and based on following objectives:

- Minimizing the impact on the landscape and negative impacts on biodiversity and interference with Protected Areas
- Avoidance of cultural heritage sites and areas of ecological interest
- Avoidance of towns and development areas, to minimize involuntary resettlement.

The replacement of the old line in a distance of 50 m and additional new bypasses around settlements and potential historical sites is assessed to be the most feasible alternative (Alternative 3).

1.4 Baseline Conditions

General Environment and Ecology

The investigation area covers the zone of the electrical network Hrazdan-Shinuhair in four different regions (Marzes) of the Republic of Armenia, namely Kotayk Marz, Gegharkunik Marz, Vayots Dzor Marz and Syunik Marz. Main geographical zones are Lake Sevan (including Lake Sevan National Park), Selim Mountain Pass, Arpa Valley and Sisian Plateau.

The entire investigation area is located between 1,093 m and 2,410 m altitude. Mountain tops reach between 2,600 m-3,600 m altitude.

The proposed 220 kV line starts at Hrazdan Substation (Kotayk Marz), stretches along the western shore of Lake Sevan (1,898 m) in Gegharkunik Marz, passes the town of Gavar and parts of Lake Sevan National Park. From the south-western End of Lake Sevan (town of Lichk) the line leads towards Selim Pass (2,410 m), where it crosses into Vayots Dzor Marz. From Selim Pass the line leads down the steep valley of Yeghegis River, and leads towards Yegegnadzor. Yeghegis Wildlife Reserve is bypassed on the western side of the village Shatin. The lowest point of the transmission line is reached at the village Agarakadzor in the valley of the Arpa River at 1,093 m altitude, from where the line leads up the Arpa River Valley. After the town of Vayk the valley narrows to Arpa Gorge, with the village Seravan and reaches Vorotan Pass at 2,344 m. The Sisian Plateau (between 2,130 m and 1,900 m) is reached after the village Shaki and then the line is stretching to Shinuhair Substation at 1,545 m.



Map 1-1: 220 kV transmission line corridor

Armenia is located in a seismically active zone stretching from Turkey to the Arabian Sea. As large earthquakes with magnitudes over 5.5 occur in Armenia every 30 to 40 years reaching magnitudes up to 7.1 on the Richter scale, a high-level seismic hazard is indicated for the country. Maximum seismic risk is given around the city of Yerevan, where active faults exist.

The investigation area is characterized by a continental dry high-altitude climate, with a small difference at the northern part of Lake Sevan and the eastern part of Syunik region, where rainfall is significantly higher than in other areas due to micro-climatic effects. The summers are hot and the winters cold, with max. temperatures reaching up to 40° Celsius (despite the altitude of more than 1,000 m) and going down to -35° Celsius.

The investigation area involves three main watersheds: Lake Sevan Watershed with the western and south western tributaries in Gegharkunik Marz, the Arpa River Watershed in Vayots Dzor Marz with the tributaries from Yeghegis, Herher, Jermuk Valleys, and finally the Vorotan Watershed in Syunik Marz. The main water resource of Gegharkunik Marz is Lake Sevan (1260 km², 1898 m above sea level).

The forest cover of the investigation area is very low, what results in a quantitatively less important impact of the Project on forest resources. Some open juniper forests, especially at the Vayk sector, are crossed by the proposed transmission line, not requiring the felling of densely forested areas.

Armenia has a rich diversity of flora and fauna in a relatively small territory. The prevailing biotypes are semi-desert, mountain-steppe, mountain-meadow and Alpine vegetation. Regarding fauna, for example, at least 345 bird species have been recorded of which over 240 species breed here. At the Lake Sevan breeding colonies of the Armenian Gull and the Citrine Wagtail can be found. Armenia is further situated on an important bird migration flyway. Big mammals occur rather in the southern part of Armenia, an area which belongs to the distribution area of the Persian leopard in the Caucasus. However, biodiversity is under threat in Armenia, as the recently published Red Book demonstrates.

There are several Protected Areas within the RA, which are not affected by the transmission line corridor.

Socio Economic Baseline

The Republic of Armenia has a population of 3,262,200 people for a territory of 29,743 km². Population density is 108.4 persons/km². Nominal GDP is \$8,830 billion (2010 estimate), per capita \$2,676. The Human Development Index is estimated for 2010 at 0.695 which ranks the country 76th. After the break-up of the USSR the country has experienced a problem of population decline due to elevated levels of emigration.

The population density in Kotayk Marz is 115.5 persons/km², in Gegharkunik Marz 40.3 persons/km², in Vayots Dzor Marz 23.1 persons/km², and in Syunik Marz 29.8 persons/km². The regions concerned by the Project have a low population density.

The settlement structure is concentric with most of the people living in towns and villages, which makes bypasses of settlements technically feasible. Large parts of the investigation area are rather uninhabited and are used for agriculture or pastures.

There are no indigenous peoples in the investigation area, but a significant level of vulnerable people as 35-60% of the population live below the poverty line.

The share of single women headed households is disproportionately high due to work migration of men. These people are among the poorest and most vulnerable PAPs. The lack of “public voice” may lead to a situation where women’s concerns are overlooked or not taken seriously and are consequently not addressed.

There are numerous cultural monuments and heritage sites within the investigation area. Only a minor part of the existing monuments are well preserved and known to the public as for example the Caravanserai at Selim Pass, Hayravank Church at Lake Sevan or Zorats Karer on Sisian Plateau. Others are in ruins but visible, but to a greater extent monuments have yet to be unearthed and are known only to a few local experts linked to the Department for the Protection of Monuments and Historical Sites of RA. There are no maps indicating locations or descriptive lists readily available. Field investigations, accompanied by local experts and consultative meetings have revealed a number of existing and potential sites along the proposed line, and the probability of chance finds will be high.

With the deindustrialization after break-up of the Soviet Union, agriculture has become the main livelihood sector in the area again. Due to the high altitude of the entire investigation area, main cultivated crops are potatoes in Gegharkunik and Syunik Region (Sisian Plateau) as well as hay fields and pastures. Orchards and vineyards are concentrated in the valleys of Vayots Dzor Region (Yeghegis Valley, Arpa Valley) where also wheat, potatoes and other legumes are cultivated. With the increased importance of agriculture for people’s livelihoods and the high fragmentation and small size of landholdings, expropriation of agricultural land is an issue of potential impact for the planned transmission line.

While access to land is still widespread in rural Armenia, amongst farm households, the poor and extreme poor are those who own very little land, or the landless. The poorest Armenians are found in rural areas with the least favourable conditions for agricultural activities. There is a stark contrast between the city of Yerevan and the remote rural areas in terms of socio-economic opportunities.

Most of the population, even in rural areas has access to electricity. Efforts to provide a general supply with gas and drinking water are made. However, with the incidence of poverty the problem arises, that households are not able to pay for the (new) services.

1.5 Impact Assessment

Tab. 1-1: Impacts during design phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Line Routing	In line sections Vardenis, Vayk ■■■ In line sections Noratuz, Lichk, Vorotan I ■	■	Long term	Direct	The sensitivity of the area for the line routing is high because numerous historical sites can be found along the proposed transmission line. Selection of line routing in order to avoid resettlement activities to the greatest extent possible; avoidance of any protected areas; minimal ground clearance will be sufficient so that no negative interference with the traffic occurs in case of road crossings.
Access Roads	In line sections Vardenis, Vayk ■■■ In line sections Noratuz, Lichk, Vorotan I ■■	■■	Long term	Direct	Highest sensitivity of the investigation area regarding the construction of access roads has to be stated for line sections Vardenis and Vayk because of crossing of historical sites as graveyards located beneath the surface and in mountainous areas. The necessity to construct access roads to the line corridor represents the biggest impacts of the Project regarding protection of flora, fauna, and historical sites. The line routing will be selected with focus on minimising access roads by routing it along existing paved roads. Existing tracks will be used to the greatest extent possible.

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
○	=	nil
+	=	locally positive
++	=	regionally positive

Extent of sensitivity

■■■	=	high
■■	=	medium
■	=	low

Tab. 1-2: Impacts during construction phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Soil and Erosion	In line sections Vardenis, Vayk ■■■■ In line sections Noratuz, Lichk, Vorotan1 ■	In line sections Vardenis, Vayk ■■ In line sections Noratuz, Lichk, Vorotan1 ■	Long term	Direct	In the steep mountainous slopes the sensitivity of the terrain for erosion is high. Removal of topsoil around tower feet will be minimised. Topsoil will be brought back after construction and soil will be replanted when towers are erected in steeper slopes. New access roads not needed anymore after having finished the construction will be rehabilitated and replanted. Erosion prevention measures for access roads as road-side plantation with bushes and drainage systems will have to be implemented.
Landscape and Visual Aspects	■	■	Short term during construction	Direct	In most parts of the line routing the old line will be replaced by the new ones. There are also numerous other transmission lines running nearby the proposed corridor. The influence on the landscape during construction is time limited. In order to reduce the visual impact the old line towers shall be dismantled completely.
Noise	■	■	Short term during construction	Direct	Due to the limited time of the construction period the annoyance of the population by noise generated during construction activities will be low. For workers a proper HSE Management Plan will address the issue 'noise'. All workers will be fitted with PPE as ear plugs etc.
Air Quality	■	■	Short term during construction	Direct	Due to the limited time of the construction period the impacts on ambient air quality by vehicle exhausts will be low. Machines and vehicles will be checked regularly to minimise exhausted pollutants.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
<u>Water Resources</u>					
a) Groundwater	■■■	■	Short term during construction	Direct	A proper HSE Management Plan will be in place during construction phase. There is only a small risk of groundwater pollution by e.g. oil/fuel spills of machines and trucks which can be avoided by proper maintenance.
b) Surface Water	■■■	■			Beside oil/fuel spills soil run-off during construction could pollute surface waters. However, the pylon locations will be far away from surface waters, because only small rivers and creeks have to be crossed.
Flora and Fauna	■■	■	Short term during construction	Direct	Most of the land to be crossed consists of agricultural land not providing any specific habitat for endangered or threatened plant or animal species. However, near the corridor some important habitats can be found for birds (e.g. Lake Sevan National Park) and big mammals. In some parts a high burden caused by many other lines has to be stated. Forest areas are not crossed by this transmission line. The planned line crosses neither Jermuk nor Herher Forestry Reserves. However, in several locations trees have to be felled and in one area a small patch of forest is traversed by the line resulting in 3.5 ha of deforested land. The present design of the transmission line avoids a migratory corridor of mammals between Khosrov Reserve and Iran, which is located on the southern side of Arpa valley, whereas the line passes on the northern side.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Protected Areas and Wetlands	■ ■	■	Short term	Direct	<p>The proposed line runs partly through the buffer zone of Sevan National Park and by-passes the Yeghegis Wildlife Reserve. Fortunately, the transmission line is located on the hillside and not the lake side of the main road and runs through rocky terrain and grassland that are not particularly sensitive, especially as the existing line has already impacted the area.</p> <p>In case of Yeghegis Reserve the planned bypass of village Shatin will be constructed on the opposite hillside, officially belonging to the edge of the reserve, but separated from the main reserve by the road and the village. The existing line touches the reserve and shall be dismantled completely. This would create a positive (visual) impact for the reserve.</p> <p>The planned transmission line crosses neither Jermuk nor Herher Forestry Reserves.</p>
Solid Waste (generated by construction activities and by workers)	■ ■	■	Short term during construction	Indirect	<p>Some line sections will be erected in remote areas without proper landfills. The sensitivity of the line corridor for solid waste is assessed to be medium.</p> <p>The generation of solid waste will be minimised by a proper waste management implemented by the construction contractor.</p>
Dismantling of old Line		+	Long term	direct	<p>According to information obtained by HVEN it has not been decided yet what happens to the old line. In discussion are following scenarios:</p> <ul style="list-style-type: none"> • The old line will be untouched as spare line • The old line will be untouched and towers/conductors will be used as spare parts elsewhere • The old line will be dismantled and the dismantled towers and conductors will be stored elsewhere as spare parts • The old line will be dismantled and the iron parts will be recycled.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Health and Safety	■ ■	■	Short term during construction	Direct	The construction contractor will develop an appropriate Health, Safety and Environment Management System (HSEMS) and implement it during the construction phase.
Nuclear Power Plant Safety	■ ■	Assessment not possible	Short term during construction	Indirect	<p>The implementing agency and construction contractor will have to inform the authorities responsible for the safety of the nuclear power plant in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut of the existing line during construction works.</p> <p>It is strongly recommended to develop a detailed risk analysis and to set up an effective emergency plan to exclude any risk for the power supply of the nuclear power plant during construction.</p>
Historical and Cultural Sites	■ ■ ■	■	Short term during construction and long term impacts by the physical presence of towers	Direct and indirect by the physical presence of the line (visual aspect)	<p>Historical sites will be avoided by by-passing them or will be over-spanned e.g. in case of graves located below the surface. Representatives of the Department of Protection of Monuments and Historical Sites / Department of Cultural Heritage will accompany the construction contractor during the design phase and determine the exact tower location according to their requirements (see also Chapter 9.1.1). Same procedure will be applied for location of needed new access roads.</p> <p>In case of chance finds, the construction has to be stopped immediately and the Department of Protection of Monuments and Historical Sites has to be informed to agree on further steps (as according to Armenian Law).</p>
Infrastructure	■	■	Short term during construction	Direct	Minimal ground clearance will be sufficient that no negative interference to the traffic occurs in case of road crossings. Proper traffic management will avoid negative impacts on traffic as far as possible.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Power Supply to the Public	■■■	■	Short term, during construction	Direct	During construction some new towers have to be erected at the same places like the old ones. This makes it necessary to cut the power supply of the old 220 kV line for one to two weeks. At this time the power supply between the Northern and Southern part of the country is ensured by a second 220 kV line (Shamb Line).
Power Supply to Nuclear Power Plant	■■■	Assessment not possible		Indirect	There is a risk that during this construction period the power can be cut totally if an accident of fatal error happens to the second power line, resulting in frequency variations possibly impacting the nuclear power plant negatively. In this case a repair team will be able to fix the line within 10 to 15 hrs.
Land Use and Land Acquisition	■	■■	Long term	Direct	Land acquisition for all tower foundations, access roads, relocation of houses will be necessary, as the line corridor will be a new corridor for the entire Project (except for approx 10 towers in 3 locations where the old ROW will be used). Land acquisition for approximately 820 towers will be necessary (100 m ² per tower) equalling 8.2 ha of land, which is estimated to be private land for at least 50% of the territories concerned. Additionally, land has to be acquired to compensate house owners that need to be relocated or lands have to be purchased and given in exchange to resettle them.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Loss of Houses and Livelihood Involuntary Displacement	■ ■	■	Long term	Direct	<p>If all suggested bypass sections around villages are constructed the necessity to relocate PAPs will be reduced significantly compared to a corridor that follows the existing line.</p> <p>Regarding the old line routing approximately 100 houses are located in the ROW, for the present bypass areas the number can be reduced to Zero; a careful estimate is made with max. 20 houses. In specific cases, i.e. for houses located far below the line in a valley, not all houses need to be removed from the ROW.</p> <p>The surface of a house is estimated as 225 m² for Cat.1 and 2 houses and 400 m² for Cat. 3 and 4 houses.</p> <p>Avoidance of relocation is seen as a priority issue. A relocation package that ensures full restoration of people's livelihoods will have to be established in the Resettlement Action Plan.</p>
Gender Aspects	■ ■	■	Short term	Indirect	<p>The construction of the line may increase existing gender disparities, as benefits from construction work will be earned mostly by men and access and control over compensation payments are likely to be at the disposal of men and not of women. This will increase the probability that the family benefits less.</p> <p>There is a considerable percentage of single women headed households in the area that are among the most vulnerable people. If resettlement issues arise in this case the same procedure applies as for vulnerable people.</p>
Vulnerable people	■ ■ ■	■ ■	Long term	Direct	<p>Households below the poverty line and otherwise vulnerable households may lose their livelihood base if impacted by the Project / loss of land or relocation. In this case, a special livelihood support program shall be implemented.</p>

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Local Workforce	■■■	+	Short term limited to construction period	Direct	During the construction period local workforce will be employed for the construction of towers and stringing procedures. This will contribute to much needed monetary income in remote rural areas and towns, where the industrial basis has eroded. However, the income generation opportunity is not of long term duration.

Extent of impact:

- = high
- = medium
- = low
- = nil
- ⊕ = locally positive
- ⊕⊕ = regionally positive

Extent of sensitivity

- = high
- = medium
- = low

Tab. 1-3: Impacts during operation phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Landscape	■	■	Long term	Direct	In many parts of the transmission line corridor, a high burden of the landscape caused by many other lines crossing the country and by long distribution lines exists.
Flora	■	■	Long term	Direct	Trees are not to be allowed to grow beneath the line.
Fauna	■	■	Long term	Direct	Lake Sevan is the most sensitive area of the transmission line corridor regarding bird collisions with conductors. Here, some sensitive species are living like herons, pelicans, egrets. However, there are no reports about bird collisions with conductors in this region. No specific mitigation measures are necessary. In other line sections big birds are mostly represented by birds of prey. These species have a good ability to see and are not very sensitive to this threat.
Noise	■ ■	■	Long term	Indirect	Noise emitted by substations or by the conductors (corona effect) will be minimal. Specific mitigation measures are not necessary.
Climate Change	■	+	Long term	Indirect	The increased efficiency of the transmission line is supposed to have a positive impact on climate change.
Electric and Magnetic Fields for the Public at the Workplaces	■ ■	■ ■	Long term	Indirect	From similar projects it can be stated that the relevant internationally accepted limit values for the public will not be exceeded if the minimum safety distance of 7 m to the conductor is kept as recommended.
Land Use	■	■	Long term	Direct	An area of 100 m ² per tower will have to be expropriated and partly sealed for tower foundations. However, the remaining land of the line corridor can be used as agricultural land or as pasture land without restriction.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Electricity Supply	■■■	+ ++	Long term	Direct	An increased stability of the electricity supply, especially if a raising demand is expected, is a locally positive impact of the Project. An increased efficiency / reduction of transmission losses in the electricity network will be regionally positive.

Extent of impact:

- = high
- = medium
- = low
- = nil
- + = locally positive
- ++ = regionally positive

Extent of sensitivity

- = high
- = medium
- = low

In summary, the results of the investigation demonstrate that the Project will have mostly low impacts on the environment if the proposed ESMP is implemented and all proposed mitigation measures are accomplished.

Several impact areas have to be highlighted:

- Relocation of houses /households within new ROW;
- Land acquisition for towers;
- Damages to crops and trees during land survey, construction of access roads, construction of towers and conductor stringing;
- Avoidance of Historical Sites.

The transmission line passing by the Sevan National Park is located on the hillside and not the lake side of the main road and runs through rocky terrain and grassland that are not particularly sensitive, especially as the existing line has already impacted the area. A potential impact of the transmission line on water birds has been inquired; however, there are no records of bird collisions with the existing line. In addition, Sevan Lake National Park staff has not found any evidence of dead birds below the conductors.

As the forest cover of the area is very low, the impact on forest resources is quantitatively small. The planned line crosses neither Jermuk nor Herher Forestry Reserves. However, in several locations trees have to be felled and in one area a small patch of forest is traversed by the line resulting in 3.5 ha of deforested land. Due to the lack of forests in Armenia the resource is very precious and should not only be compensated in monetary terms. A replanting of forest (twice the amount of felled trees / deforested area) has been suggested by the Ministry of Agriculture.

Visual aspects constitute a negative impact of transmission lines in general. However, regarding the proposed Project the negative impacts have already occurred. In the area concerned there are various overhead transmission lines existing with several hundreds of towers that are often clearly visible from far away, due to the flat landscape (i.e. on Sisian Plateau). Underground cables are not considered as an option for financial reasons as well as due to the partly very difficult terrain.

Depending on the final design of the transmission line, between about 20 and 100 households may have to be resettled. In order to mitigate this fact a Resettlement Action Plan shall be elaborated during the final land survey, including census, detailed inventory of losses and a socio-economic survey. The RAP shall be based on the Resettlement Policy Framework (RPF) prepared by FICHTNER within the present assignment.

Land acquisition of 820 new towers will affect approximately 8.2 ha of different categories of land on which new tower foundations will be built. It is estimated that 50% of this land will be private land. The individual area of the

tower is small enough not to cause a vulnerability situation in itself. However, placing of towers into gardens, fruit tree orchards or vineyards should be avoided.

Damages to crops will occur during land survey, construction of access roads, construction of towers and conductor stringing. The damages have to be evaluated and fully compensated. In case of severe damages to property or vulnerability of PAPs a livelihood restoration package will be detailed in the Resettlement Action Plan (RAP).

A prominent issue during investigation of the proposed line corridor was that numerous historical sites occur within the ROW. Wherever possible, these sites have to be by-passed. At other sites, an over-spanning has been agreed. A member of the local Department for the Protection of Monuments and Historical Sites and the Department of Cultural Heritage will supervise fixing of the exact locations of the towers and access roads.

Furthermore, it is strongly recommended to develop a detailed risk analysis and to set up an effective emergency plan to exclude any risk for the functioning / power supply of the nuclear power plant during construction of the new 220 kV OHL.

Other impacts as employment of unskilled workers during construction and a more reliable power supply for the national grid will be positive. An indirect positive impact will be a better power supply in the rural areas in future when the corresponding distribution network is also rehabilitated.

Consequently, it can be concluded: if all proposed mitigation measures are implemented, the **Transmission Line Reconstruction Project Hrazdan to Shinuhair** can be constructed and operated **without having significant adverse impacts** on the social and ecological environment in the investigation area and its surroundings.

1.6 Environmental and Social Management Plan

Mitigation Measures for the Design

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Avoidance of cultural and historical sites	<ul style="list-style-type: none"> • Selection of the OHL corridor that bypasses most of the sites • Minimization of the length of access roads • Selection of location of access roads to avoid any specific site • Local experts will accompany designer to check whether cultural sites will be affected by the final corridor and to advise if over-spanning is possible or if a bypass is needed. 	CC	<p>Included in construction costs</p> <p>10.000 USD for local experts team to accompany final design engineer</p>	During final routing
Minimisation of resettlement needs	<ul style="list-style-type: none"> • Selection of the OHL corridor with minimum resettlement actions/ relocation of households required • Utilisation of long span towers in order to bridge valleys and increase distances of the conductors to houses • Construction of bypasses around all major affected villages. 	CC	Included in construction costs	During final routing

Mitigation Measures for the Construction Phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Soil / Erosion	<ul style="list-style-type: none"> • Minimization of removing topsoil at tower sites. • Bringing back the topsoil to its original place after having finished the erection of the tower. • Replanting of grass/shrubs at tower sites in steeper slopes. • Careful selection of locations for access roads. • Erosion prevention measures at access roads. • Rehabilitation of new access roads not needed anymore. 	CC	Included in construction costs	During construction
Landscape and visual impacts	<ul style="list-style-type: none"> • Complete dismantling of the old line. 	CC	Included in construction costs	After construction
Noise exposure of workers and of local population during construction activities	<ul style="list-style-type: none"> • Optimisation of transportation management to avoid needless truck drives; avoidance of truck movements in residential areas at least during night-time. • Reduction of speed of trucks crossing residential areas. • Utilization of low sound power mechanical equipment like bulldozer, air compressor, concrete pumps, excavator, concrete mixer etc. whenever possible. • Regular maintenance and service of building machinery and other during construction works. • Shut down or throttling down of noisy machinery to a minimum. • Utilization of ear protection devices by the workers if they are exposed to high noise levels (included in the construction site HSE Management Plan). 	CC	Included in construction costs	Before starting construction and during construction period

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Air pollution (dust, exhausts etc.) during construction activities	<ul style="list-style-type: none"> • Limitations of size, weight or axle loads of vehicles using particularly difficult roads. • Reduction of speed and limited movement of vehicles. • Optimised transportation management to avoid needless truck trips. • Routine service and regular maintenance of vehicles and machines to reduce engine emissions. • Burning of rubbish on site must be strictly forbidden. 	CC	Included in construction costs	During construction period
Pollution of groundwater during construction	<ul style="list-style-type: none"> • Good and regular maintenance of all vehicles and machines used on site is mandatory. Maintenance activities of the vehicles shall be performed in regular service stations. • Maintenance and re-fuelling of the construction equipment shall be done only on sealed and enclosed areas (careful handling and careful maintenance, especially of the fuel tanks). • On site storage of fuel, engine oil and lubricants in locked tanks and on sealed and shadow roofed areas. • All wastes generated through the use of fuel, engine oil and lubricants like drums and containers shall be collected and disposed of properly. • Staff training to increase awareness of waste minimisation and appropriate waste disposal. 	CC	Included in construction costs	During construction period

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Pollution of surface water especially during rainy seasons	<ul style="list-style-type: none"> • All liquid materials and lubricants shall be stored in closed containers or barrels. • Construction material as bags of cement etc. shall be stored in containers in order to avoid rinsing out. • Temporary sewage treatment facilities shall be provided for the construction site and the labour camp. 	CC	Included in construction costs	During construction period
Loss of trees	<ul style="list-style-type: none"> • Compensation is paid for felled trees either to the private owner or to the Forestry Department / SNCO. • Demarcation of communal land for re-plantation of trees. • Use of old ROW for plantation of trees wherever suitable. • Determination of necessary lay down areas together with the environmental site manager to prevent the cutting of trees. • Protection of large trees which are not required to be cut but which are located adjacent to the construction site with wooden barriers to prevent unintended destruction. However, from the site visit it is not expected to find large trees within the line corridor in a significant number, if any. • Marking of the extent of the lay down areas and the routing of the access roads. 	HVEN	50.000 USD	During fixing of the final routing (final land survey)
Disturbance of animals living in and nearby the corridor	<ul style="list-style-type: none"> • The line corridor will be located mainly outside of designated forest/reforestation areas, woodland and wetland areas • Instruction of the employees not to disturb animals; hunting shall be prohibited in general. 	HVEN CC	Included in construction costs	During design and construction phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Protected areas and wetlands	<ul style="list-style-type: none"> The line routing was selected in such a way to avoid crossing of any protected areas or Ramsar Wetlands. 	HVEN CC		During design phase
Solid waste	<ul style="list-style-type: none"> Development of a Waste Management Plan within the HSE Management Plan considering following principles: (i) waste management hierarchy of avoidance-minimisation-reuse-treatment-disposal; (ii) segregation of waste; (iii) minimisation of construction waste by good technical planning; (iv) training of staff. Implementation of a Waste Management System. Steel parts gained during dismantling of the old line shall be reused or recycled. 	CC	Included in construction costs	Prior start of construction and during construction phase
Workers health and influence of workers on local communities	<ul style="list-style-type: none"> Development of an HSE Policy for the construction phase. Development of an HSE Management Plan for the construction phase (shall include a Waste Management Plan). Installation of an HSE Management System (HSEMS) during the construction phase. 	CC	Included in construction costs	Prior start of construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
	<ul style="list-style-type: none"> • Make sure that all workers have a health insurance • Put in place sufficient sanitation facilities for workers. • Provision of HIV/AIDS protection equipment for workers. • Implementation of health and safety workshops for construction workers. • Installation of warning signs “Danger of Electrocutation” at towers, substations etc. • Accommodation of workers in adjacent towns has the first priority. In the case that construction camps are necessary these will be located in accordance with relevant municipal authorities. 			During construction
Impacts on climate	<ul style="list-style-type: none"> • The Project itself will have only very marginal impacts on the climate during the construction phase. Some specific measures to reduce exhausts from machines and vehicles are given above. 	CC	Included in construction costs	During Construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Effects on historical and cultural sites	<ul style="list-style-type: none"> • Identification of known historical and excavation sites and sensitive areas for unknown historical sites together with local experts of the Department for the Protection of Monuments and Historical Sites of RA during final routing / land survey. • Training of the construction workers to stop earth or foundation works immediately if there are any signs for historical or cultural sites. • Report of chance finds immediately to the Ministry of Culture, Department for the Protection of Monuments and Historical Sites of RA. • Agree with representatives of the Department for the Protection of Monuments and Historical Sites of RA if towers can be shifted a few meters forward or backward in case historical excavation sites are touched. • Agree with the Department for the Protection of Monuments and Historical Sites of RA where over-spanning of historical sites is possible and where bypasses of important cultural sites have to be realised. • Agree with Ministry of Culture if compensation for restoration or excavation of selected important areas is an option in order to maintain line routing at other (less important) sites. 	HVEN, CC	Included in construction costs	During detailed land survey and during construction process
Infrastructure	<ul style="list-style-type: none"> • Ensure that traffic is not interfered by construction through proper traffic management. 	CC	Included in construction costs	During construction
Infrastructure	<ul style="list-style-type: none"> • Dismantling of towers of the old line will reduce the existing impact on the landscape (less towers than before). 	HVEN/CC	During construction	During construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Power supply of the nuclear power plant	<ul style="list-style-type: none"> Development of a detailed risk analysis and elaboration of an appropriate emergency plan in case of accidental cut of electricity power during construction especially in periods where the power flow of the old 220 kV line has to be interrupted for construction purposes. 	HVEN	unknown	Prior start of construction
Loss of crops and trees during design phase / land survey	<ul style="list-style-type: none"> Prior information of PAPs that plantations / trees (i.e. apricots, almonds etc) are likely to be affected during the design phase / land survey. Limitation of cutting trees and crops wherever feasible. Compensation for all damages caused during the land survey 	HVEN, CC	Included in construction costs	Before and during design phase / land survey

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Loss of crops and soil degradation through construction activities	<ul style="list-style-type: none"> • Utilisation of existing main roads and village tracks for the construction traffic as far as possible. • Limitation of construction of access roads. • Careful selection of access tracks/paths. • Line stringing shall be carried out with minimal interference to the ground / crops, helicopter stringing for sensitive areas (i.e. town of Gavar). • Location of laydown areas close to existing roads in non-productive areas to minimise interference with agricultural activities and to facilitate site clean-up and rehabilitation. • Careful routing of the access road to minimize the impacts on agricultural land. • Limitation of the construction activities to selected areas within the construction corridor. • Demarcation of the extent of the laydown areas. • Minimizing surface of and damage caused by workers' camps (if applicable). 	CC	Included in construction costs	During construction phase
Loss of crops and soil degradation through construction activities	<ul style="list-style-type: none"> • Compensation payments for PAPs for damages and loss of crops. • Documentation of compensation payments. • Presence of a person to receive complaints during the construction process. 	HVEN, International Consultant	Estimate not possible at present	During construction phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Involuntary resettlement; loss of houses and livelihood	<ul style="list-style-type: none"> Development of a Resettlement Action Plan (RAP) including PAP census, detailed inventory of losses, socio-economic surveys based on the present Resettlement Policy Framework (RPF). 	HVEN, International Consultant	Estimate not possible at present	During land survey
Loss of land for towers, access roads and affected houses	<ul style="list-style-type: none"> Compensation payments for PAPs for expropriation of land. Documentation of compensation payments for expropriation. Presence of an impartial person to receive complaints during the construction process. 	HVEN, International Consultant	Estimate not possible at present	Before and during construction phase
Involuntary resettlement; loss of houses and livelihood	<ul style="list-style-type: none"> Line routing shall be selected to minimize the need to displace people. Public consultation about resettlement options with PAP incl. land for land compensation. Shifting of towers for a few meters to avoid resettlement wherever necessary and possible. Payment of full compensation for lost property and support for new house construction, incl. moving allowance, legal support and livelihood restoration to a minimum pre-project level. An accessible grievance mechanism has to be put in place and communicated to PAPs (see RPF). Equal involvement of male and female members of the household in resettlement decisions. 	HVEN, International Consultant	Estimate not possible at present	Immediately after land survey/ design of final routing

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Livelihood restoration and improvement	<ul style="list-style-type: none"> • Consultation with PAPs about their development priorities in the framework of RAP development. • Health awareness workshops for workers by a specialized NGO. • Support of vulnerable households (especially women headed households) with a micro-credit / revolving fund program managed by a Women NGO. • A saving and investment support program shall be carried out to support sustainable utilization of compensation payments. • Liaison with development projects of national and international organisations to avoid duplication (i.e. UNDP etc.). 	HVEN, Consultant, NGOs	300,000 USD	After land survey
Grievance mechanism	<ul style="list-style-type: none"> • Implementation of an accessible grievance mechanism for PAPs to address complaints at the local level. • Monitoring of grievances through consultation with PAPs during construction process by an independent consultant. 	HVEN	25,000 USD	During and after construction
Gender	<ul style="list-style-type: none"> • Zero tolerance for sexual harassment at the work place or in workers' camps / overnight locations. • Woman headed households need to be considered especially during public consultation, census and monitoring for empowerment, economic and legal support. 	CC	Included in construction costs	During construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Gender	<ul style="list-style-type: none"> • Strengthen district administrations on gender issues (i.e. receive complaints by women). • Cash compensations shall be made in presence of male and female household members. • Bank accounts shall be accessible both for male and female household members. 	HVEN / RAP Consultant	No extra costs	During final land survey / expropriation Inventory
Vulnerable People	<ul style="list-style-type: none"> • Special livelihood support for very poor, marginalised people, women-headed households, ethnic minorities and refugees. 	HVEN	Included in livelihood restoration and improvement costs	During final land survey / RAP

Mitigation Measures for the Operational and Maintenance Phases

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Seismic activities	<ul style="list-style-type: none"> The design of towers will be adopted to the seismic risk level in the investigation area. 	CC	Included in construction costs	During design phase
Flora	<ul style="list-style-type: none"> Herbicides for ROW clearing measures will not be used. 	HVEN	Included in operational costs	During operation
Electric and magnetic fields	<ul style="list-style-type: none"> A minimum safety distance of 7 m from a house to the closest conductor has to be respected. From other similar projects it can be reasonably assumed that in this distance the limit values for electric and magnetic fields for the public are not exceeded. It has to be mentioned that Armenian standards only require a minimum distance of 4-5 m. 	CC/ HCEN	Included in design	During final land survey
Land use	<ul style="list-style-type: none"> Land within the ROW can further be used for agricultural purposes. Compensations for damaged crops during maintenance. 	HVEN	Included in operational costs	During operation

Summary of Monitoring Measures

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored/ type of monitoring equipment?</i>	When <i>is the parameter to be monitored- frequency of measurement or continuous?</i>	Why <i>is the parameter to be monitored (optional)?</i>	Cost		Responsibility	
						Install	Operate	Install	Operate
C o n s t r u c t i o n	Realisation of mitigation measures	Construction site	Audit by an independent international consultant	3 times a year during construction activities	Ensuring that the proposed mitigation measures are realised		50,000 USD per year in total 100,000 USD	HVEN	HVEN
	Monitoring of compensation payments for crop damages during erection of towers and stringing	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensuring that the farmers get sufficient compensation for lost crops		60,000 USD per year in total 120,000 USD	HVEN / Consultant	HVEN
	Monitoring of compensation payments for land acquisition for tower sites	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensuring that the owners get sufficient compensation for acquired land				

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored/ type of monitoring equipment?</i>	When <i>is the parameter to be monitored- frequency of measurement or continuous?</i>	Why <i>is the parameter to be monitored (optional)?</i>	Cost		Responsibility	
						Install	Operate	Install	Operate
C o n s t r u c t i o n	Monitoring of compensation payments for displacement actions	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensuring that affected households get sufficient compensation for acquired properties / effective relocation and livelihood restoration including provision of new house		60,000 USD	HVEN / Consultant	HVEN

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored/ type of monitoring equipment?</i>	When <i>is the parameter to be monitored- frequency of measurement or continuous?</i>	Why <i>is the parameter to be monitored (optional)?</i>	Cost		Responsibility	
						Install	Operate	Install	Operate
O p e r a t i o n	Electric and magnetic field	Buildings remaining within the ROW	Electric and magnetic field measuring devices	Once after the start of the operation of the OHL	To document that internationally accepted limits for electric and magnetic fields are met	EMF-Meter 15,000 USD	Staff of HVEN	HVEN	HVEN

Further specific monitoring activities during construction period will have to be implemented related to:

Impact of/on	Monitoring Activity
Line Routing	Visual control (in Google Earth/ Field Visit) of final line routing including selected bypasses by independent expert.
Access Roads	- Control of low impact construction standards - Record keeping of length built and length rehabilitated/ decommissioned after project completion.
Surface Water	- Visual control of downstream water quality (turbidity), regular measurements of upstream / downstream basic parameters (pH, temperature, conductivity, redox state), plan for detailed analysis (e.g. for hydrocarbons) if pollution / spills are suspected. - Visual control that any temporary bridges are properly constructed, do not cause deterioration of river bed and are dismantled after completion.
Groundwater	Selection of existing wells for baseline analysis of basic parameters (see above) and 1-2 measurements during construction period and after completion.
Land Use / Waste Management	Visual control of economic land use, proper topsoil management, erosion control and post construction site restoration. This should be reviewed in the final design also and in the field checked for design compliance. Visual control and record keeping of proper waste disposal, including recycling.
Noise	Short term impact during construction, no specific monitoring necessary.
Vehicle Emissions	Maintenance records of trucks and machines.
Construction Waste	Visual control that construction waste is effectively managed.
Traffic Safety	Short term impact during construction, no specific monitoring necessary.
Work Safety /Sanitation	Included in construction Site Audit.
Physical Cultural Heritage	Photo-documentation of key sites close to alignment before start and after completion of construction, visual control that sensitive areas are fenced off and secured against unintended damage by construction activities.

Impact of/on	Monitoring Activity
Tower Locations and Construction	Visual control that towers are located with minimum local environmental impact and that construction activities are restricted to as small an area as possible (incl. access roads).
Affected Houses / Resettlement	Visual control and photo-documentation of resettlement activities and re-installation including GPS data.
Grievance Mechanism	Social survey by independent expert to find out if grievances have been settled.

Training of HVEN Staff

At HVEN there is no Social/Environmental Department and no prior experience of international requirements exists concerning transmission line construction or rehabilitation.

The creation of a Social/Environmental Department in HVEN and a training of qualified staff are therefore highly recommended. Trainings should focus on the application of World Bank safeguard policy and monitoring procedures (see also Chapter 6.3 in RPF).

Provision for training requirements is of about 50,000 USD.

1.7 Costs ESMP Implementation

Measure	Costs [USD]
Mitigation measures during design	10,000
Mitigation measures during construction	375,000
Mitigation measures during construction for compensations and resettlement needs	3,000,000 – 7,000,000*
Mitigation measures during operation and maintenance	none
Monitoring measures	295,000
Training for HVEN HSE staff	50,000

*Depending on resettlement needs and valuation results in final design stage

1.8 Overall Findings and Recommendations

It can be concluded that the **Transmission Line Reconstruction Project Hrazdan to Shinuhair** can be constructed and operated **without having significant adverse impacts** on the social and ecological environment in the investigation area and its surroundings, if all proposed mitigation measures are implemented.

Careful line routing will help to minimize impacts on cultural and historical sites especially in areas where the remnants are still unearthed. Precondition is the involvement of members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture in the selection of the final routing done by the construction contractor. Especially the construction of access roads and the final location of towers have to be implemented very carefully to avoid any sensitive historical area, making future excavation activities possible. In case of chance finds of historical artefacts the construction process has to be stopped immediately and the local representative of the Department for the Protection of Monuments and Historical Sites / Department of Cultural Heritage has to be contacted.

The proposed line including the suggested bypasses will not cross sensitive zones of Protected Areas. Involuntary displacement and relocation can be mitigated to an absolute minimum. If the priority to avoid involuntary displacement is respected by the construction contractor and bypasses are carefully designed, involuntary displacement can be totally avoided.

It is strongly recommended to develop a detailed risk analysis for the stability of the Armenian power grid during construction of the new overhead line and to set up an effective emergency plan to exclude any risk of power supply failure of the nuclear power plant during construction of the new 220 kV OHL.

The overall construction shall be supervised by an independent international expert. The duty of such an HSE Audit shall be to ensure that the requirements

stipulated in the Environmental and Social Management Plan to this Project are fulfilled. Focus shall be put on:

- Avoidance of houses in the ROW to minimize resettlement, if possible to zero;
- Avoidance of historical sites;
- Avoidance of protected or ecological sensitive areas.

These extensive supervision activities are necessary because the elaboration of detailed design features including detailed line routing is not known yet. The determination of the details is shifted to the construction contractor and could therefore not be covered by this study.

It is also recommended to dismantle the old line in total and to recycle steel parts or to take them as spare parts. This would help to minimise environmental impacts caused by the physical presence of the overhead transmission lines.

Within HVEN an Environmental and Social Department does currently not exist. It is recommended to implement such a department and train the staff regarding all health, safety and environmental aspects including social aspects that will invariably arise during construction and operation of overhead lines and their associated substations.

It is recommended that the World Bank takes on the responsibility to make sure that the ESIA is read and understood by the selected designer of line routing / Construction Company. The ESMP and RPF have to be part of the tender documents. A review of the final design by independent social and environmental experts is recommended.

In cooperation with the World Bank and the design monitoring experts, HVEN will give the directive to redesign sections that have been identified within the ESIA or are identified during the course of the design process.

A significant change of line routing i.e. from valleys on the mountain side would have important environmental impacts, especially as it would then almost certainly lead through Protected Areas. This would result in a change of the Category of the project from Category B to Category A and make the present ESIA unsubstantiated.

There are several areas where tradeoffs between social and environmental impacts are expected. Whereas a construction of bypasses to the old line on the mountain side may have less social impacts, the environmental impacts will be higher. On the other hand, the corridor parallel to the old line is expected to have higher social impacts and less environmental impacts. It is argued that a careful design will be able to balance the impacts, avoiding resettlement as the highest priority, without increasing environmental impacts i.e. by long access roads or crossing protected areas and without affecting cultural heritage sites. Also quite often, design options are able to reduce environmental as well as social impacts at the same time as i.e. in town of Gavar (N1-N6 Lichk line). For more details refer to chapter 6 and 7 as well as Annex 12.3.

Line section	Tower No.	Location	Impact Criteria	Recommendation
Noratus	N 96 – N 149	Villages Lchashen, Lchap, Hayravank	Planned line is near to villages on village development land. A new bypass would not represent major environmental impacts	Design of new bypasses linking towers N96-N134 and N134-N149 should be considered in order to move away from villages and lake shore zone
	N171, N171A; N172 And	Town Gavar	Massive Involuntary resettlement needs to be avoided. Trees in old line corridor Houses under the line	Use old towers before and after Kamo Substation / incurring power cut. Alternatively study possibilities of underground cable, which would also increase experience in Armenia with this type of technology
Lichk	N 1- N 6	Town Gavar	Avoidance of Involuntary resettlement in town of Gavar	First five towers of Lichk line should be reconstructed in old corridor in order to avoid resettlement and cutting of forest. Study possibilities of underground cable for this section.
	N 48- N 84	Bypass of Village Yeranos, Dzorgyugh etc.	Avoidance of involuntary resettlement as a priority issue	Bypass of villages needs to be constructed to avoid resettlement as a priority. Bypass should be designed not to affect cultural sites. Alternatively an underground cable would be a smart option in this section (cost effectiveness compared with large bypass should be studied)
Vardenis	N1; N2	Village Lichk	Property issues; plots earmarked for house construction, village development; no houses directly affected.	PAP consultation, transect with community leader, study of potential bypass corridor
	N4 – N18	Village Verin Getashen	Property issues; plots earmarked for house construction, village development; no houses directly affected.	A bypass from bypass angle tower 15 of Vardenis Line before Lichk SS to N18 Lichk line should be considered in order not to affect village extension land
	- N36	Bypass of village Madina	Ancient settlement of Sanei Gomesh is situated in bypass area.	Bypass needs to be reconsidered in order to avoid cultural heritage site and involuntary resettlement
	N100- N107	Selim Pass Road	- Avoid Erosion and problem of little construction space	Consider bypass on mountain ridge

Line section	Tower No.	Location	Impact Criteria	Recommendation
	N 107 – N144	Village Taratumb	- Avoidance of resettlement in bypass area. Still 11 houses affected.	A line routing in the valley should be reconsidered
	N 151 – N 178	Village Shatin	- bypass of village Shatin represents risk of erosion (esp. access roads), but avoids resettlement; N 151 located in private garden	Bypass of village is necessary to avoid resettlement
Vayk	N7 – N 13	Village Agarakadz or	Avoidance of Resettlement	Bypass of village as corridor of old line is narrow. Underground cable as an option.
	N ?	Malishka / Arpa Narrows	Narrows between river, village and mountain - a bypass via mountain would have undesirable environmental impacts especially because of access roads; - a bypass via the village would have undesirable resettlement impacts	Use old towers / incurring power cut or study possibilities of underground cable, which would also increase experience in Armenia with this type of technology
	N 48 – N105	Vayk Gorge	Reconstruction parallel to old line would have big social impacts. The bypass over the mountains has limited environmental impacts, but juniper forest and migration corridor is on the other side of valley	Planned bypass of Vayk Gorge shall be constructed; Old line in Vayk Gorge needs to be dismantled completely
	N 120 – N123	Village Saravan	Planned parallel line ROW affects several houses	Bypass shall be deviated to the North.
	N 132- N134	Forest Area Vorotan Pass	The oak forest area before Vorotan Pass is rather small and not very dense. Access is possible without needing to cut many trees.	Minimize tree cutting; Over-Spanning is recommended.
Vorotan 1		Entire Line	Minimization of Access roads and destruction of grass land by trucks.	Avoidance of settlements and cultural sites should not be problematic

It is recommended to bring the ESIA to the attention of the selected construction contractor and to include ESMP / RPF as integral part of the tender documents.

The role of the World Bank is to monitor safeguard compliance during design and construction phase.

In order to comply with World Bank safeguards on public consultation and Aarhus Convention the information and consultation with PAPs is crucial and needs to start during the design phase and continue throughout the construction process.

- Information of PAPs with brochures, announcements via local TV, Radio, newspaper during the design stage.
- Focus Groups with PAPs during design stage including consultation protocols in every affected village
- Transects with Community leaders of every affected village during design including minutes of visit
- Transects with representatives of Department for the Protection of Historical Monuments during design phase including consultation protocols/minutes
- Development of RAP including census, inventory of losses and social survey if compensation and resettlement was satisfactory for PAPs
- Respect of consultation periods
- Additional monitoring of public consultation process and functioning of grievance mechanism.

2. Introduction

2.1. Project Description

The Government of the Republic of Armenia has requested financial assistance from the World Bank (WB) to perform the environmental due diligence process for the Electricity Supply Reliability and Energy Efficiency Project (ESREE). Besides the component of energy efficiency, ESREE implies an electricity transmission component aiming at a complete replacement of the about 225 km long high-voltage transmission line from Hrazdan substation (in the north-east of Armenia) to Shinuhair substation (in the south of the country) to enhance the reliability and capacity of the transmission network and to close the power supply gap in Armenia.

This power transmission rehabilitation component (named “the Project” in the following) comprises the five separate sections (approximate lengths): Noraduz (45 km), Lichk (25 km), Vardenis (45 km) Vayk (70 km) and Vorotanl (40 km) from the central regions (KotaikeMarz), via the city of Vayk, to Southern Armenia (SunikMarz, City of Goris). Substations and plants are located in Hrazdan (Hrazdan Thermal Power Plant) Gavar, Lichk, Yeghignadzor, Shaghat village (Spandaryan Hydro Power Plant) and Shinuhair. The Project will include the erection of new towers/pylons including foundations, replacement of existing conductors, insulators and other key pieces of infrastructure and equipment.

The new transmission line will mostly run parallel to the old one (50 m distance). It will mainly follow the existing Right of Way (ROW) with deviations to bypass settlements, cultural sites, difficult terrain etc.

The existing line has been commissioned in 1956. It is at the edge of its life span and technically not up-to-date anymore. In the course of this replacement the diameter of the conductors being 300 mm² today will be augmented to 400 mm² in order to increase capacity and reliability of power transport.

Very few details are known about the technical features of the line. The detailed design including final land survey is shifted to the construction contractor and will be part of the tender documents. In general, the average distance between the towers will be around 300 m and the average land that has to be acquired for the towers will be 100 m².

The number of towers of the present line is 870. MVVdecon estimates the number of required new towers to be 719 what would correspond to an average distance between the towers of a little bit more than 300 m. Considering several bypass areas and the difficult terrain, the number of towers is estimated to be approximately 820. However, the number of required towers greatly depends on the construction type of towers used, which is not known at present and will be decided by the construction company.

The transmission line corridor for the 220 kV rehabilitation project Hrazdan to Shinuhair I is shown in Map 2-1.



Map 2-1: 220 kV transmission line corridor

2.2. Scope of the Study

Within the scope of this Environmental and Social Impact Assessment, FICHTNER investigated the environmental and social impacts of the replacement of the existing 220 kV single circuit transmission line with two short 220 kV section from Hrazdan TPP to Kamo (3.2 km) and Eghegnadzor to Spandaryan HPP (4.8 km). The total length of the line is around 225 km. It stretches from Hrazdan substation (in the north-east of Armenia) to Shinuhair substation (in the south of the country). This replacement project covers the new construction of a parallel line with some deviations around settlements.

On the basis of the existing environmental situation and the technical planning of the transmission line, FICHTNER determined and evaluated the environmental and social impacts during construction and operation of the proposed transmission line. The impact assessment focused on the ecological aspects of the Project and on the effects for the local population especially because of needed land for towers and involuntary displacement of houses from the Right-of-Way (ROW) corridor. In a second step appropriate mitigation measures, alternative routings and monitoring measures were considered to reduce possible adverse impacts.

During the investigation, main focus was put on to find a line routing that is feasible from a technical point of view which avoids a) the need of resettlement actions to the greatest extent possible and b) crossing of cultural and historical sites as much as possible.

Crossing of the buffer zone of Lake Sevan National Park (IUCN Cat. II) and Yeghegis Wildlife Reserve (IUCN Cat. IV) was carefully assessed. Potential problematic issues have been discussed with experts from WWF, Acopian Centre of American University of Armenia, local environmental specialists as well as staff of the Lake Sevan National Park. Despite winter conditions during the site visits, general environmental aspects of the area and the landscape could be assessed. Proposed bypass areas were studied especially.

Due to the nature of the Project, specific public consultations with affected people could not be executed because the final line routing is still under development. The final location of the towers will be fixed by the constructing contractor after conducting the final land survey. This is also the reason why cadastral data have not been purchased for presentation in this study. The location of suspension towers is unknown, even the position of the angle towers are not fixed in detail.

2.3. Procedures and Methodology

For preparing the ESIA study to this Project, FICHTNER set up the following multi-disciplinary team:

- International Senior Environmental and Ecological Expert;
- International Socio-Economic Expert;
- National Environmental and Legal Experts.

One basis for the study consisted of intensive field surveys conducted by the environmental expert and the socio-economist in February 2011 (see Chapter 12.2 ‘Record of Field Visits’). Additional information could be gained by consultations of representatives of governmental organizations and non-governmental organizations (NGO) (see Chapter 12.1 ‘Record of Meetings’). Intensive consultations have also been conducted with local members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture of all affected districts.

Additionally to the field survey, an evaluation of possible ecological and social impacts was performed by interpretation of satellite maps.

Due to the fact, that there is no official international consensus on an agreed approach for assessing the significance of impacts on the environment, FICHTNER uses an own evaluation procedure. This transparent evaluation procedure is based upon FICHTNER’s extensive experience over the last fifteen years in performing Environmental and Social Impact Assessments (ESIA) and has proven to be a reliable method for assessing a project’s impacts on the environment. It includes identification, prediction (e.g. duration, intensity, severity, status, reversibility of the impact) and evaluation of the significance of impacts based on legal requirements. Wherever possible, impacts are quantified. The focus of the used evaluation procedure is to decide whether the Project is likely to cause significant adverse environmental effects resulting from the construction and operation.

For the purpose of a transparent presentation and evaluation, a tabulated evaluation matrix is applied. On the basis of a point scale, the severity of the particular environmental impact together with its general trend - that is negative or positive - is described. The evaluation scale applied is as follows:

Extent of impact:

■ ■ ■	=	high
■ ■	=	medium
■	=	low
○	=	no impact
+	=	locally positive
++	=	regionally positive

For the judgement international standards like standards from the World Bank, World Health Organization (WHO) etc. are used (see Chapter 3.2) supported by national Armenian standards (see Chapter 3.1). According to these standards the evaluation of impacts is done as follows (Tab. 2-1):

Extent of impact	Reason
High	International and national standards are exceeded
Medium	Between international and national standards, international and national standards are barely met
Low	International and national standards are met

Tab. 2-1: Evaluation of impacts using International and National Standards

With the presented method it can be clarified which environmental impacts are most important and for which impacts mitigation measures must be applied in order to reduce negative effects on the environment.

3. Institutional and Legislative Framework

3.1. Institutional Framework and National Requirements

Following independence in 1991, the environmental legislation was reviewed, with the aim of developing a more comprehensive state policy towards ecological protection and sustainable use. To this end, a series of laws have been developed, including regulations relating to protected areas, a land code (both 1991) and a forest statute (1994). From 1999 to today, a number of national laws of RA were implemented to regulate the protection of the environment. A summary is given in Tab. 3-1 below.

Law/policy	Date	Key areas
The Law on Principles of Environmental Protection	1991	The law states the overall environmental protection policy and establishes a framework within which the Parliament will develop specific separate acts to protect the atmosphere (air), water, soil, natural (mining) resources, forest, flora, fauna, specially protected territories, endangered species, and manage waste, etc.
The Law on Specially Protected Territories,	1991/2006	The law determines different levels of protection of different kinds of specially protected territories and puts the responsibility on the state. The current, active law “on specially protected territories” was adopted on November 27, 2006. According to the new law, a national park is “a territory of international and/or national significance where there are nature protective, scientific, historical-cultural, aesthetical, recreational values which, due to the integration of natural landscapes and cultural values, can be used for scientific, educational, recreational, cultural and economic purposes and for which a special regime of protection is foreseen”. The law also foresees the following functional zones within the national park: reserve; sanctuary; recreation; and economic use (where economic activities consistent with the conservation objectives of the national park are allowed).
The Land Statute	2001	The code underlines the importance of not damaging the environment or the defence or safety of the country: “Land ownership, utilization and arrangements should not cause any damage, should not violate the law and interests of the population”.
Act on “Water”	2002	This act mainly regulates water-use relations. In article 3 the Code states that “The State ensures the conservation and protection of water from negative impacts and its use for the sake of the security of all persons”. Important principles of water management include: the need to satisfy the daily requirements of present and future generations; protection and redemption of volume of national water resources; protection of water and adjacent ecosystems and their biodiversity; acceptance of integrity, interconnectivity of interrelations of land, air, water and biodiversity; regulation of water utilization by means of permits for water extraction.

Law/policy	Date	Key areas
Law “On Protection of Atmospheric Air”	1994	The objective of the law is early warning and elimination of air pollution, and international cooperation in the field of air protection. Important elements of the law include: norms for maximum permissible concentrations of emissions, regulation of polluting emissions, location and design of enterprises, and audit, monitoring and control of air quality.
Act on “Forest”	1994	According to this act, the forest is the exclusive property of the Republic until it grows up to industrial utilization volume. Currently the Armenian forest is the subject of protection, rehabilitation, recreation and sustainable utilization only. Only temporary utilization (up to 5-10 years) under supervision of a state authorized body and local authorities is allowed.
The Law on Payments for Nature Protection and Use of Natural Resources	1999	The law defines the concepts of nature protection and use fees, the scope of the payers, types of fees, procedures for calculations and payment of the fees, the liability in case of violation of this law and other relations connected to the fees. The types of nature protection fees are: a) For releasing harmful substances into the environment (aerial and water basins) b) For disposal of industrial and consumption wastes in the environment, according to defined procedures c) For industry of products that are harmful for the environment
The Act on Flora	1999	The Act on Flora defines the State policy of the Republic of Armenia on scientifically motivated protection, maintenance, reproduction and use of natural flora.
The Act on Fauna	1999	The Act on Fauna aims to: ensure conservation of animals and their genetic diversity, maintain the integrity of animal populations, protect animals from inappropriate disturbance, protect migration routes and regulate use of animal species. The responsibilities of different agencies (including the government, ministries and other State bodies, local authorities and local self-government institutions) are outlined. The draft law makes provision for: survey, study and monitoring of animals; listings of animals and their use; elaboration of the Red Data Book for animals; setting goals for animal conservation; measures for dealing with disputes; and international agreements relating to animal conservation issues.
Law “On Sevan National Park”	2001	The introduction to the law “on Lake Sevan” states: “The present law defines the legal and economic basis of State policy on the natural development, restoration, reproduction of natural resources, conservation and utilization of Lake Sevan as an ecosystem of strategic significance for the RA, having nature protective, economic, social, scientific, historical-cultural, aesthetic, health improving, climatic, recreational and spiritual value. Lake Sevan is a strategic treasure house of fresh water for the RA”. As a specially protected territory, Sevan National Park has a buffer zone surrounding its territory where economic activities are allowed, provided that they do not conflict with the normal development and functioning of the ecological system of the specially protected territory.

Law/policy	Date	Key areas
The Law on Alienation of Property for Social and State Needs	2006	The constitutional base for the expropriation of property for public and state purposes is the exceptional prioritized public interest. Constitutional conditions for the expropriation of property for public and state purposes are: a) Expropriation should be provided within law regulation. b) The equivalent compensation against expropriated property should be provided in advance (hereinafter referred to as Compensation). (For more details see Resettlement Policy Framework RPF)
Law on Preservation and Utilisation of Immovable Monuments of History and Culture and of the Historic Environment	1998	The key law that regulates heritage issues and policies sphere is the Law on Preservation and Utilisation of Immovable Monuments of History and Culture and of the Historic Environment (1998), which defines historical and cultural monuments and the responsibilities of state governing and local self-governing authorities in the field of monument protection, usage and so on.
The Law on Environmental Impact Assessment	1999	The Law on Environmental Impact Assessment contains the standard steps of the EA process for various projects and activities in Armenia (for more details see below). The Law of the RA “on Environmental Impact Assessment” (1995) and the law of the RA “on Ecological Education and Awareness of the Population” (2001) aim at ensuring the participation of the population, NGOs and professional experts in decisions concerning the protection of the environment.

Tab. 3-1: National laws of RA were implemented to regulate the protection of the environment

Land Code of RA

“Taking into account the nature protection, economic and social significance of the land, for which it is used and protected as the warranty of vital activity of the population of the Republic of Armenia, the Land Code defines the basic directions of State regulatory system improvement concerning land relations, development of various organizational and legal forms of land economy, fertility of land, land use efficiency raise, protection and improvement of an environment – favourable for human vitality and health and the legal framework concerning the protection of the rights on land“ (Land Code of the Republic of Armenia).

Ownership, use and disposition of land must not harm the environment, security and defensibility of the State; must not violate rights and legally defined interests of citizens and other entities.

Article 2 specifies the state regulations of land relations and the principles of land valuation and land alienation for public needs.

The State regulation of land relations includes:

- 1) Definition of directions of the State policy concerning management, ownership, use and disposition of land resources;
- 2) Adaptation and control over the implementation of laws and statutory legal acts on the regulation of land relations;
- 3) Definition of procedures on land reforms;
- 4) Definition of the available land in accordance to appropriation, operational importance and type;
- 5) Implementation of projects and integrated investment policies concerning increase of land fertility, land-use, protection and agricultural utilization;
- 6) Definition of integrated principles of licensing of activities aimed at land monitoring, earth engineering and land investigation;
- 7) Regulation and disposition of State propriety land, definition of procedures on alienation and use of land belonging to the State by the rights on property and on allowable use and alienation of land;
- 8) Alienation of the land, belonging to the citizens and legal entities by the right on property, and use for public needs;
- 9) Definition of a special legal regime and restrictions on use of land of special appropriation;
- 10) Implementation of the international cooperation concerning use, protection and increase of fertility of the land;
- 11) Definition of authorities and performance procedures of State authorized bodies on management of land resources (hereinafter: authorized management bodies), other bodies of State governance and local self-governing bodies, and their interrelations;
- 12) Adaptation of land zoning and use mechanisms;
- 13) Adaptation and publication of the annual State report on land;
- 14) Maintenance of the integrated State cadastre on real estate;
- 15) Definition of land chargeability principles, land tax quotas and tax privileges;
- 16) Adaptation of administrative divisions of communities and marzes (administrative unit).

General EIA requirements in the Republic of Armenia

Any stipulated activity or concept /program/ in the Republic of Armenia, which have certain impact on the environment in the result of their implementation and introduction, can be implemented in case of a positive conclusion of environmental expertise.

The impact of the stipulated activity or concept on the environment is assessed in the drafting and preparation phase and is submitted to the environmental expertise by the client.

The RA Law “On Environmental Impact Assessment” stipulates provisions related to the environmental impact assessment, its implementation and deadlines.

The Law on Environmental Impact Assessment

The Law on Environmental Impact Assessment contains the standard steps of the EA process for various projects and activities in Armenia. Articles 2-5 define the legal, economic, and organizational principles for conducting the

mandatory state EA for various projects and "concepts" of sectoral development (e.g. energy, mining, chemical industry, construction, metallurgy, pulp and paper, agriculture, food and fishery, water, electronics, infrastructure, services, tourism and recreation).

Article 4 defines those activity sectors which are subject to expertise in any case or in case of exceeding certain thresholds. According to the law requirements, the mentioned thresholds are set by the Governmental Decree N193 issued on 30.03.1999.

The "special status" of a particular territory may also trigger a review of environmental impact. The Ministry of Nature Protection can initiate a review of environmental impact when it considers it necessary to do so. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements.

The implementation of environmental assessment is authorized to the RA Ministry of Environmental Protection, which has established "Environmental Expertise" State Non-commercial Organization (SNCO) for organising expertise procedures.

The initiator of the activity submits the package of necessary documents to the RA Ministry of Environmental Protection. The Minister directs the package to SNCO, which signs a contract with the client on the implementation of environmental expertise. The expertise is paid and the rates of payment are identified by the Minister's order.

During the expertise the client notifies about the main thresholds of possible adverse impacts of the stipulated activity and organises public hearings coming to an agreement with SNCO.

According to the Law, the maximum deadline of expertise is:

- for stipulated activity up to 120 days; it can be prolonged by the Ministry up to 180 days in more complex cases;
- for concepts up to 90 days.

According to Article 4, a reconstruction project of high voltage lines is classified under the "transmission lines" point of sub-structural sectors, for which a 35 kilovolt threshold is set by the Governmental Decree N193. According to this requirement, all construction or reconstruction projects exceeding that threshold are subject to an environmental impact assessment.

International Agreements ratified by the RA

Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity:

International Agreements ratified by the RA:

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971). Armenia ratified the Ramsar Convention in 1993, however, despite the international importance of Lake Sevan and Lake Arpa, little has been done to implement this convention.

Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention, Paris, 1972). This convention was ratified in 1993, however, there is little available information on implementation.

Convention to Combat Desertification (UNCCD, Paris, 1994). The UNCCD was ratified by Armenia in 1997. A project is currently being developed to meet obligations under this convention.

Framework Convention on Climate Change (UNFCCC, Rio de Janeiro, 1992). The UNFCCC was ratified by Armenia in 1993, and production of a Country Study on Climate Change is underway.

Convention on Biological Diversity (UNCBD, Rio de Janeiro, 1992). This convention was ratified by Armenia in 1993, and the first stage of implementation is currently being undertaken including the development of a National Biodiversity Strategy and Action Plan, and this first National Report (incorporating a Country Study of Biodiversity) to meet reporting requirements to the convention.

(source www.cac-biodiversity.org)

Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters

Public participation in decision-making is the second “pillar” of the Convention. Public participation cannot be effective without access to information, as provided under the first pillar, nor without the possibility of enforcement, through access to justice under the third pillar.

Most relevant for this project is Article 6 Aarhus convention.

Article 6 concerns public participation in decision-making by public authorities on whether to permit or license specific activities. It does not require a licensing or permitting procedure to be established, as do international instruments on environmental impact assessment, but once such a procedure is established, the public participation requirements of article 6 must be implemented as part of it. In every country, however, some government approvals are required to engage in the kinds of activities that are covered in Annex I to the Convention.

The Convention recognizes that people have the right to take part in basic decisions affecting their lives. It also recognizes that the quality of these decisions can be improved through the active involvement of the public concerned. Public participation in decision-making pulls together many of the threads of the Convention into concrete results, and thus is one of its most important subjects. Article 6 is to be enforced by article 9, paragraphs 2 and 3.

Provisions, Obligations, Implementation guidance for Aarhus Convention (art. 6)

Article 6, paragraph 1

Requires Parties to guarantee public participation in decision-making with a potentially significant environmental impact

- List of activities (annex)
- Non-listed activities
- National defence exemption

Article 6, paragraph 2

Sets requirements for notifying the public concerned about the decisionmaking

- Early in the process
- “Adequate, timely and effective”
- Minimum contents

Article 6, paragraph 3

Sets time-frames for public participation procedures within a decision-making process

- Specific time limits must be established
- Must provide enough time for notification, preparation and effective participation by the public

Article 6, paragraph 4

Requires that public participation take place early in decision-making

- Options are open
- Public participation may not be proforma

Article 6, paragraph 5

Encourages exchange of information between permit applicants and the public

- Before permit application
- Provide explanations
- Enter into dialogue

Article 6, paragraph 6

Requires public authorities to provide the public concerned with access to all information relevant to the decision-making

- Free of charge
- As soon as available

Article 4, paragraphs 3 and 4, exceptions may apply

- Minimum contents

Article 6, paragraph 7

Procedures for public participation

- In writing or public hearing
- Any comments, information, analyses or opinions
- Public to judge relevance

3.2. International Requirements

Following World Bank Guidelines are triggered by the Project and have taken into specific considerations:

World Bank Group

- OP/BP 4.01 + Annexes ‘Environmental Assessment’
- OP/BP 4.04 ‘Natural Habitats’

- OP/BP 4.12 + Annexes ‘Involuntary Resettlement’
- OP/BP 4.10 ‘Indigenous Peoples’
- OP/BP 4.11 ‘Physical Cultural Resources’
- Handbook for Preparing a Resettlement Action Plan, IFC Environmental and Social Department
- International Finance Corporation’s Performance Standards on Social & Environmental Sustainability, 2006
- World Bank/IFC General EHS Guidelines
- World Bank/IFC General EHS Guidelines for Electric Power Transmission and Distribution, 2007.

Other international guidelines used for the environmental assessment of the project are:

- ICNIRP Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (UP TO 300 GHz) (International Commission on Non-Ionizing Radiation Protection)
- CIGRE 1998: High Voltage Overhead Lines – Environmental Concerns, Procedures, Impacts & Mitigation.

3.3. Gap Analysis

The legal framework of the Republic of Armenia does in the essence correspond with the international regulations and safeguards.

Gaps however do exist in enforcement of the regulations. There is still a considerable lack of institutional capacities for implementation, monitoring and evaluation.

There have been improvements during recent years, compared to the analysis of CENN (2004)¹ but some problematic issues still persist.

There is a lack of specific Social and Environmental (S&E) qualification of staff and a specific S&E department does often not exist in the implementing institutions, partly the existing structures are overloaded with work and staff is not sufficiently remunerated. In some cases, power relations are unfavourable to guarantee an effective enforcement.

To some extent, the number of highly qualified staff is not sufficient to cope with the amount of work to guarantee an effective enforcement of the regulations.

The lack of access to legal support and lack of trust in the institutions, especially for weaker sections of the society may create further gaps concerning implementation of compensation and resettlement.

Additional training would be a necessary but however not sufficient component to improve implementation and monitoring performance. Compliance with international safeguards could be increased with independent monitoring by internationally experienced auditors/consultants.

Putting environmental and social compliance under the responsibility of the construction contractor should be clearly defined in contractor's TOR and credible monitoring measures should be implemented.

¹ CENN Caucasus Environmental NGO Network (2004): Assessment of Effectiveness of Environmental Impact Assessment (EIA) system in Armenia

4. Analysis of Alignment Alternatives

Four Project alternatives have been considered related to their scope of environmental interference and involuntary resettlement and based on following objectives:

- Minimizing the impact on the landscape and negative impacts on biodiversity and interference with Protected Areas;
- Avoidance of cultural heritage sites and areas of ecological interest;
- Avoidance of towns and development areas, to minimize involuntary resettlement.

Alternative 1: “Use of the old ROW and replacement of the line on the tower foundations of the old line”. This alternative would not cause significant expropriation of land and relocation of households as the tower foundations are already state property and in use, and there are only a few settlements in the present ROW. In a few cases the ROW has been used for new constructions, mainly of storage houses or stables, and in a few cases houses stand below the lines in a safety distance. However, due to technical reasons (stability of the electrical network, possible total power cuts in case of failures of the second 220 kV line), Alternative 1 was not chosen.

Alternative 2: “Replacement of the line next to the old ROW in a distance of 50 m”. This alternative means a new construction next to the old line. Acquisition of partly private lands would be necessary for all tower construction sites. The impact on settlements would be significant as the line traverses towns and villages. At least 100 households including several apartment blocks would have to be relocated selecting this alternative. Considering the high social impact on involuntary displacement this alternative was not chosen.

Alternative 3: “Replacement of the old line in a distance of 50 m using partly the old ROW and additional new bypasses around settlements and historical (excavation) sites”. Most of the line will be new construction; however at minimum three locations (two in the town of Gavar (Gegharkunik Marz), one at village Malishka (Vayots Dzor Marz)) the old corridor with old tower foundations will be used. This includes the use of towers after having improved them concerning their stability. Acquisition of partly private lands would be necessary for all tower construction sites. This alternative is planned with the aim not to cause the necessity to relocate households but the final design is not available yet. Few households might be affected. This is the chosen alternative. It is estimated that less than 20 houses have to be relocated. In some cases the planned bypasses may have to be revised to find better options from technical point of view.

Alternative 4: “No re-construction of the 220 kV line (No Project)”. This alternative would not result in any resettlement activities, but is not feasible because the existing line, commissioned in 1956, is at the edge of its life span and technically not up-to-date (e.g. diameter of the old conductors is 300 mm², but 400 mm² will be needed). If this line is not rehabilitated another line will have to be connected to the substations and power plants of the present line in the near future.

5. Baseline Conditions

5.1. General Environment and Ecology

5.1.1. Investigation Area

The investigation area covers the zone of the electrical network Hrazdan-Shinuhair in four different regions (Marzes) of the Republic of Armenia, namely Kotayk Marz, Gegharkunik Marz, Vayots Dzor Marz and Syunik Marz. The planned transmission line traverses or contours several villages and three towns. Otherwise, the area is sparsely populated, with a total population density below 40 persons/km².

Main geographical zones are Lake Sevan, Selim Mountain Pass, Arpa Valley and Sisian Plateau. The area has been inhabited from the ages of the Neolithic and is location of countless historical monuments, a big part of which is still unearthed. The planned transmission line follows to a great extent a branch of the great Silk Road. The investigation area partly overlaps with Sevan National Park, created in 1978 (IUCN Cat. II), and touches Yeghegis/Yeghegnazor Wildlife Reserve (IUCN Cat IV). The forest cover within the entire investigation area is estimated to be below 5%.

5.1.2. Geography

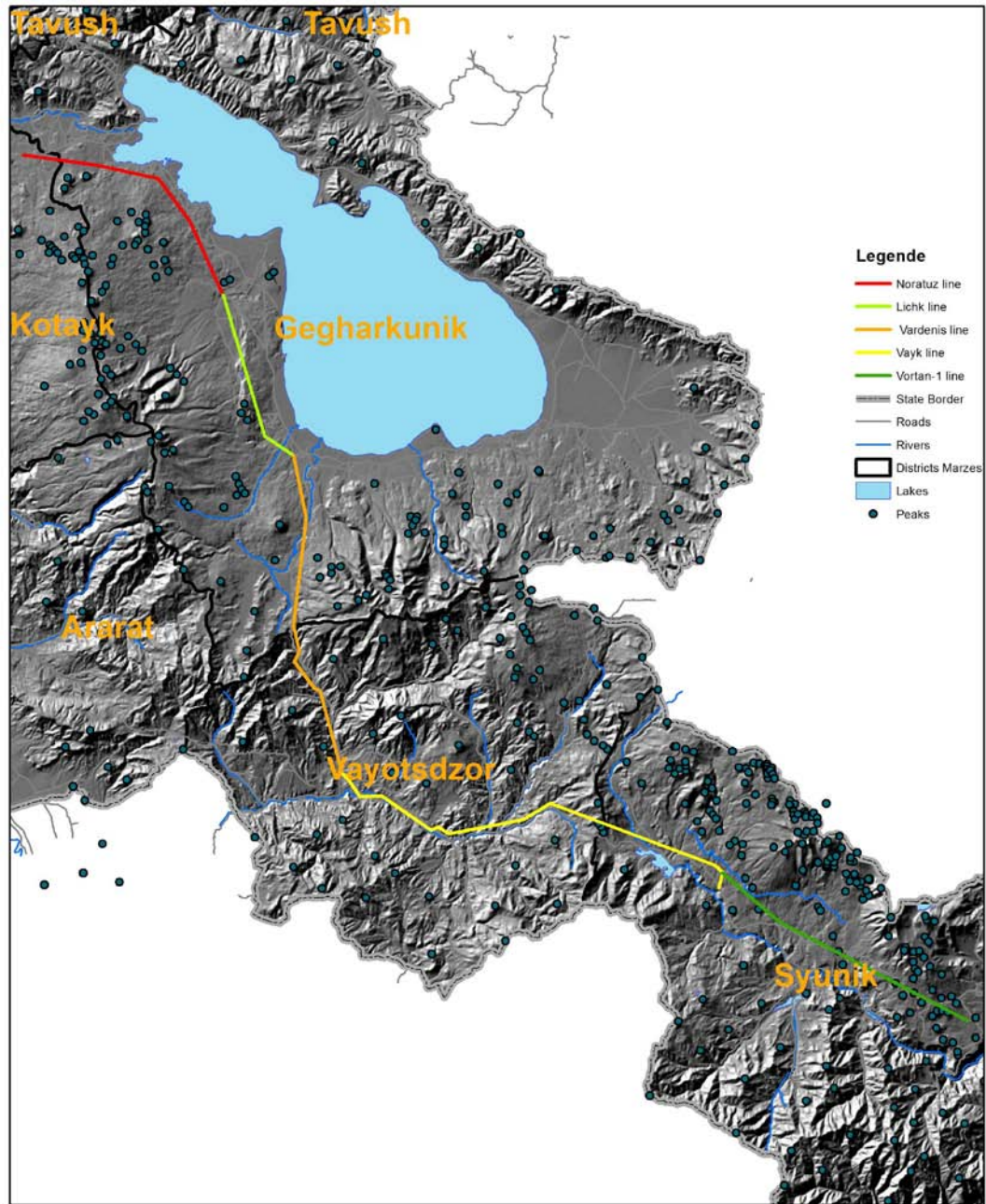
The topography of the Republic Armenia is characterized by high altitude, rocky plains with highland fields and pastures and mountain valleys with alluvial plains. The remaining few trees and open forest lands are often located in valleys and north-facing slopes. The entire investigation area is located between 1,093 m and 2,410 m altitude. Mountain tops reach between 2,600 m-3,600 m altitude. Major mountains around the investigation area are Mt. Azhdahak (3,597 m), Mt. Vardenis (3,521 m), Mt. Gndasar (2,946 m), Mt. Vayots (2,586m), Mt. Gogi (3,120 m), and Mt. Mets Ishkanasar (3,548 m). The first part of the line from Hrazdan Substation to Selim Pass is part of the Lake Sevan Watershed; from Selim Pass to Vorotan Pass part of the Arpa river watershed and from Vorotan Pass to Shinuhair Substation part of Vorotan Watershed (see Map 5-1).

The proposed 220 kV line starts at Hrazdan Substation (Kotayk Marz), stretches along the western shore of lake Sevan (1,898 m) in Gegharkunik Marz, passes numerous villages (Lchashen, Norashen, Hayravan, Lchap Yeranov, Vardadzor, Dzoragyugh, Lichk etc.) with agriculture terrains (mainly potatoes), the town of Gavar and parts of Lake Sevan National Park. From the south-western End of Lake Sevan (town of Lichk) the line leads towards SelimPass (2,410 m), where it crosses into Vayots Dzor Marz. The investigation area covers the villages of Verin Getashen, Madina, Lernakert, Geghovit and Yanegh and the fields and pastures of Selim Pass plains east of the extinct volcano Aghmaghan (2,815 m). From Selim Pass the line leads down the steep valley of Yeghegis River, passes the villages of Taratumb, Karaglukh, Salli, and Shatin and leads towards Yegegnadzor Substation and the Arpa Valley. Yeghegis Wildlife Reserve is bypassed on the western side of

the village Shatin. The lowest point of the transmission line is reached at the village Agarakadzor in the valley of the Arpa River at 1,093 m altitude, from where the line leads up the Arpa River Valley. The Arpa Valley stretches as a broad alluvial plain with vineyards, apricot plantations and fields up to the village Malishka from where the terrain is more rugged. After the town of Vayk the valley narrows to Arpa Gorge, with the village Seravan, beyond which the terrain raises steadily to reach Vorotan Pass at 2,344 m. Beyond the pass, high meadows extend towards the Spandaryan Reservoir, which is passed on its northern shore. The Sisian Plateau (between 2,130 m and 1,900 m) is reached after the village Shaki from where highland pastures are gently sloping down towards the Vorotan Canyon to reach the Shinuhair Substation at 1,545 m (see Map 5-2).



Map 5-1: Investigation area and proposed transmission line corridor



Map 5-2: Topography of the investigation area

Regional Data of Project Area	Kotayk Marz	Gegharkunik Marz	Vayots Dzor Marz	Syunik Marz
Location in RA	Center	East	South East	South East
Territory	2,089 km ²	5,348 km ² (Sevan Lake 1, 260 km ²)	2,308 km ²	4,506 km ²
Territory share of the marz in the territory of RA	7%	18%	7.8%	15.1%
Towns	7	5	3	7
Villages	62	93	52	127
Population number (Jan. 2007) (persons)	276,200	239,000	55,800	152,900
Including:				
-Urban	155,100 (56%)	79,600 (33%)	19,400 (35%)	103,700 (68%)
-Rural	121,100 (44%)	160,000(66%)	36,400 (65%)	49,200 (32%)
Approx. km of the line per region	10 km (5%)	80 km (36%)	70 km (32%)	60 km (27%)

Source: www.armstat.am; Marzes of the Republic of Armenia, 2002-2006

Tab. 5-1: Data about the regions crosses by the transmission line

The investigation area encompasses several distinctly different regions, ranging from the Shore of Lake Sevan, to the narrow mountain valleys of Yeghegis Valley and Arpa Gorge to the high plateau of Sisian.

Main features of the investigation area are:

- Agricultural plain between Hrazdan and Lake Sevan
- Lake Sevan Recreation Area and Lake Sevan National Park
- Villages and towns of western/south-western shore of Lake Sevan,
- Cultural Sites of Lake Sevan, Selim Pass, Arpa Valley, Sisian Plateau
- Villages of Selim Pass Valley,
- Summer pastures & settlements of Kurdish minority at Selim Pass
- Villages of Yeghegis Valley
- Yeghegis Wildlife Reserve
- Fruit tree orchards, vineyards and fields of Arpa River Valley
- Villages and towns of Arpa River Valley
- Juniper open forest land of Arpa River Valley
- Forested Area near Vorotan Pass
- High pastures and fields of Sisian Plateau
- Villages and towns of Sisian Plateau.

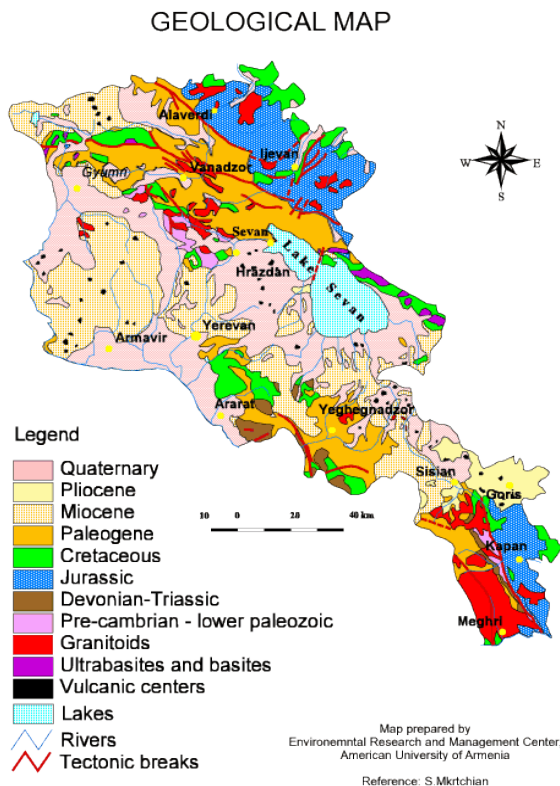
See also detailed impact identification list (Chapter 12.3)

5.1.3. Geology, Seismic Situation, and Soil

The terrain of Armenia can be divided into the following four main geographical/geological regions²:

1. Mountainous ridges and valleys in the north-east which occur mainly in the basin of the River Kur (including the ranges of Virahajots, Bazumi, Pambak, Gougarats, Aregouni and Sevan). This region is subject to extensive erosion.
2. Regions of volcanic origin, including the mountain ranges of Ashotsk, Aragats, Geghama, Vardenis, Syunik and Mount Aragats. These areas are covered by lava of relatively recent origin (upper Pliocene) and are characterized by gentle slopes. Here, only minor erosion occurs, although larger rivers have built deep gorges and canyons.
3. A series of ridged mountains adjacent to the River Arax (ridges on the left bank along with the Urts-Eranossian, Teksar, Vayk, and Zangezour mountain ranges, including the peak of Kapoutdjugh) constitute the Minor Caucasian system. This area is prone to intense erosion.
4. The Ararat Valley represents the lowest part of the Ararat depression (which is still undergoing tectonic movement). This area is covered with alluvial and proluvial sediments.

In the following, a geological map of Armenia is given:



Map 5-3: General geological map of Armenia

² http://www.cac-biodiversity.org/arm/arm_geography.htm

The planned transmission line will run through the Hrazdan Region, the Sevan Region, Vardenis Mountains, the river-bed of Arpa, the Sisian Region and the Goris Region.

The Hrazdan Region, is characterized by black earth free of lime. In the Sevan Region, the HVTN will pass through the western part of the Lake Sevan with its mountainous zone and will run in the western base of the Geghama volcanic plateau. This plateau is up to 3000 m high and shows a volcanic surface with hills and tops. With 3598 m, Azhdahak top is the highest top among them. The prevailing types of soil in this region include carbonic black earth. The Vardenis Mountains spread in the south-eastern parts of the Lake Sevan. They have an average height of 2500-3500 m and reach the highest top at 3522 m. Geologically, the region is composed of andezit, basalts, dacite, tufa and sandstone. In the western part the Vardenis Mountains border the Sulema mountain pass with a height of 2410 m. The region of Voyots Dzor is situated in the south of the Sulema mountain pass. In the river-bed of Arpa, brown soil free of lime can be found. The Sisian Region consists of a plateau with Alpine meadows. Its soil is formed under cold and damp climatic conditions. The Goris Region is characterized by mountains and canyons. The soil is mainly black carbonic earth.

Armenia is located in a **seismically active zone** stretching from Turkey to the Arabian Sea. Here, the Arabian landmass slowly collides with the Eurasian plate. As large earthquakes with magnitudes over 5.5 occur in Armenia every 30 to 40 years reaching magnitudes up to 7.1 on the Richter Scale, a high-level seismic hazard is indicated for the country. Maximum seismic risk is given around the city of Yerevan, where active faults exist. Here, the Garni earthquake in 1679 was the most destructive one, with a magnitude oscillating between 5.5 and 7. Another destructive earthquake with a magnitude of 6.9 occurred in Spitak in 1988³. Only recently (2011-02-27), an earthquake with a magnitude of 3.2 occurred 37 km north of Gyumri⁴.

5.1.4. Landscape

The landscape of the investigation area is marked by the general features of the Armenian high-plateaus: wide rocky mountain slopes and intervals of pastures and agricultural fields. Characteristic regional differences are Sevan shore in Gharkunik Region, Yeghegis and Arpa Valley in Vayots Dzor Region and Sisian plateau in Syunik region. Sevan lake shore is marked by the former shore line, located 16 m above the present water level as well as the lake-shore road and Sowjet, as well as recent tourism developments. The existing transmission line is located on the mountain side / western side of the road, not on the lake side, representing a rather low visual impact in this area.

The mountain plateaus are marked by wide spaces where electric transmission towers are visible from far and in effect hundreds of towers are visually impressive on Sisian plateau for instance.

³<http://info.worldbank.org/etools/docs/library/114715/istanbul03/docs/istanbul03/09melkumyan3-n%5B1%5D.pdf>

⁴<http://www.emsc-csem.org/Earthquake/earthquake.php?id=210376>

The river valleys are marked by settlements and agricultural fields as well as cultural heritage sites. Arpa River valley is very scenic and presence of the transmission lines may represent a visual nuisance from a tourism perspective. However, there are three parallel lines (220 kV Shamb line, 220 kV Vayk Line, 35kV line) already installed.

5.1.5. Tourism

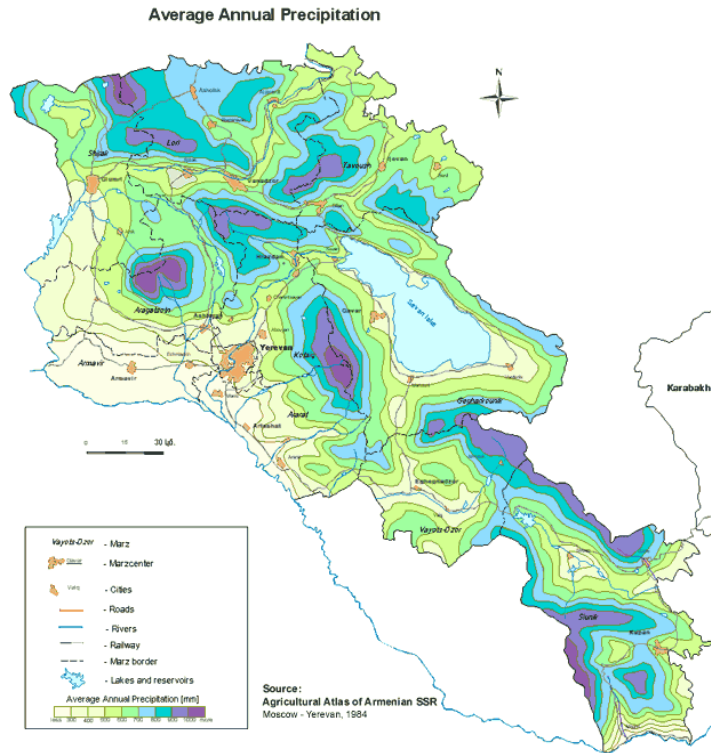
Tourism is an important sector of the Armenian economy since the 1990s. Most visitors are ethnic Armenians from the Diaspora. The Armenian Ministry of Economy reports that most of the tourists come from the CIS, particularly Russia and Georgia, EU states, Iran and the US. Outdoor activities and scenery seem to be the primary attractions, the mountain and lakeshore landscapes are important features. Lake Sevan is a popular summer tourist spot, especially for domestic tourists. Tourism has been growing gradually in Armenia since 2000. The Republic of Armenia Ministry of Economy declared that 575,281 tourists visited Armenia in 2009, 3% more than the estimated index for 2008, and 5% growth was predicted for 2010.

5.1.6. Meteorology

The investigation area is characterized by a continental dry high-altitude climate, with a small difference at the northern part of Lake Sevan and the eastern part of Syunik region, where rainfall is significantly more than in other areas due to micro-climatic effects. The summers are hot and the winters cold, with max. temperatures reaching up to 40° Celsius (despite the altitude of more than 1,000 m) and going down to -35° Celsius. The climatic data for the study area are provided by the Meteorological Institute of Armenia. The tables below show the given data.

Meteorological stations	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Sevan	25	30	40	65	103	79	50	40	37	51	38	25
Hrazdan	45	57	63	86	100	69	44	31	32	60	55	46
Yeghegnadzor	33	34	41	58	59	41	21	15	14	35	32	34
Sisian	18	22	36	57	73	57	27	16	23	37	30	18
Goris	34	45	71	91	114	92	50	40	64	65	53	34
Kapan	26	31	64	75	102	65	32	28	38	48	40	26

Tab. 5-2: Precipitation in the investigation area



Map 5-4: Distribution of rainfall in Armenia

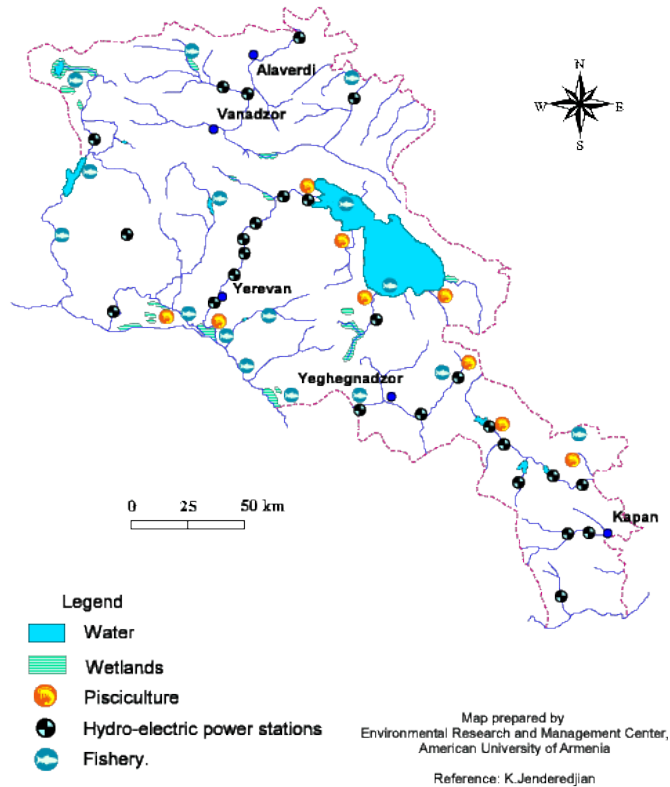
Meteorological stations	Temperature (°C) Absolute		Wind speed (m/s)		Prevailing direction of the wind	
	Max.	Min.	Max.	Burst	Summer	Winter
Sevan	32	-33	25	32	North-eastern, Eastern	Western, South-western
Hrazdan	35	-32	18	25	Eastern	South-western
Yeghegnadzor	39	-30	21	28	Western, Eastern	
Sisian	36	-34	18	20	Eastern	North-western
Goris	35	-20	35	40	North-western	
Sisian mountain-pass	31	-26	48	60	North-eastern, Eastern	Western, South-western

Tab. 5-3: Temperature and wind in the investigation area

5.1.7. Water Resources

The investigation area involves three main watersheds Lake Sevan Watershed, with the western and south western tributaries in Gegharkunik Marz. The Arpa River Watershed in Vayots Dzor Marz with the tributaries from Yeghegis, Herher, Jermuk Valleys and finally the Vorotan Watershed in Syunik Marz.

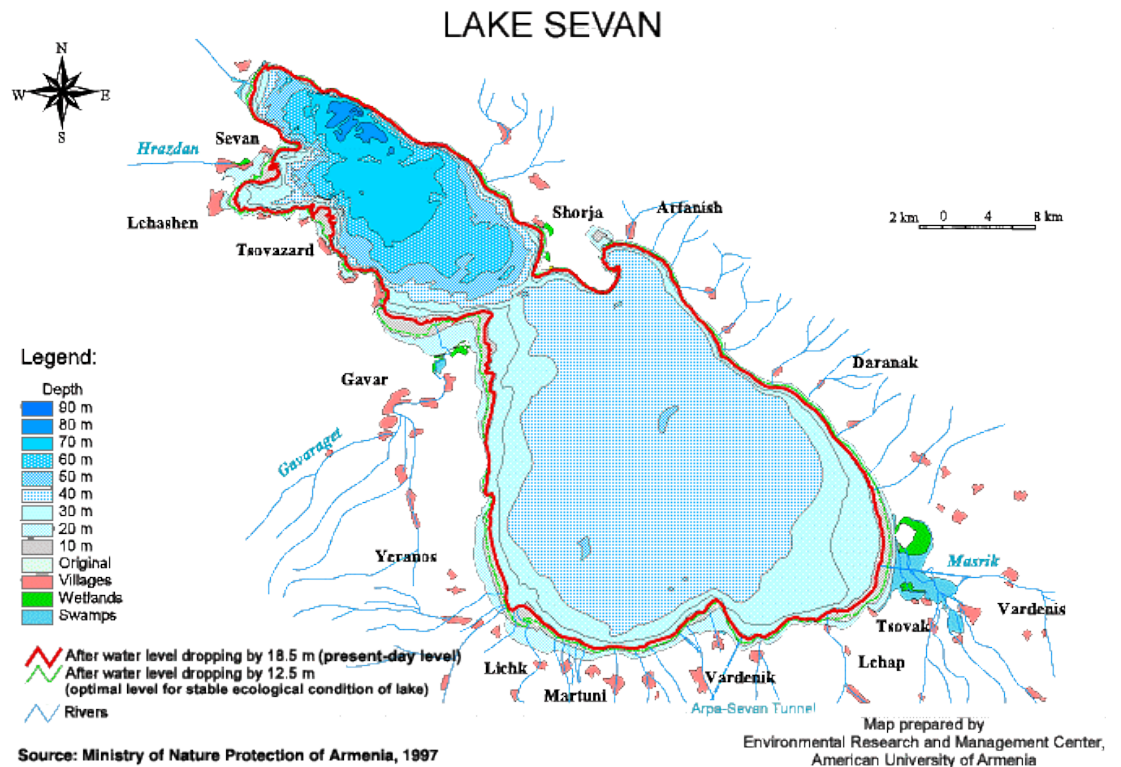
KEY WATER BODIES AND RIVERS IN ARMENIA



Map 5-5: Water Resources of Armenia

The main water resource of Gegharkunik Marz is Lake Sevan (1,260 km², 1,898 m above sea level). It is the largest pool of fresh water within the Southern Caucasus. The lake has vital influence on local and regional ecosystems and economy.

Due to the irrigation and installation of hydropower plants on the outflow of the Lake the water-level dropped during Sowjet times by 19m and the lake lost more than 30% of its volume. The area of the Lake was reduced by more than 180 km². Since early 1960s, it is planned to maintain the water level, and a tunnel was built to let water from Arpa River into the lake, but especially difficult situation in 1990s increased the need to produce electricity from lake water. In recent years the water level has risen by more than 1m and it is planned to raise the water level by 3 m to a stable level. (see Map 5-6)



Map 5-6: Lake Sevan

The ecosystem of the lake is threatened by various natural and anthropogenic influences, which the Armenian section of the report *Piloting Landscape Planning in the Southern Caucasus Countries* (2009), summarizes as follows:

“Discharge of harmful substances into the lake. As a result of intensification of the development of a number of branches of economy in the basin of the lake and a lack of effluent treatment measures, pollution of the lake by heavy metals, biogenic elements, and chemical pesticides and herbicides increased annually on average by around 7000 tonnes of nitrogen, 400 tonnes of phosphorus, 13 tonnes of chemical pesticides and herbicides and 135 tonnes of heavy metals. There are high levels of petrochemicals, which are related to increased water transport.

Reduction in biodiversity: Huge changes in biodiversity have taken place in the biota of the lake, which a number of water and terrestrial representatives of flora and fauna were habituating and maintaining the trophic level of littoral zone of the lake. In the water part of the ecotone, due to drying of the rocky bottom, the spawning ground of the Sevan trout (*Salmo ischchan*) has disappeared. This is one of the reasons behind the loss of trout species which spawn in the lake. The population of pelagic whitefish (*Coregonus lavaretus*) which was introduced into the lake in the 1930s has also declined in recent years and they are not in a condition to ensure reproduction. Similar changes in trophic chains are causing additional impacts on the water quality of the lake, promoting the process of eutrophication. During the last decade an unpremeditated introduction of crustaceans and crabs took place. As a result of the draining of Lake Gilli and other wetlands, out of 167 endemic and migratory birds only 18 species are left. The number of mammals has also sharply declined”⁵.

This has led to the formulation of RA law on “Lake Sevan” and the creation of Sevan National Park. Other lakes in Gegharkunik are comparatively small lakes of crater lakes of Ajdahak and Aghmaghani, - up to 50 m in diameter and at a depth of 15 m.

Rivers of Gegharkunik Marz include Gavaraget (47 km) and Masrik (45 km). Masrik is of great importance, since it is a spawning place for such endemic species as Gegharkunik trout (*Salmo ishchan gegarkuni*), Sevan koghak (*Capoeta capoeta sevangi*) and Sevan beghlu (*Barbus geokschaikus*). The Sevan trout (*Salmo ischchan*) and Sevan beghlu are included in the Red Book of Armenia.

All small rivers and streams crossed by the transmission line in Gegharkunik Marz flow into the Lake.

The main river of Vayots Dzor is Arpa River. Tributaries are Yeghegis River and rivers from Herher and Jermuk Valleys. On Arpa, near Vayk town, there is Kechut water reservoir, linking Arpa and Sevan via Arpa-Sevan channel.

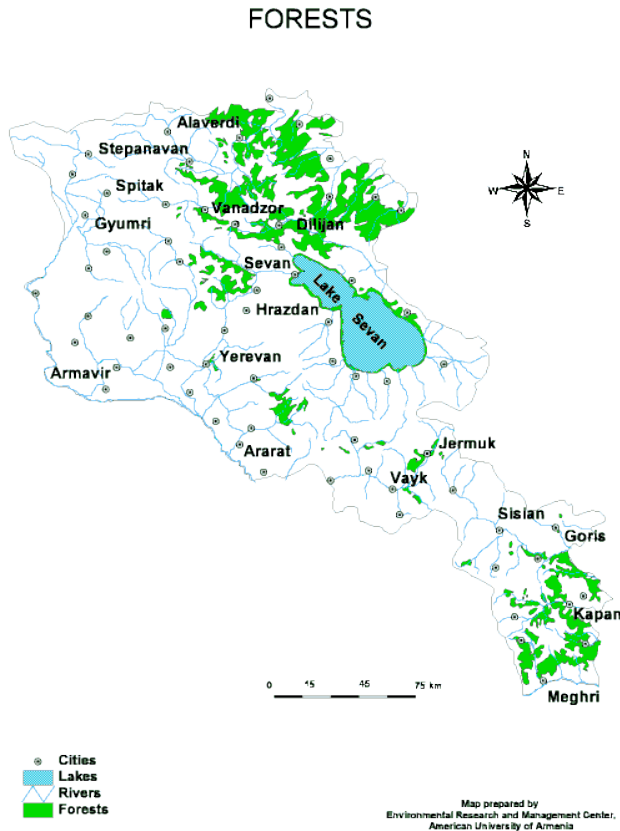
The main rivers of Syunik are Vorotan, Voghji, Meghriget. The biggest river is Vorotan, flowing in a deep gorge, reaching 800 m depth. Tatev hydro-power station, the first of the cascade, is situated on Vorotan River.

Compared to the level of precipitation and river flow rates, Armenia has an astonishing installed Hydro Power Generating Capacity. However, since the implementation of the policy to raise the water level of Sevan, not all installations are functioning at full capacity.

⁵ Sayadyan, H., Mammadov, R., Elizbarishvili, N. and Garforth, M. 2009. *Piloting Landscape Planning in the Countries of the South Caucasus*. State Agrarian University of the Republic of Armenia, Yerevan, G.A. Aliev Institute of Geography of the National Academy of Sciences of Azerbaijan, Baku, and Ivane Javakhishvili Tbilisi State University, Tbilisi.

5.1.8. Forests

The forest areas in Armenia are shown in Map 5-7:



Map 5-7: Forest cover in Armenia

The forest cover of the Investigation area is very low, what results in a quantitatively less important impact of the Project on forest resources. Some open juniper forest especially at the Vayk sector are crossed by the proposed transmission line, but not requiring the felling of densely forested areas. Only in one short line section (350 m) a forest area with beech trees will be crossed.

5.1.9. Flora and Fauna

Armenia shows a rich diversity of flora and fauna in a relatively small territory. The prevailing biotypes are semi-desert, mountain-steppe, mountain-meadow and Alpine vegetation.

Regarding fauna, for example, at least 345 bird species have been recorded of which over 240 species breed here. At the Lake Sevan large breeding colonies of the Armenian Gull and the Citrine Wagtail can be found. Armenia is further situated on an important bird migration flyway. The migration path between Eastern Europe and Africa leads through the country in east-western direction. According to information from WWF, typical bird migration routes can be found south of Lake Sevan.

Big mammals occur rather in the southern part of Armenia, which for example belongs to the distribution area of the Persian leopard in the Caucasus. According to Khorozyan & Malkhasyan (2002)⁶, Khosrov Reserve, located south-east of Yerevan on the south-western slopes of the Geghama mountains, is a habitat for this species. From 2000 to 2002 tracks of 10 individuals of the Persian leopard could be found here in an area of 780 km². Leopards are also known to live on the Meghri Ridge, where the number of individuals has declined due to various disturbances and prey scarcity. WWF Caucasus Armenia estimates 5-7 individuals to live in this area today (2005 estimate).

The HVTN is planned in the Hrazdan Region, the Sevan Region, the Vardenis Mountains, the river-bed of Arpa, the Sisian Region and the Goris Region. In the following, some information on vegetation and flora of these regions are given:

Hrazdan Region

The vegetation of this region is characterized by a semi-arid steppe flora and some scattered oak-forests. *Sambucus tigranii*, a plant species of the IUCN Red List of Threatened Species is endemic to Armenia.

Sevan Region

Characteristic for this region is Alpine vegetation, which is sometimes utilized as pasture. Such vegetation can be found on an area of about 40 km x 6 km. *Sipa gegarkunii*, *Hypericum eleonora*, and *Galium sosnowskii* are endemic plant species.

Vardenis Mountains

The flora in this area is characterised by meadowy Alpine vegetation and agricultural areas. Endemic flora includes *Sipa gegarkunii*, *Symphytum hajastanum*, and species of the plant family Plumbaginaceae.

The river-bed of Arpa

The region of Voyots Dzor is situated in the south of the Sulema mountain pass. Here, forest areas can be found. Vegetation types of this region include steppe, meadow steppe, oak forests and areas with cultivated plants. *Seseli leptocladum*, *Sephalaria armeniaca*, *Sambucus tigranii*, *Pirus woronovii*, *Grossheimia caroli-henricii*, and *Cousinia fedorovii* are endemic species

Sisian Region

Sisian Region, as a plateau, shows comparatively strict climatic conditions resulting in a short vegetation period. Mountain-meadows, steppe, agricultural areas and bushes are typical for this forestless region. Endemic flora includes *Cousinia fedorovii* and *Hedysarum bordzilowskii*.

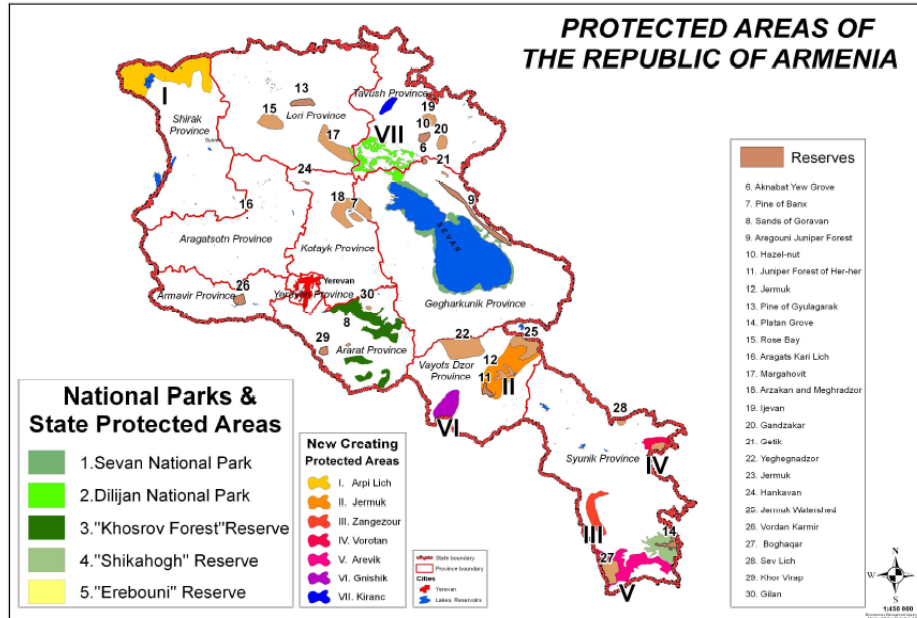
Goris Region

The typical vegetation of this region is meadow steppe, steppe and forest. Also, agricultural areas can be found. The forest flora consists of broad-leaved beech tree, oak tree, horse fennel (*Hippomarathrum*), ash-tree and lime-tree varieties.

⁶ Khorozyan, I., Malkhasyan, A. (2002): Ecology of the leopard (*Panthera pardus*) in Khosrov Reserve, Armenia: implications for conservation. Scientific Reports of the Zoological Society "La Torbiera" 6: 1-41

5.1.10. Protected Areas

The actual and proposed protected zones in Armenia are shown in Map 5-8. None of them is crossed or affected by the transmission line corridor as it is presently designed.



Source: Fourth National Report to the Convention on Biological Diversity, Republic of Armenia, Yerevan 2009

Map 5-8: Protected areas of Armenia

5.2. Socio-economic Conditions

5.2.1. Population within the Investigation Area

The Republic of Armenia has a population of 3,262,200 people for a territory of 29,743 km². Population density is 108.4 persons/km². Nominal GDP is \$8,830 billion (2010 estimate), per capita \$2,676. The Human Development Index is estimated for 2010 at 0.695 which ranks the country 76th. After the break-up of the USSR the country has experienced a problem of population decline due to elevated levels of emigration. The rates of emigration have decreased drastically in the recent years and a moderate influx of Armenians returning to Armenia is expected to continue. From 2010 Armenian population is expected to increase.

Ethnic Armenians make up 97.9% of the population. Yazidis make up 1.3%, and Russians 0.5%. Other minorities include Assyrians, Ukrainians, Greeks, Kurds, Georgians, and Belarusians. There are also smaller communities of Vlachs, Mordvins, Ossetians, Udis, and Tats. Minorities of Poles and Caucasus Germans also exist though they are heavily russified⁷

⁷ (Source: Asatryan, Garnik; Arakelova, Victoria (2002). The Ethnic Minorities of Armenia. Routledge)

The population within the Investigation area can be differentiated into urban population of the towns of Gavar, Yeghegnadzor, Vayk, Sisian and rural population of the many villages along the line.

Region	Kotayk Marz	Gegharkunik Marz	Vayots Dzor Marz	Syunik Marz
Population number (Jan. 2007) (persons)	276,200	239,000	55,800	152,900
Urban Population	155,100 (56%)	79,600 (33%)	19,400 (35%)	103,700 (68%)
Main towns*	Hrazdan, Charentsavan, Tsaghkadzor, Abovyan	Sevan, Gavar, Martuni, Vardenis	Yeghegnadzor, Jermuk	Goris, Sisian, Kapan, Meghri
Rural Population	121,100 (44%)	160,000(66%)	36,400 (65%)	49,200 (32%)

*) bold: towns directly affected by T-Line corridor

Tab. 5-4: Population by region

Characterization of towns:

Source: www.armstat.am / Marzes of the Republic of Armenia 2002-2006:

Gavar town (26,000 inhabitants in 2006) used to be one of the industrial centres of the republic, but the production of industrial output was considerably shortened because of discontinuance of works of a number of large factories. Nowadays manufacturing is the main trend of industry of the town, in which the following branches of industry have bigger share: machinery, building materials, light and food industry.

Yeghegnadzor town (8.2 ths. inhabitants in 2006) is considered the one of Syunik ancient settlements. The main branches of economy of Yeghegnadzor town are industry and construction. The most developed branches in industry are grape wine and manufacture of electrical equipments. The manufacture of fabricated metal products has some particular role in the industry of the marz too.

Vayk town (5.9 ths. inhabitants in 2006) is situated 16 km from Yeghegnadzor. The main branch of economy of Vayk town is industry. Especially production of mineral water, alcohol-free beverages, building materials and carpet making industry are developed.

Sisian town (16.7 ths. inhabitants in 2006) is located in Syunik region. Its economy is mainly specialized in mining industry. The manufacturing industry produces in particular food, beverages, and textiles.

The area of the planned transmission line corridor passes several villages, where houses might be affected depending on the line design:

Region of RA	Villages affected by TL Corridor
Kotayk Marz	None
Gegharkunik Marz	Village Lchashen Village Lchap Village Hayravank Town Gavar Village Yeranos Village Vardadzor Village Dzoragyugh Village Lichk Village Verin Getashen Village Madina
Vayots Dzor Marz	Village Taratumb Village Karaglukh Village Salli Village Shatin Village Getap Town Yeghegnadzot Village Agarakadzor Village Malishka Town Vayk Village Saravan Village Kechut
Syunik Marz	Village Shaki

Tab. 5-5: Villages affected by the transmission line corridor

Population Density and settlement structure

Armenia has a population density of 108.4 persons/km². The population density in Kotayk Marz is 115.5 persons/km², in Gegharkunik Marz 40.3 persons/km², in Vayots Dzor Marz 23.1 persons/km², and in Syunik Marz 29.8 persons/km². The regions concerned by the Project have a low population density.

The settlement structure is concentric with most of the people living in towns and villages, which makes bypasses of settlements technically feasible. Large parts of the investigation area are rather uninhabited and used for agriculture or pastures.

5.2.2. Historical and Cultural Sites

As the history of human settlement in Armenia goes back to the Neolithic age and the area has since then been important as settlement, trade and agricultural area, numerous historical and cultural sites exist. To a great extent the proposed transmission line follows the route of the Great Silk Road.

Only a minor part of the existing monuments are well preserved and known to the public as for example the Caravanserai at Selim Pass, Hayravank Church at Lake Sevan or Zorats Karer on Sisian Plateau. Others are in ruins but visible, but to a greater extent monuments have yet to be unearthed and are known only to a few local experts linked to the Department for the Protection of Monuments of RA. There are no maps indicating locations or descriptive lists readily available. Field investigations, accompanied by local experts and consultative meetings have revealed a number of existing and potential sites along the proposed line.

Other cultural and historical sites within the investigation area are listed below:

Gegharkunik Region:

- Lchashen Cyclopean Fortress Settlement and Burial Place
- Lchashen, Remnants of Urartian Settlement (2 km South of Lchashen village)
- Noratus Cemetery, east end of Noratus Village, 1.6 km from Gavar-Martuni Highway
- Hayravank Church, East of Gavar-Martuni Highway
- Urartian Settlement excavation site near Gavar Town (at Lichk Tower No. 40)
- Veranos, Vardazor, Dzoragyugh Fortress Remnants
- Gili Shelters, Dzoragyugh-Gili Road
- Natural Bridge, Village Tsakkar
- Sanei Gomesh: Remnants of Settlement and Church near Verin Getashen / Madina
- “General Paskevich Road” at Selim Pass

Vayots Dzor Region:

- Caravanserai and Settlement at Selim Pass
- Bridges and Caravanserai (below Selim Pass)
- Excavation site of Urartian Fortress Dadaiberd (Vardenis Line N159)
- Urartian Hill Fortress above village Getap, near Yegegnadzor Substation
- Historical Site, Burial Place near Malishka,
- Ruins of Town Moz, Arpa Valley, near Malishka, 39°42'59''N/45°25'09'' E
- Ancient burial place near Vayk

Syunik Region:

- Potential historical site Khatchkar Stone Site near Spandaryan SS
- Historical site (unexcavated) on Sisian Plateau near village Shaki (39°34'02'' N / 46°02'41'')
- Zorats Karer on Sisian Plateau (at 1.5 km from the present line)
- Historical area with old stone towers at 39°31'44'' N / 46°08'57'' E

5.2.3. Indigenous Peoples

There are no records of indigenous peoples in the strict sense of the term in Armenia; or as 97.5% of the population are Armenians technically all would be indigenous people. More interesting is the focus on vulnerable minorities: A few minorities can be found (i.e. Kurds, Yazidis, Russians and Georgians etc.) (see Chapter 5.2.1).

Some of the members of these minorities might live in a situation of vulnerability; however there is no record of a systematic discrimination or of a general vulnerability situation.

At Selim Pass the planned transmission line touches a summer settlement of Kurdish shepherds near the village Yanegh (personal communication HVEN). It is important to recognize the ownership status of these people and compensate losses, even if they might not have legal land titles.

Vayk town has reportedly been used to resettle Armenian refugees from Azerbaijan (Karabakh conflict), however, the situation has improved during the last years. The line is not directly impacting the town of Vayk.

5.2.4. Gender Aspects

The Republic Armenia grants women equal rights under the law, including equal entitlement to education, health care, employment and certain anti-discrimination measures. However, such legislation is not widely applied since Armenia does not have a public agency designed to deal with gender issues.

In practice, women have less influence in public, economic and political life than men. There is a low representation in local decision making bodies. Men control most parts of public life and women do not have access to their informal networks, which constitute an important part of the social capital in daily life. This exclusion makes women dependent on men's decisions and approval concerning their life. The overall situation for them is stressful with double or triple workload. Many admit that they are unaware of their rights and without access to essential information. Limited economic resources restrict their activities in business and politics. This situation is even more relevant in rural areas.

Due to frequent out-migration of men from the investigation area, the number of female single headed households is considerable. Female-headed households are particularly vulnerable to falling into extreme poverty since women are left alone with the burdens of income generation, household and childcare responsibilities. Another consequence of male migration has been the growth in "parallel families", where migrant male workers establish another family in their new location. This increases the vulnerability of women especially when men return home in poor health or infected with sexually transmitted diseases.

The National Action Plan 2004-2010 on Improving the Status of Women and Enhancing Their Role in Society emphasizes the need for effective institutions to address women's issues. The Plan also highlights the unequal participation of women in the country's political and social spheres and calls for women's increased involvement in democratization and the development of civil society. To improve the social and economic condition of women, the Plan recommends expanding business opportunities for women, especially in rural areas.

Armenia's Poverty Reduction Strategy Paper promotes the use of microcredit schemes to help boost women's employment and entrepreneurship, especially

among female-headed households. Additionally, the paper outlines the establishment of quotas to substantially increase women's participation in governance.

Facts and Figures on Gender:

Source: <http://www.ifad.org>

- There are 3.1 million people living in Armenia; about 52 per cent are women
- In Armenia, women are more likely to live below the poverty line than men
- One third of the Armenian population lives in rural areas; about half of these rural inhabitants are women
- Agriculture employs 45 per cent of the work force in Armenia; almost half of these workers are women
- Women constitute 66 per cent of the unemployed workers in Armenia
- On average, women earn about 30 per cent less than their male counterparts
- Nearly 1 million people have migrated from Armenia since 1991; the vast majority of these migrants are men
- Female-headed households constitute about 27 per cent of Armenian households
- Women's participation in government is very low; for instance, less than 5 per cent of deputies in the Armenian Parliament are women
- About 83 per cent of the country's educators are women

The situation of women in Armenia, especially in rural areas is characterized by a precarious livelihood situation, where even minor shocks, trends or seasonality can contribute to a situation of extreme vulnerability, without possibility of coping strategies. The loss of housing, land or other assets might be critical in this situation.

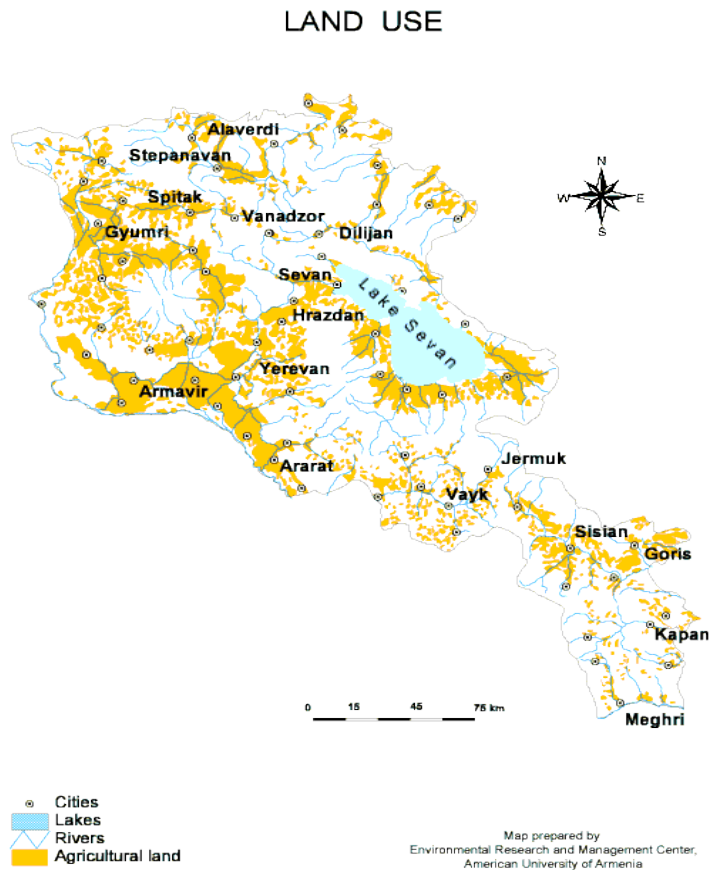
The lack of "public voice" may lead to a situation where women's concerns are overlooked or not taken seriously and are consequently not addressed. The lack of empowerment may even lead to a situation where women do not address their grievances, because they have psychologically internalized their lack of "voice".

For PAPs consultations during technical design, compensation and relocation practice and monitoring activities the gender issue has to be taken seriously.

5.2.5. Land Use Pattern and Agriculture

Armenia has 2.2 million ha of agricultural land, meaning 72% of the country's land area. Most of this, however, are mountain pastures (700.000 ha), and cultivable land comprises about 480,000 ha (452,900 ha arable land, 27,300 ha in orchards and vineyards), or 16% of the country's area.

Within the regions of the investigation area, agriculture is mainly concentrated in valleys and lower mountain slopes. As Map 5-9 suggests, Lake Sevan Region and Sisian Plateau have the highest percentage of agricultural land of the investigation area.



Map 5-9: Agricultural land in Armenia

Due to the high altitude of the entire investigation area, main cultivated crops are potatoes in Gegharkunik and Syunik Region (Sisian Plateau) as well as hay fields and pasture. Within the investigation area orchards and vineyards are concentrated in the valleys of Vayots Dzor Region (Yeghegis Valley, Arpa Valley) where also wheat, potatoes other legumes are cultivated.

Main problems of agriculture have been identified by UNDP (2004) as:

- Small and fragmented landholdings;
- Limited access to irrigated land (9%) and poor state of irrigation infrastructure;
- Lack of good quality farm inputs (seed, fertiliser, etc.);
- Limited availability of farm credit;
- Low levels of crop and livestock productivity; and
- Lack of storage and agro-processing facilities.

Land Category /Selected Region	Kotayk	Gegharkunik	Vayots Dzor	Syunik	Total Armenia
Total Private Land (ha)	43,383	66,218	14,937	37,020	450,456
Arable (ha)	30,136	50,064	10,752	31,863	326,105
Orchard (ha)	2483	0	1,187	844	30,647
Vineyard (ha)	436	0	607	496	13,571
Hay Field (ha)	8,268	16,581	2,226	3,815	57,076
Fallow and other (ha)	1,080	107	80	480	11,312
Total State Land (ha)	68,201	144,445	130,358	156,396	975,298
Arable (ha)	7,707	16,503	4,743	10,872	110,895
Orchard (ha)	124	15	52	319	2,136
Vineyard (ha)	2	0	103	26	568
Without use (ha)	16,375	29,993	62,146	73,040	248,003
Hay Field (ha)	1,211	5,626	2176	2,228	34,564
Pasture	42,784	82,315	61,119	70,0423	579,697

Tab. 5-6: Land Inventory of RA, for selected Marzes, data from report of the State Cadastre Committee of the of Republic of Armenia as of 01.07.2010⁸

- Around 40% of hay fields and pastures (state land) are located outside community boundaries. All private lands are located within community boundaries.
- Private agricultural lands within the regions are less than 50% of all agricultural land, with pastures accounting for more than 75% of the State agricultural lands. However more than 70% of arable lands are private land.
- Agriculture is a main source of income for the poorest segments of Armenian society and a main coping strategy to sustain a livelihood. Due to the decline of industry (especially along Lake Sevan) the dependence on agriculture has increased after independence.

Due to the importance of agriculture for people's livelihoods and the high fragmentation and small size of landholdings, expropriation of agricultural land is an issue of potential impact for the planned transmission line rehabilitation.

⁸ Source: Land Inventory of RA, for selected Marzes, data from report of the State Cadastre Committee of the of Republic of Armenia as of 01.07.2010⁸

Livelihood and Housing

Despite economic reforms and some recent growth, unemployment and poverty remain widespread in Armenia. Agriculture is the country's largest labour sector, followed by services and industry. The UNDP report (2004) analyses that "Rural poverty used to be lower than urban poverty, and access to land has been important in the explanation of this phenomenon. However, rural poverty in 2003 has surpassed its urban counterpart, stagnating at a level similar to 1996. While access to land is still widespread in rural Armenia, amongst farm households, the poor and extreme poor are those who own very little land, or the landless." The poorest Armenians are found in rural areas with the least favourable conditions for agricultural activities. There is a stark contrast between the city of Yerevan and the remote rural areas in terms of socio-economic opportunities.

Region	1996	2001	2003
Kotayk	62.4	50.5	52.5
Gegharkunik	48.1	62.2	59.9
Vayots Dzor	61.5	51.1	42.9
Syunik	47.1	-	34.6
Average RA	54.7	50.9	42.9

Source: "Food security and poverty", January-June 2004, NSS

Tab. 5-7: Poverty incidence in (%)

Within the investigation area, Gegharkunik Marz is the region with the highest poverty incidence with 60% of the population living below the poverty line, whereas in Syunik region the percentage is lowest (34.6%).

Marz	2006	2007	2008	2009	2010
Kotayk	60,897	67,654	78,170	85,604	99,336
Gegharkunik	48,786	60,769	71,076	79,397	86,270
Vayots Dzor	47,336	59,162	73,094	72,523	80,477
Syunik	74,772	100,328	119,518	102,456	132,811
Total in RA	64,166	77,776	92,759	96,019	108,840

Source: www.armstat.am / Statistics of Marzes

Tab. 5-8: Monthly average wages in AMD:

For employees, wages are highest in Syunik region and lowest in Vayots Dzor, followed by Geharkunik region. This reflects the high percentage of urban population in Syunik and the proximity to Iran and the main trade route. Vayots Dzor region is the most remote and most rural of the four regions,

despite a growing tourism potential. However, most households do not have a regular wage-based income, but depend on their agricultural produce in a sort of extended subsistence based economy.

Most of the population, even in rural areas has access to electricity. Efforts to provide a general supply with gas and drinking water are made. However, with the incidence of poverty the problem arises, that households are not able to pay for the (new) services.

Remittances from migration constitute a major source of income for the families, who have a breadwinner in Yerevan or abroad. This is especially obvious in the villages along Lake Sevan, where the economic divide is visibly growing.

6. Environmental and Ecological Impacts

6.1. Environmental and Ecological Impacts during Design Phase

6.1.1. Line routing

The present design of line routing is preliminary. Most of the planned line will follow the existing line in a distance of 50 m, which nevertheless results in a completely new corridor. Due to the fact, that the routing of the old line leads through various environmentally sensitive zones, historical sites and settlements (towns and villages), there is a necessity for the creation of bypasses and in three places a reconstruction of the line exactly in the old corridor (see Chapter 4, Discussion of Alternatives).

The sensitivity of the area is high because several areas are crossed where numerous historical sites, settlements and buffer zones for ecologically sensitive areas can be found along the proposed transmission line routing.

Areas of special concern for line routing are:

- Bypass of Lchashen: the old line leads close to the lake near village Lchashen, the bypass does not affect any populated areas and should be constructed (N67-N89).
- Populated areas along Sevan Lake, especially villages of Lchap, Hayravank should be bypassed.
- In the town of Gavar it is planned to take the old line corridor in order to avoid involuntary displacement.
- Bypass of Yeranos, Vardadzor, Dzoragyugh has been suggested and needs to be constructed.
- Old line corridor to be taken for last 3 towers before Kamo Substation.
- Historical site of Sanei Gomesh, Villages of Madina and Lernakert: Bypass should be redesigned together with an expert of the Department for the Protection of Monuments and Historical Sites.
- Erosion prone areas South of Selim Pass.
- Bypass of villages Aghnjadzor, Karaglukh, Salli via Taratumb (left side of valley). The planned bypass is not yet sufficient to avoid resettlement and should be extended. Alternatively a new bypass should be considered, which is close to the road and nearer to the old line and which would also avoid settlements.
- Bypass of village Shatin to avoid settlements and erosion.
- Avoidance of cultural heritage site near village Getap.
- Line Routing in Village Agarakadzor. The present design was incorrect.
- Line routing through narrows of Arpa River at village Malishka: As avoidance of resettlement is a priority detailed design should consider, whether taking exactly the old corridor is feasible or if a bypass over the mountain (South) has to be taken. A bypass through Malishka village would have a high social impact and is not recommended.

- Bypass of Vayk town: Due to the inaccessibility of the terrain it will be necessary to construct access roads.
- Bypass of Village Saravan / Kirs. Despite a presence of several lines in the area it should be considered if the bypass can shift the planned line northwards in order not to affect the village.
- For procedure to avoid historical sites, see Chapter 7.2.2.

A careful line routing is of special significance for the protection of Lake Sevan in order to ensure the protection of water resources, prevention of erosion and avoidance of interference with local development activities i.e. recreational development.

Selection of line routing shall be done in order to avoid resettlement activities to the greatest extent possible and to avoid any protected areas. Minimal ground clearance will be sufficient so that no negative interference with the traffic occurs in case of road crossings.

It is evident that an orientation on minimal construction costs will considerably increase social and environmental impact of the planned Project. As the detailed design is shifted under the responsibility of the construction contractor, a careful monitoring will be necessary. The recommendations of the ESMP have to be part of the contract.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Line routing	In line sections Vardenis, Vayk ■■■■ In line sections Noratuz, Lichk, Vorotan1 ■	■	Long term	Direct

6.1.2. Access Roads

In most parts of the line access is rather easy due to the terrain and it is expected that no special access roads will have to be constructed. This will be the case for most of Noratus, Lichk and Vorotan line sections. In all sections the access tracks/roads may cross historical sites and graveyards which are located beneath the surface and in mountainous areas. In this case the Department for the protection of Monuments / ministry of Culture has to be informed.

Construction of new access roads will be required in Vardenis and Vayk line sections the line traverses difficult terrain that is partly difficult to access. In Yeghegis Valley and Arpa Gorge several bypasses are planned that would require new construction of access roads.

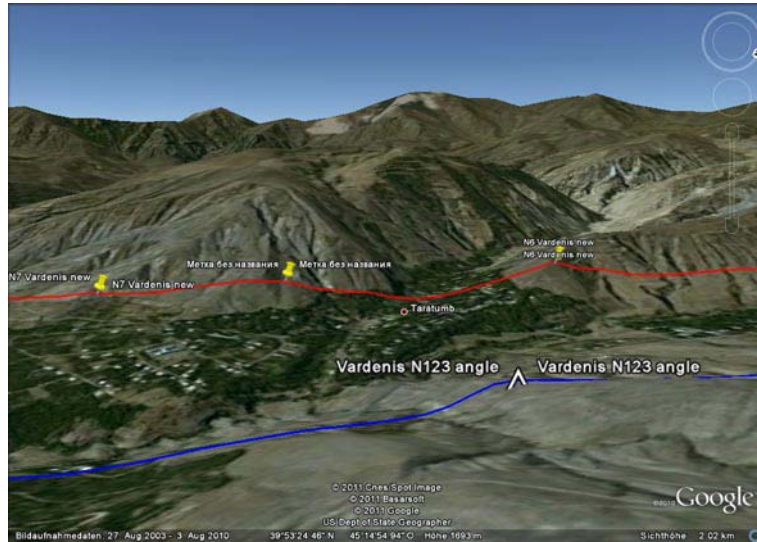


Figure 6-1: Bypass of Taratumb village (red); old line (blue)

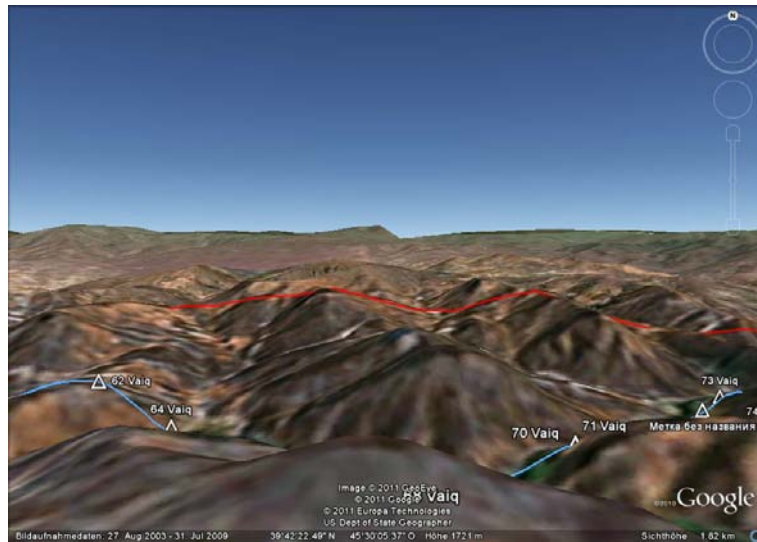


Figure 6-2: Bypass of Vayk Gorge (red), old line (blue)

Road erosion is characteristic in highlands with by alpine meadow and sub-alpine landscapes which are utilised as pastures. In the Vardenis massif road erosion reached threatening proportions, covering pastures from top to bottom. The construction of access roads represents the biggest impacts of the Project regarding the protection of flora, fauna, and historical sites.

The line routing will be selected with focus on minimising of access roads by routing it along existing paved roads. Existing tracks will be used to the greatest extent possible. Erosion prevention measures as road-side plantation with bushes and drainage systems will have to be implemented.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Access roads	In line sections Vardenis, Vayk ■■■ In line sections Noratuz, Lichk, VorotanI ■■	■■	Long term	Direct

6.2. Environmental and Ecological Impacts during Construction

6.2.1. Soil and Erosion

The line corridor is characterized by two types of landscapes:

- a) Undulating rocky or verdant plains in the Noratus, Lichk and Vorotan line sections, and
- b) Steep mountainous terrains (sometimes more than 45°), with mountain passes over 2500 m altitude and river gorges with several hundreds of meters difference between the edge and the bottom of the gorge located in Vardenis and Vayk line sections. Several gorges or side valleys (i.e. Jermuk Valley) will have to be over-spanned.

Landscape type a) a does not represent a major risk for erosion, however, erosion is a considerable issue in the basin of Lake Sevan. In landscape type b) there is a high risk for erosion in several areas. Unfortunately geological data from drilling points does exist only for 5 points in the Noratus line section (landscape type a) so that the results cannot validate the present analysis.

Erosion is a potential issue in the following zones:

1.) Vardenis line section:



Figure 6-3: Old line (left side); planned bypass (right side above Taratumb village)

Steep slopes above Taratumb village (on the far right side of the picture) are difficult to access and prone to erosion. Tower construction and access roads need to be designed carefully if the bypass is effectively chosen. However, there may be another option on the less steep left side near the road that does not affect settlements.



Figure 6-4: Bypass area of Shatin village

Ophiolite rock formation and steep slopes characterize the bypass of Shatin village. Construction of towers and especially of access roads will invariably produce erosion processes that will have to be minimized.

2.) Vayk line section:



Figure 6-5: Landscape in Vayk Gorge

Vayk Gorge is characterized by steep slopes and a winding valley. Hillsides are prone to erosion. The bypass of the line is planned on top of the gorge, in mountainous terrain, requiring tricky access roads overspanning of gorges and small valleys. A careful design will be necessary to prevent occurrence of erosion phenomena.

In the steep mountainous slopes the sensitivity of the terrain for erosion is high.

Removal of topsoil around tower feet will be minimised. Topsoil will be brought back after construction and soil will be replanted when towers are erected in steeper slopes. Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Soil and Erosion	In line sections Vardenis, Vayk ■ ■ ■	In line sections Vardenis, Vayk ■ ■	Long term	Direct
	In line sections Noratuz, Lichk, Vorotan I ■ ■	In line sections Noratuz, Lichk, Vorotan I ■		

6.2.2. Landscape and Visual Aspects

The transmission line partly traverses scenic areas of national importance for tourism and recreation. Especially Sevan shore is used as a place for summer vacation, but also Arpa Valley and Sisian Plateau are very scenic from a natural landscape perspective. In most parts of the line routing towers of the old line will be replaced by new ones, if the old line will be effectively dismantled, in

the end there might be fewer towers than before. There are also numerous other transmission lines found nearby the proposed corridor. In some areas of Sisian Plateau the outstanding landscape feature are several dozens of towers.



Figure 6-6: Landscape on Sisian Plateau

Most of the visual impact has already occurred. Further lines are planned (i.e. 400 kV Hrazdan-Iranian border) following more or less the same corridor outside the scope of this ESIA.

The influence on the landscape during construction is limited in time. In order to reduce the visual impact of towers the old line towers should be completely dismantled.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Landscape and Visual Aspects	■	■	Short term during construction	Direct

6.2.3. Noise

Due to the limited time of the construction period and the sparsely populated area for a largest part of the transmission line route noise during construction activities will be low.

For workers a proper HSE management Plan will address the issue ‘noise’. All workers will be fitted with PPE as ear plugs etc.⁹

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Noise	■	■	Short term during construction	Direct

⁹ The TOR reads: “Modest issues may arise from noise, dust generation, vehicle emissions, construction waste and traffic/pedestrian safety. All these impacts are expected to be easily and readily manageable with simple EMP templates and are not part of this assignment.”

6.2.4. Air Quality

Due to the limited time of the construction period the impacts on ambient air quality by vehicle exhausts will be low. Machines and vehicles will be checked regularly to minimise exhausted pollutants

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Air Quality	■	■	Short term during construction	Direct

6.2.5. Water Resources

There is a risk of pollution of groundwater by e.g. oil/fuel of machines and trucks which can be avoided by proper maintenance. A selection of existing wells for baseline analysis of basic parameters and 1-2 measurements during construction period and after completion have to be carried out.

Additionally, oil/fuel soil run-off during construction could pollute surface waters. However, the pylon locations will be far away of surface waters, because only small rivers and creeks have to be crossed.

Construction of temporary bridges may cause deterioration of river bed. Construction has to be careful and bridges will have to be dismantled after completion.

A detailed HSE Management Plan shall be implemented during construction phase.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
<u>Water Resources</u>				
a) Groundwater	■■■	■	Short term during construction	Direct
b) Surface Water	■■■	■		

6.2.6. Flora and Fauna

Most of the land to be crossed consists of agricultural land, grazing land and rocky terrains. Near the corridor some important habitats can be found for birds (e.g. Sevan National Park) and big mammals (e.g. Yeghegis Wildlife Reserve). There is a high biodiversity of plants on the meadows and in the higher areas of gorges of Yeghegis Valley and Arpa Gorge there are juniper open forest lands which are important ecosystems for the area.

No important forest areas will be crossed by this line. The planned line crosses neither Jermuk nor Herher Forestry Reserves. However, in several locations

trees have to be felled and in one area a small patch of forest is traversed by the line resulting in 3.5 ha of deforested land. The present design of the transmission line avoids a migratory corridor of mammals between Khosrov Reserve and Iran, which is located on the southern side of Arpa valley, whereas the line passes on the northern side.

As the natural habitats are not very densely populated and mostly easily accessible (e.g. no primary, dense forest, no important wetlands) but rather open lands, the impacts of the construction process on Flora and Fauna are not expected to be high. There are several areas where access roads will be necessary especially in the valleys of Yeghegis and Arpa Rivers.

Though the line is not crossing any nationally important or protected natural sites, the ecosystem value of the area is important and construction process should be carried out with great care in order to limit damages to vegetation. Access roads should be limited, wherever possible.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Flora and Fauna	■ ■	■	Short term during construction	Direct

6.2.7. Protected Areas and Wetlands

The proposed line runs partly through the buffer zone of Sevan National Park and by-passes the Yeghegis Wildlife Reserve. Fortunately, the transmission line is located on the hillside and not the lake side of the main road and runs through rocky terrain and grassland that are not particularly sensitive, especially as the existing line has already impacted the area.

In case of Yeghegis Reserve the planned bypass of village Shatin will be constructed on the opposite hillside, separated from the reserve by the road and the village. The line crosses neither Jermuk nor Herher Forestry Reserves.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Protected Areas and Wetlands	■ ■	■	Short term	Direct

6.2.8. Solid Waste

Some line sections will be erected in remote areas without proper landfills. There will also be remains of vacated structures due to involuntary displacement. The sensitivity of the line corridor for solid waste is assessed to be medium. The generation of solid waste will be minimised by a proper waste management implemented by the construction contractor.

According to information obtained by HVEN it is not decided yet what will happen to the old line. In discussion are following scenarios:

- The old line will be untouched as spare line
- The old line will be untouched and towers/conductors will be used as spare parts elsewhere
- The old line will be dismantled and the dismantled towers and conductors will be stored elsewhere as spare parts

The old line will be dismantled and the iron parts will be recycled.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Solid Waste (generated by construction activities and by workers)	■ ■	■	Short term during construction	Indirect
Dismantling of old line	■ ■	+	Long Term	Direct

6.3. Environmental and Ecological Impacts during Operation

6.3.1. Landscape

In many parts of the transmission line corridor, there is a high burden on the landscape caused by many other parallel lines crossing the country and by long distribution lines. Due to the character of the landscape the visibility of towers is high and it is possible to see several dozens of towers from almost every point on the main road.

Being a replacement of an existing line the planned transmission line is not expected to increase the visual burden on the landscape. If all towers of the old line are completely dismantled the number of towers should remain equal or even be slightly lower because of longer distances between the towers. However this will greatly depend on the final routing and the design of towers. The potential additional impact is assessed to be low.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Landscape	■	■	Long term	Direct

6.3.2. Flora

Growing trees and shrubs within the ROW have to be cut from time to time to keep the minimum safety clearance of 4 m between vegetation and the conductor cables. Biocides shall not be used for corridor clearance. Most of the land within the ROW is agricultural land that can be cultivated with most of the original crops as before, except for the tower sites themselves.

The vegetation under the towers and along the access roads / tracks will partly be destroyed permanently. New access roads will promote access by cars in formerly little disturbed regions. However, no forest areas occur in the Investigation Area and no rare or endangered species are expected to be found in the line corridor. The vegetation within the ROW is cleared on a regularly basis during operation of the OHL without using any herbicides. Thus, the impact of the proposed Project on the flora in the line corridor is assessed to be low.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Flora	■	■	Long term	Direct

6.3.3. Fauna

Birds are the animal group which are most affected by OHLs. The three main types of risk to birds from overhead lines are:

- risk of electrocution
- risk of collision
- parcelling of bird habitats.

Risk of electrocution

Birds sitting on power poles and / or conducting cables are killed if they cause short circuits (short circuit between energized wires, or short-to-ground). Electrocution can be largely avoided by proper design of the poles, conductors and insulators. According to the Bird Protection Clause in the German Industry Norm (DIN VDE 0210/12.85) „Crossarms, insulators and other parts of power lines shall be constructed so that birds find no opportunity to perch near energized power lines that might be hazardous“.

Three criteria mainly determine the safety of the installations:

- Type of attachment of the insulators and the poles;
- Space between the power cables and other energized and grounded parts;
- Power poles with upright insulators have a high risk regarding electrocution of birds. Power poles with suspended insulators are fairly safe provided the distance between crossarms and the energized parts (conductors) is at least 60 cm. Conductors should be spaced at least 140 cm apart. **There is no such a treat for the birds in case of 220kv OHL.**

The conductor arrangement and the insulators of the pylons proposed in the feasibility study fulfil the above mentioned requirements to prevent bird electrocution.

Risk of collision

During their flight, birds can collide with the cables of power lines because the cables are often difficult to see. In most cases, the impact of collision leads to immediate death or to fatal injuries and mutilations of birds.

The risk of OHLs regarding bird collision depends on the arrangement of the conductor cables and the earth wire. The highest risks are posed by those power lines, where the conductor cables are arranged at different heights or where the earth cables can be found high above the conductor cables. The lowest risks concerning bird collision can be related to those constructions, which have all conductor cables arranged at one height.

Parcelling of bird habitats

Transmission lines in particular affect birds by parcelling their territories, influencing the suitability of breeding habitats or presenting an obstacle during flight. The territory of a bird may vary in size from a very large area to little more than a spot on which the nest is built, depending on the species. The various habitats suitable for different purposes (e.g. for breeding, sleeping, feeding) forces a bird to be very mobile. Some birds migrate from one area to another during the night and/or the day. For these birds, transmission lines can represent an obstacle because of possible collision with the conductors. During the migration season, big birds like herons, pelicans, storks etc. react very sensitively to transmission lines which are close to their resting and feeding areas.

Lake Sevan is the most sensitive area of the transmission line corridor regarding bird collisions with conductors. Here, some sensitive species are living like herons, pelicans, egrets. However, there are no reports about bird collisions with conductors in this region. The line does not run close to the lake, where bird habitats are located, but on the mountain side. In other line sections i.e. on Selim Pass, Arpa Gorge and Sisian Plateau big birds are mostly birds of prey. These species have a good ability to see and are generally not very sensitive to this threat.

The impact of the transmission line on bird habitats is therefore assessed to be low. No specific mitigation measures are recommended.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Fauna	■	■	Long term	Direct

6.3.4. Noise

The intensity of corona noise is influenced by weather conditions. Wet weather, fog or rain increases the noise level but these weather conditions do not dominate the weather in the Investigation Area. Also noise emitted by the substations will be minimal and not affect population outside the fence.

For population following limit values are valid (General IFC HSE Guideline):

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 7:00 – 22:00	Night-time 22:00 – 7:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Tab. 6-1: Limit values for noise regarding population

Noise levels for workers within the substations will also not be exceeded. As stipulated in the General IFC EHS Guidelines of the World Bank Group, ‘no employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection’. Such high noise levels are not to be expected to occur within a substation designed as state-of-the-art during regular operation.

The impacts on the landscape through noise resulting from the OHL are assessed to be low. Noise emitted by substations or by the conductors (corona effect) will be minimal. Specific mitigation measures are not necessary.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Noise	■ ■	■	Long term	Indirect

6.3.5. Climate Change

The replacement of the existing transmission line may have a positive impact on climate change as energy efficiency will be increased for the new line.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Climate change	■	+	Long term	Indirect

6.3.6. Electric and Magnetic Fields

From similar projects it can be stated that the relevant internationally accepted limit values for the public will not be exceeded if the minimum safety distance of 7 m to the conductor is kept as recommended. (see Annex 12.4)

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Electric and Magnetic Fields for the public	■	■	Long term	Indirect
at the workplaces	■	■		

7. Social Impacts

7.1. Introduction and Methodology

The essential part of the Project's potential social impacts will occur during the construction phase of the transmission line. Generally, impacts will be created through land acquisition of the ROW (70 m corridor) for the construction of substations, towers and access roads. There are also impacts on settlements and agricultural practices within the ROW as well as damages to crops etc. resulting from the access to the construction sites / line corridor.

Other fields of impacts analyzed are health issues, cultural heritage as well as impacts on gender issues. Positive socio-economic impacts regarding local employment (during construction) were also analyzed.

The social impacts can be divided into two categories: permanent impacts and temporary impacts:

Permanent positive impacts are the stabilization of electricity supply in the connected towns and the indirect benefits on economic development. Permanent negative impacts occur through land acquisition for the construction of towers and substations, the removal of houses and other built structures within the minimal distance from the transmission line, and clearing of trees within the limit distances of the transmission line. Also, potential impacts on cultural and historical sites may occur.

Temporary positive impacts are the economic benefits through employment of local people during construction work. Temporary negative impacts occur through the potential damages of crops during construction within the way leave corridor / ROW and for the access to the construction site of towers. Other temporary negative impacts are due to the presence of external workers and workers' camps. A potential negative impact is the necessary power-cut during the construction period.

7.2. Social Impacts during Construction Phase

7.2.1. Health and Safety

Direct impacts Health and Safety during construction of the planned transmission line may result from various factors as electrocution during construction, sanitary situation during construction, e.g. contamination of water, sexually transmitted diseases due to contact of workers and population etc.

As the construction will be undertaken in an environment, where other functioning lines are present in the vicinity the risk of electrocution may be increased in some areas, especially those where the distance between the lines is small or where crossing of existing lines is planned.

A potential impact for the health and safety of workers could be further related to work accidents during construction of the line (fall of rocks, blasting of rocks) or due to contaminated drinking water or food.

Indirect impacts on Health and Safety are related to the stability and functioning of the Armenian Power Grid and the functioning of power supply to the safety circuits of the Nuclear Power Plant. As the existing transmission line (e.g. in town of Gavar, Arpa Valley etc.) will have to be interrupted during construction at several places, only one other line (Shamb Line) will assure the connection with Iran and linked to this the stability of power frequency (around 50Hz) necessary for the safety circuits of the Nuclear Power Plant. It has been questioned by HVEN if the necessary repairs of a potentially interrupted other line and a resulting total power cut (both parallel lines interrupted) would be quick enough to stabilize the power supply in the Nuclear Power Plant. However, the increase of risk will be limited to a relatively short time (planned 1,5-2 weeks). The indirect impact of the project will only gradually increase a risk that exists without relation to the project e.g. in case of a natural disaster.

The construction contractor will develop an appropriate Health, Safety and Environment Management System (HSEMS) and implement it during the construction phase.

The implementing agency and construction contractor will have to inform the authorities responsible for the Safety of the Nuclear Power Plant in advance about any planned or immediately in case of a spontaneous / accidental power cut of the existing line during construction works. The Safety circuits of the Nuclear Power Plant should be studied in detail and if necessary updated to make sure that an accidental power cut of the entire connection to Iran would not have negative consequences on the functioning of safety circuits.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Health and Safety	■■	■	Short term during construction	Direct
Safety of Nuclear Power Plant	■■	Assessment not possible	Short term during construction	Indirect

7.2.2. Historical and Cultural Sites

OP/BP 4.11 ‘Physical Cultural Resources’ states that “physical cultural resources may not be known or visible; therefore, it is important that a project’s potential impacts on physical cultural resources be considered at the earliest possible stage of the project planning cycle. (...) Since many physical cultural resources are not documented, or protected by law, consultation is an important means of identifying such resources, documenting their presence and significance, assessing potential impacts, and exploring mitigation options.”

The planned transmission line traverses many areas of importance for the Armenian Cultural Heritage as mentioned in Chapter 5.2.2. Field visits and consultations with representatives of the Department for the Protection of

Historical Monuments under the Ministry of Culture of Republic of Armenia have revealed a couple of areas of potential impact mainly on sites yet to be excavated. For a majority of the sites the importance for the Cultural Heritage has not been determined at present.

The investigation has been done on site and with support of satellite pictures and with the participation of local experts. Only sites that are in the proximity (1km distance) of the existing and planned lines have been considered.

Major cultural sites e.g. monasteries that are located in a few km distance will not be mentioned here, as they won't be directly affected by the line construction.

The law on the Protection and Use of Immovable Cultural and Historic Monuments and Historic Environment (1998) provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments.

In response to a request of the Ministry of Culture the identified sites have been indicated and visualized using Google satellite images with potential historical and cultural heritage areas for all line sections. The identification of the areas is somewhat imprecise, as the exact location has to be checked exactly in the field during summer time and the underground areas that are not yet excavated are not visible on satellite images. The following list is therefore approximate and incomplete. A detailed list / inventory of Historical Monuments of RA is in preparation by the Ministry of Culture.

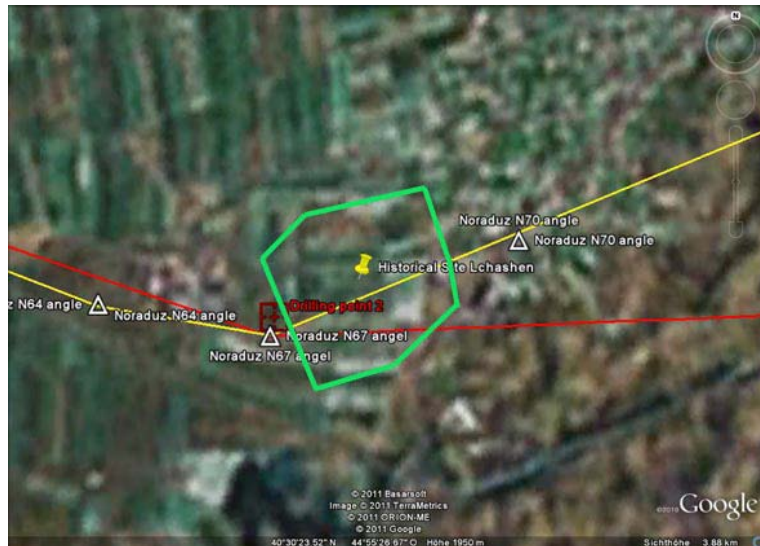


Figure 7-1: Lchashen Excavation Site

The excavation site near Lchashen is one of the most important archaeological sites in Armenia. It has been only partly excavated and experts suppose to find artefacts and remains of settlements in the vicinity of the present excavation sites. The main excavation site is not affected by the corridor. During final design the proposed corridor has to be investigated together with experts from the Department for the protection of Monuments / Ministry of Culture.

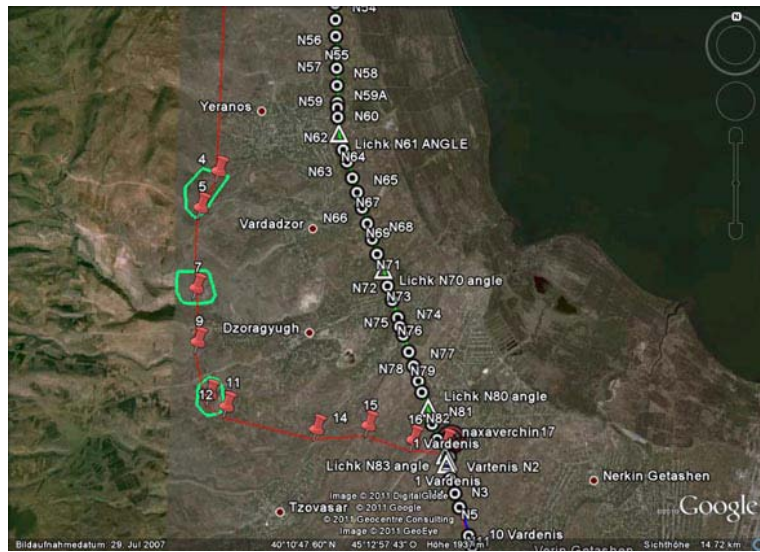


Figure 7-2: Urartian Fortresses of Yeranos, Dzoragyugh

Field investigation has drawn attention to three Urartian fortresses located in / near the planned bypass corridor around villages Yeranos, Vardadzor, Dzoragyugh and Tzovasar. Exact location and importance needs to be identified by Department of Protection of Monuments / Ministry of Culture and investigated during final design.

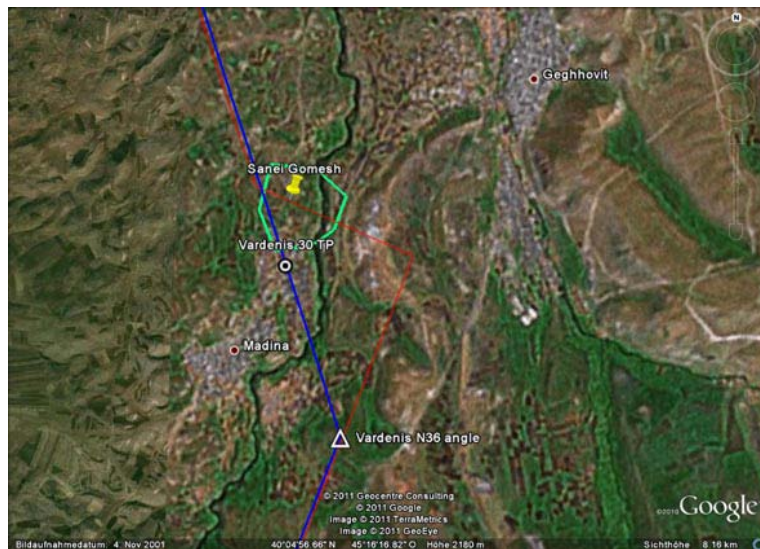


Figure 7-3: Sanei Gomesh /Madina

The location of an important historical site “Sanei Gomesh” with remains of a settlement and a church have been identified in the corridor of Village Madina bypass. Exact location needs to be identified by the Department of Protection of Monuments / Ministry of Culture.



Figure 7-4: Caravanserai on Selim Pass and Historical Bridges

The 11th Century caravanserai on Selim Pass Road is an important historical monument and tourist attraction. It is one of the rare well preserved and visible monuments in proximity of the planned line corridor. There are several other less preserved structures in the vicinity. The line corridor should be designed as distant as possible from the caravanserai, also for tourism reasons in order to avoid unnecessary visual impacts.



Figure 7-5: Dadaiberd / Shatin

The fortress known as “Dadaiberd” by local villagers is located in planned ROW of Shatin bypass. Archaeological works have been started. It should be checked if the bypass can be designed differently or if over-spanning is sufficient. If the site is considered to be culturally important over-spanning is not the best option, especially in view of future tourism development possibilities.

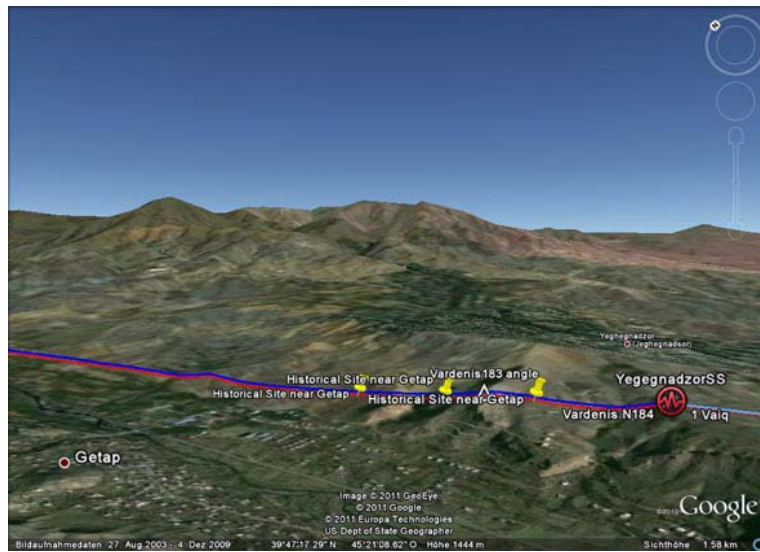


Figure 7-6: Fortresses above Village Getap

Above village Getap, on the ridge dividing Getap and Yeghegnadzor the existing and planned transmission line corridor traverses an area with remains of fortresses. The exact location needs to be identified by Department of Protection of Monuments / Ministry of Culture.



Figure 7-7: Historical Site near Malishka

Two historical sites, an ancient settlement site and a burial ground are located near village Getap near the existing line corridor. Over-spanning is regarded as an option, especially as towers are constructed on the hills, whereas the sites are located in the valley (see also Figure 12-43).

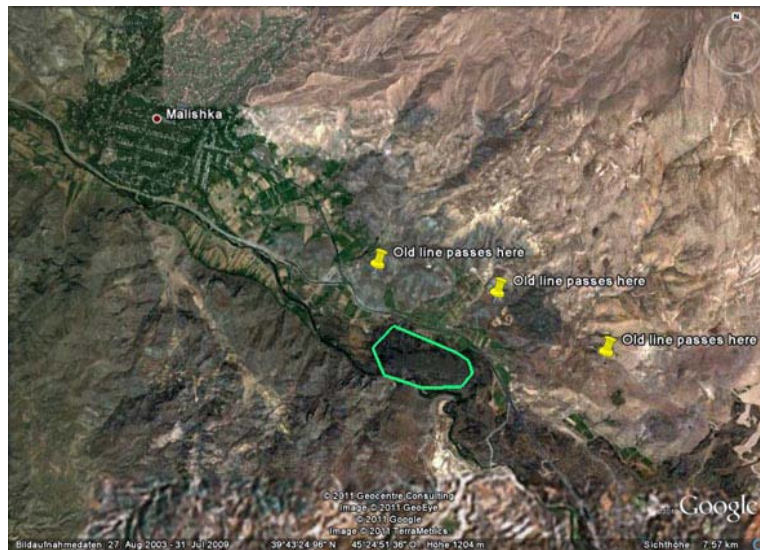


Figure 7-8: Historical Site of Moz near village Malishka

The ancient town of Moz was a famous trade center even in medieval times situated in Arpa river valley at the end of Vayk Gorge on a hillock. With present design the line does not affect the site.

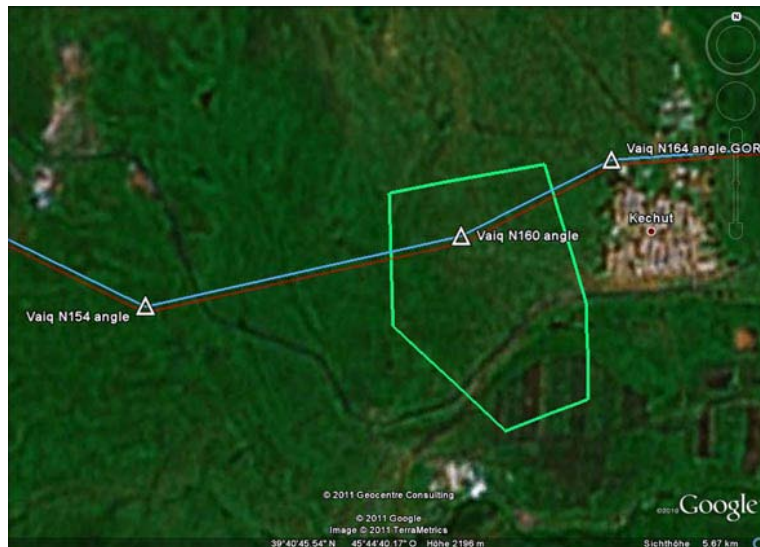


Figure 7-9: Potential historical site near Kechut

Near village “Kechut” experts suppose a historical area (not yet excavated) dated 3000 B.C. Exact location and historical importance need to be checked by Ministry of Culture.



Figure 7-10: Potential Historical Site near Spandaryan Substation

On the new double circuit line near Spandaryan HPP a potential historical site has been identified within ROW by local experts. It is supposed to be a Katchkar Stone Site, Armenia's Stone Carved Crosses. Exact location and historical importance needs to be identified by Department of Protection of Monuments / Ministry of Culture.

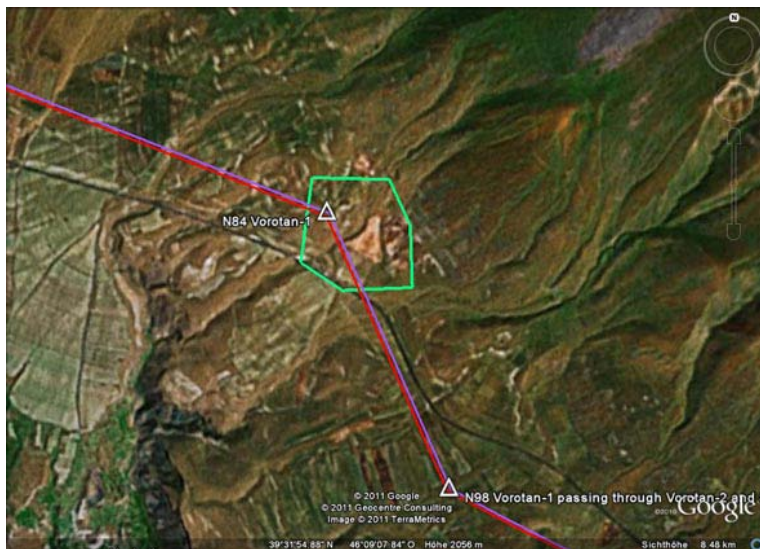


Figure 7-11: Historical site on Sisian Plateau:

The historical area with stone towers is supposed to be the only site on Sisian Plateau touched by the line. The exact location and importance needs to be identified by Department of Protection of Monuments / Ministry of Culture.

Additionally, along the entire transmission line corridor, there are a several sites below towers of the existing line which cannot be excavated due to the presence of the line. The replacement and dismantling of the old line would be beneficial for those sites.

Historical sites will be avoided via by-passing or over-spanning e.g. in case of graves located below the surface. Representatives of the Department of Protection of Monuments and historical sites / Department of Cultural Heritage will accompany the construction contractor during the design phase and determine the exact tower location according to their requirements (see also Chapter 9.2.1). Same procedure will be applied for location of needed new access roads.

In case of chance finds, the construction has to be stopped immediately and the Department of Protection of Monuments and historical sites has to be informed to agree on further steps (as according to Armenian Law).

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Historical and Cultural Sites	■■■	■	Short term during construction and long term impacts by the physical presence of towers	Direct and indirect by the physical presence of the line (visual aspect)

7.2.3. Infrastructure

Respect of minimal ground clearance will be sufficient in order to avoid negative interference to the traffic occurs in case of road crossings. Proper traffic management will avoid negative impacts on traffic as far as possible.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Infrastructure	■	■	Short term during construction	Direct

7.2.4. Power Supply

During construction some new towers have to be erected at the same places like the old ones. This makes it necessary to cut the power supply of the old 220 kV line for **one to** two weeks. At this time the power supply between the Northern and Southern part of the country is ensured by a second 220 kV line (Shamb Line). However, there is a risk that during this construction period the power can be cut totally if an accident of fatal error happens to the second power line, resulting in frequency variations possibly impacting the nuclear power plant negatively. A repair team will be in place being able to fix the line within 10 to 15 hrs.

The implementing agency and construction contractor will have to inform the authorities who are responsible for the Safety of the Nuclear Power Plant in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut during construction works.

The Safety circuits of the Nuclear Power Plant should be studied in detail and if necessary updated to make sure that an accidental power cut of the entire connection to Iran would not have negative consequences on the functioning of safety circuits.

1. For the public: In some sections (e.g. at substation Gavar) the exactly the old corridor has to be taken for the new line. In these sections it is not possible to construct the line parallel to the existing one (see Figure 7-12; Chapter 12.5). That means, during a short period of construction the old line has to shut down for about 1-1.5 week. During this period, however, the power supply of the relevant substations and the associated distribution systems can be maintained by bringing in the power from the other side thus no interruption of power will occur for the public. But doing so the whole system is more sensitive to accidental power cuts. An emergency troop will be established being able to perform repair actions within 10 to 14 hours after accidental cut off the power supply.
2. For the nuclear power plant: As mentioned above the grid system will be more sensitive to accidental shut downs during the period where the old 220 kV line is interrupted. Accidental interruption of the power supply could result in severe problems for the power supply of the nuclear power plant's safety circuits, what has to be avoided in any case. (see also Chapter 7.2.1) It is not possible to assess the risks for the nuclear power plant within this study. Such a risk assessment is very complex and beyond the scope of this study. It is strongly recommended to develop a detailed risk analysis and to set up an effective emergency plan to exclude any risk for the power supply of the nuclear power plant during construction of the new 220 kV OHL.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Power supply to the public	■■■	■	Short term, during construction	Direct
Power supply to nuclear power plant	■■■	Assessment not possible		Indirect

7.2.5. Land Use and Land Acquisition

With a length of approximately 225 km, the planned transmission line will have significant impacts on the land use and land acquisition in the affected area. Partly private land will have to be expropriated in the National Interest. This does not constitute a legal problem (Law on Alienation of Property for Social and State Needs, 2006) but will invariably impact the lives of local residents, change land use practices temporarily and permanently and cause the felling of (fruit) trees and damages to crops.

The strategy adopted is to avoid and to minimize impacts wherever possible and to compensate PAPs for impacts that cannot be avoided. OP 4.01 and OP

4.12 foresee the full compensation of PAPs and livelihood restoration to a situation that at the minimum equals the level prior to the Project.

As the line will pass agricultural lands and mountain pastures it will have an impact on the land use. Despite the line being reconstructed close to the existing line, a completely new ROW will be created in 50 m distance of the existing line. The share of private and public lands is expected to be around 50% each. Once the tower locations will be defined the cadastral information will exactly determine the ownership status of the affected land.

Land Acquisition:

It is understood that the acquisition of the entire ROW is not considered as an option. If acquisition of the entire ROW was planned, the total area to purchase would amount to 1,575 ha.

For the planned line, land acquisition will be made only for tower locations at a rate of 100m² each and of terrains with houses that need to be removed (see Chapter 7.2.6 and RPF for details). All substations do exist already.

Other land acquisition is not expected as other lands will only be used temporarily and damages can be compensated.

Impact on land use (Trees):

Forest areas that are located within ROW are subject to height limitations. Trees higher than 4 m will be cut and safety distances of 4 m should be respected. Growing trees in ROW increases maintenance works. For the present design the loss of trees will be minimal. Apart occasional trees in most of the areas, there are fruit orchards in the river valleys (notably in Arpa valley) a planted forest patch in Gavar town and a forest patch with beech trees just west of Vorotan pass. These areas are together less than 3.5 ha.

As forests / trees are a scarce resource in Armenia the number of cut trees should be reduced to the absolute minimum. In general forest areas are state property, especially for forest plantations. Trees are private property if they are located in fields and gardens. These are mostly fruit trees (apricots/almonds) in the area.

Fruit tree plantations should be avoided wherever possible. Furthermore it should be checked during design if safety distances of 4 m can be met if almond or apricot trees are grown below the line and prevent an impact on this important livelihood resource. Otherwise a monetary compensation will have to be paid, reflecting the long-term benefit that an owner would have of this resource and the time replanting and growth to productivity-size would take.

As a compensation measure for the loss of forestry trees, it has been suggested to not only pay monetary compensation for the loss of trees, but to replant twice the amount of trees and pay for nursery activities in order to increase forest cover in Armenia and ensure future availability of this important resource (personal communication Hayantar SNCO).

Compensation measures:

Impact on land use (Agriculture):

Main agricultural produce of the areas are potatoes and wheat, and a smaller production of vegetables, wine, fruits etc. Fields are fragmented and size often very small. Agriculture will be possible in ROW after construction period.

A permanent impact is expected only for tower locations, where land acquisition procedure will be executed. Compensation for loss of agricultural produce and production capacity will have to be paid if towers are located in fields, as specified in the entitlement framework presented in the Resettlement Policy Framework (RPF). In case of vulnerable people losing more than 10% of their income generation capacity, additional income/livelihood restoration measures will have to be implemented.

Vineyards should be allowed in ROW and damages during construction compensated, otherwise the same compensation procedure is suggested as for fruit trees / orchards.

Temporary impacts, i.e damages to crops during design and construction period will be compensated on the spot. Ideally construction period would avoid agricultural season. Compensation is not limited to people with land titles. Also people without land titles, whose crops are damaged during construction process has to receive compensation.



Figure 7-13: Agriculture in Arpa Valley near village Agarakadzor

Impact on land use (Grazing Lands):

Most of the grazing lands / mountain pastures are communal lands used by livestock owners. Grazing will be allowed within the corridor. Permanent as well as temporary impacts will be limited.

Impact on land use (Access Roads):

Impact of access roads can either be permanent, if the change of land use is not reversible or temporary, if the former land use can be continued after construction. Considering the character of the landscape, (inaccessible terrains where access roads would rather be permanent due to blasting of rocks etc.) are not used for agriculture, but are mostly rocky terrains and steep slopes. (see Chapter 6.1.2).

The extent of permanent impact of access roads on private lands therefore estimated to be limited. However, if private lands are irreversibly changed for the construction of access roads, the same expropriation procedure applies as for tower locations and lands with settlements. In case of a temporary impact, damages to crops and production capacity of the land will have to be fully compensated.

Summary:

Land acquisition for all tower foundations, access roads, relocation of houses will be necessary, as the line corridor will be a new corridor for the entire Project (except for approx 10 towers in 3 locations where the old ROW will be used). Land acquisition for approximately 820 towers will be necessary (100 m² per tower) equalling 8.2 ha of land, which is estimated to be private land for at least 50% of the territories concerned. Additionally, land has to be acquired to compensate house owners that need to be relocated or lands have to be purchased and given in exchange to resettle them. (see also Resettlement Policy Framework (RPF)).

Expropriation of private land for access roads should be avoided. If this is not possible due to technical reasons, the same procedure will have to apply as for tower locations. Temporary damages to crops during design, construction of towers and stringing will be compensated. Trees cut on public land will be replanted in a ratio of at least 2:1 (there are examples of re-plantation ratio of 10:1) and a contract will be made to nurse trees until they will be able to survive on their own after 2-3 years.

Overall, sensitivity of the area is estimated to be low, however due to the number of plots required for the construction of towers, the extent of the potential impact on land use and land acquisition is estimated to be medium.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Land Use and Land Acquisition	■	■■	Long term	Direct

7.2.6. Involuntary Resettlement

Involuntary resettlement has a big impact on the livelihood of affected people and is one of the most serious issues of infrastructure projects. Such a resettlement should be avoided or if this is not possible minimized. Losses of houses and livelihood shall be fully compensated.

The World Bank's Operational Policy OP 4.12 "Involuntary Resettlement" provides safeguards to address and mitigate impoverishment risks related to involuntary resettlement under development projects. The main objectives of OP 4.12 are that involuntary resettlement should be avoided where feasible. At least, its social and economic impacts should be minimized and affected parties should be enabled to share the project benefits. Project affected persons should be consulted and be given the opportunity to participate in the planning and implementation of the resettlement program. Displaced persons should be assisted to improve their livelihoods or at least to restore them to pre-project levels.

To address the negative impacts of involuntary resettlement, the World Bank policy requires that affected persons are:

- informed about their options and rights pertaining to resettlement;
- consulted on and provided with feasible resettlement alternatives;
- provided with prompt and full replacement costs for losses of assets;
- provided with assistance such as moving allowances during relocation;
- provided with development assistance in addition to the compensation, such as credit facilities, training or job opportunities.
- Vulnerable persons among the displaced people, such as the handicapped, elderly people, women, widows, and children should be provided with specific social assistance.

At the time of this study, the detailed routing for the planned line has not been fixed. This has an advantage, because it is still possible to avoid important impacts through a re-design of the line routing. The inconvenient is that impacts cannot be quantified in detail in the present stage of the project. Several errors in the present design (i.e. in the representation of the old line) make a detailed assessment difficult. However, as the routing is still subject to many variations the present analysis is a snap-shot within a process. The present design has chosen to bypass settlements as a priority. However, it is unknown if all the bypasses will be technically feasible. The result would be a final design with a far higher impact on resettlement. (See also Chapter 4: Analysis of Alignment Alternatives as well as the separate Resettlement Policy Framework (RPF).

Impact on settlements has been analyzed by interpretation of satellite images and crosschecked during field-visits. A RAP or Abbreviated RAP will have to be carried out when final design will be fixed.

Under the present design resettlement issues are likely to arise in the following villages:

1.) Noratus Line:



Figure 7-14: Settlement near tower N113

A house or a barn is located near tower N113 before village Lchap at 25 m from planned new line within ROW. It should be considered whether safety distances are sufficient to avoid resettlement.

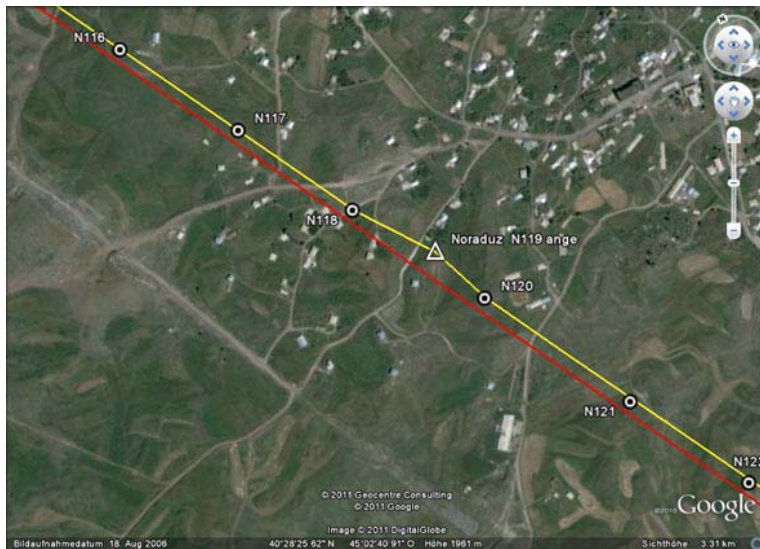


Figure 7-15: Potentially affected houses near village Lchap.

A reconstruction of the line in 50 m distance of the old corridor would affect up to 10 houses that would potentially need to be resettled. A new bypass the western side of the village behind settlements between N113 and N128on should be considered in order not to affect any houses.



Figure 7-16: Potentially affected houses near village Hayravank

Hayravank is a village that is partly in ruins, however, most of the houses near the transmission line are inhabited. Three houses and one barn would be potentially affected in parallel new ROW. A bypass from N134 to N146 (or N 163) would not affect any settlements and should be considered.

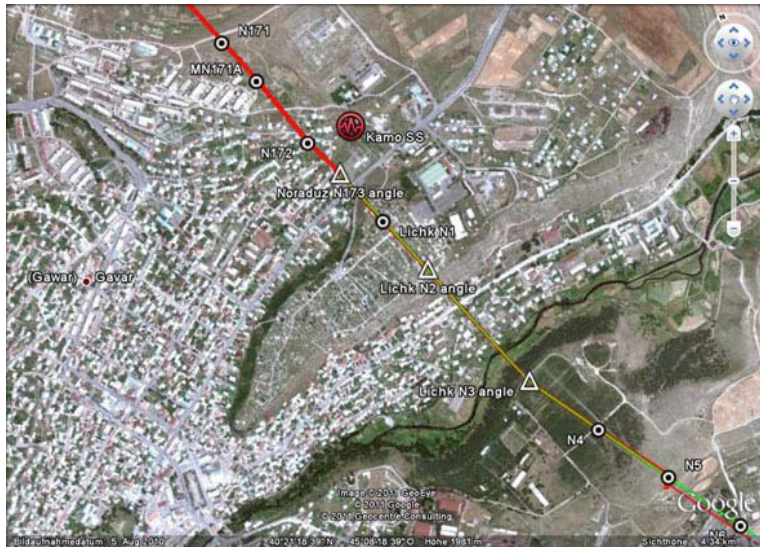


Figure 7-17: Town of Gavar

A replacement of the new line using exactly the old line corridor is planned for at least four towers before Kamo SS in order not to affect settlements. A new parallel corridor would potentially affect 16 buildings among which several multi-storey apartment blocks and thereby creating a considerable impact on involuntary resettlement. A necessary power-cut for replacement of conductors in old ROW is expected to be 1.5-2 weeks (see also Annex 12.5; Kamo Substation).

2.) Lichk Line:



Figure 7-18: Overspanning of Gavar Valley

It is planned to use old ROW from N1 to N5 of Lichk line in order to avoid resettlement. Trees that need to be cut shall be compensated and replanted in appropriate area. At N5 there is another settlement (no photo) that is potentially affected (distance 25-30 m from ROW). Resettlement may be avoided if safety distances are considered sufficient.

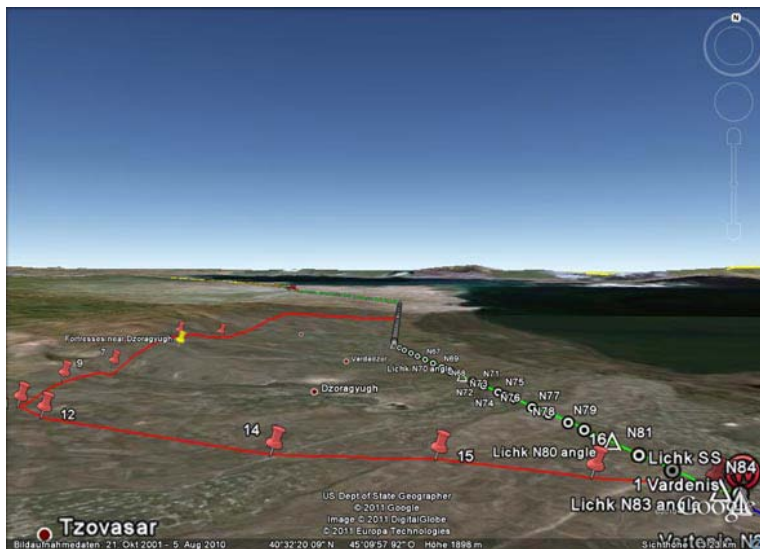


Figure 7-19: Bypass of Yeranov, Vardadzor, Dzoragyugh, Tzovasar

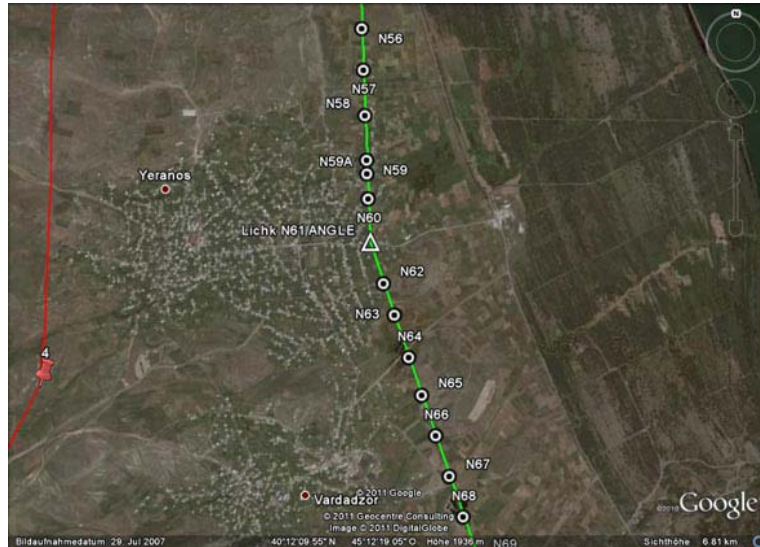


Figure 7-20: Villages Yeranios, Vardadzor

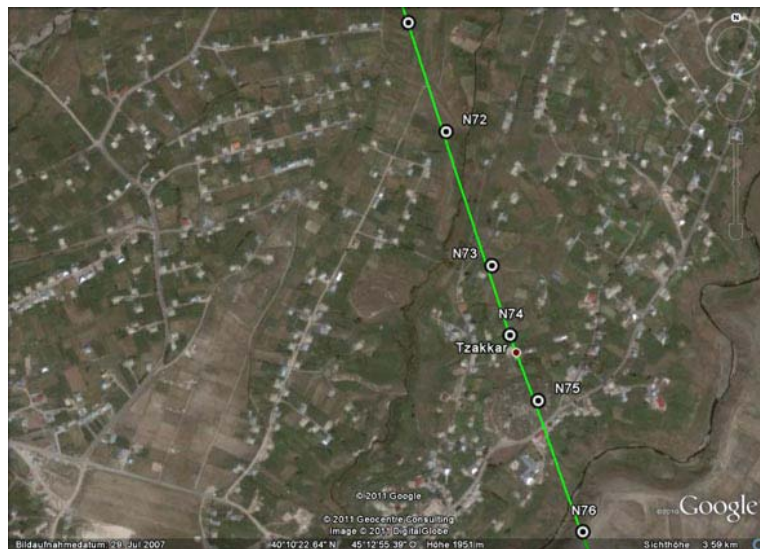


Figure 7-21: Old corridor at village Vardadzor / Tzakkar

The old line leads through three villages in a narrow corridor, where safety distances are not met in every case. A reconstruction in a parallel new corridor would affect at least 50 houses. The construction of the bypass (or use of old ROW) is necessary to avoid settlements. There are three houses / barns in the bypass corridor. It is expected that there are remains of three Urartian fortresses near the bypass corridor (see also Chapter 7.2.2). A bypass on the lake side of the villages is not recommended due to proximity of the lake-shore / Sevan National Park (see also Annex 12.5; Village Yeranios).

3.) Vardenis Line:

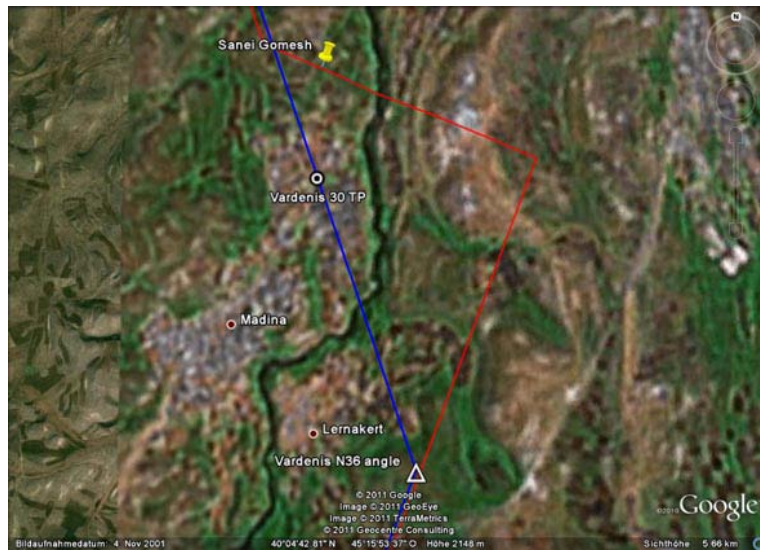


Figure 7-22: Village Madina, Lernakert

The bypass of village Madina and Lernakert needs to be revised for technical reasons and because of a potential impact on a historical site (Sanei Gomesh / Chapter 7.2.2). A careful design should be possible in order not to affect settlements.

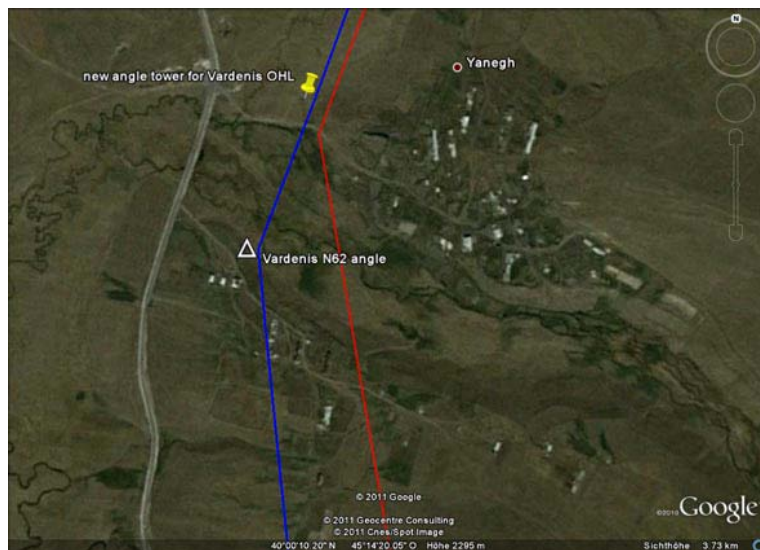


Figure 7-23: Village Yanegh

As most of the houses in parallel ROW seem to be in ruins, the necessity of a bypass should be checked and if necessary, the bypass should be designed not to affect any inhabited/used houses (see also title photo of this report).

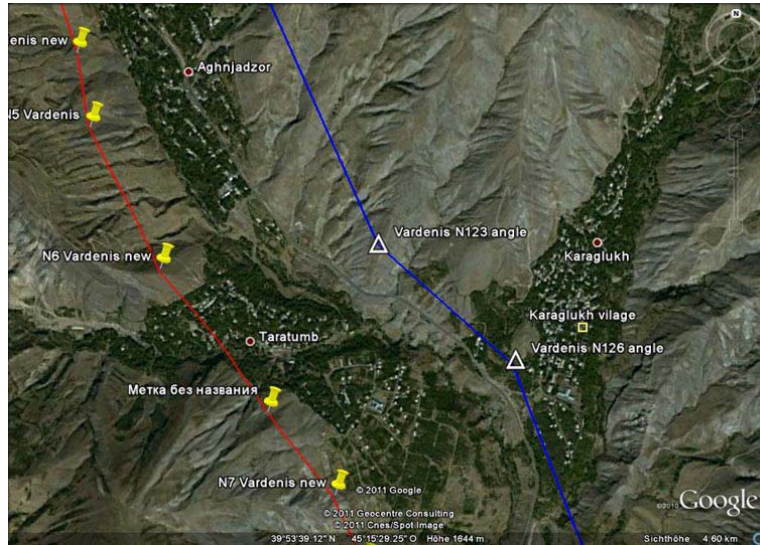


Figure 7-24: Taratumb, Karaglukh, Salli

It is planned to bypass the villages Aghnjadzor, Karaglukh and Salli on right side of Valley at around village Tratumbe. (approx. 50-100 m above river). With the present design, the bypass represents a difficult access in steep slopes and affects 11 houses in village Taratumb. The old corridor / parallel corridor affects minimum 20 houses of Karaglukh and Salli villages.

It should be checked if the bypass needs to be on the right river side or if a corridor can be found close to the road / river gorge on the left side / near existing ROW that does not affect any settlements (see also Annex 12.5, Taratumb Village).

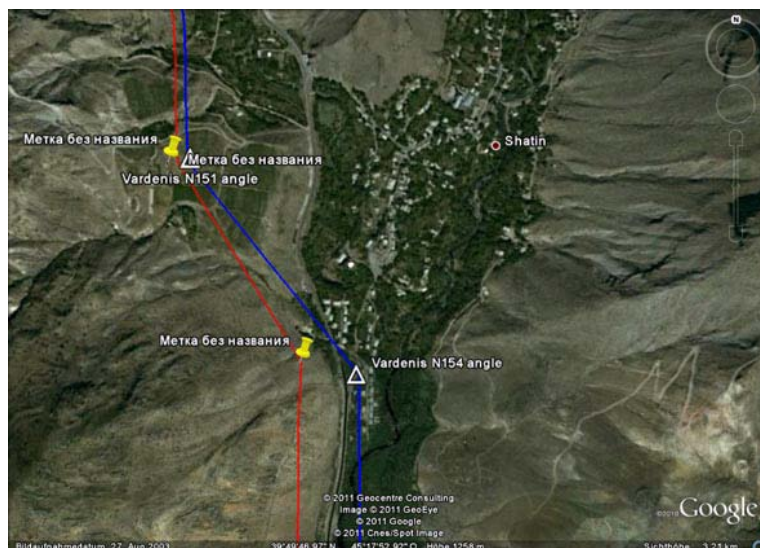


Figure 7-25: Village Shatin

The bypass of Shatin village is planned on a slope where the risk of erosion is marked. The old corridor affects up to 12 houses. All potential other corridors in the valley would affect several houses. The bypass of village Shatin should

be maintained on the western side of the valley, despite difficult construction on steep slope (see also Annex 12.5; Village Shatin).

4.) Vayk Line:



Figure 7-26: Agarakadzor and Arpa Valley

The line corridor through the Arpa valley at village Agarakadzor that does not affect settlements is quite narrow and there are presently three lines. It could not be determined if the new line would affect any houses as the design was incorrect in this area. The bypass corridor needs to be revised.



Figure 7-27: Village Malishka

It is planned to use old ROW through the Arpa valley narrows in order not to affect settlements of village Malishka and not to bypass the narrow on the mountain side. There are several lines (also Shamb line) in the corridor. Using

the old line would create necessity for another power cut of 1.5-2 weeks (see also Annex 12.5, Arpa Valley). An underground cable in this short line section could be a viable solution to this problem, especially as the road is parallel to the line.

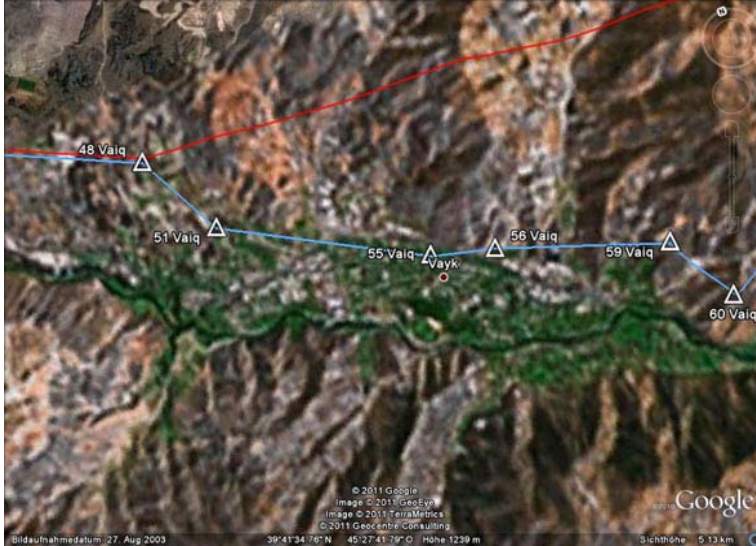


Figure 7-28: Town of Vayk and start of bypass

The old ROW or a parallel new ROW in the Arpa Gorge would potentially affect several houses. The planned bypass on the mountain side is not expected to create resettlement impacts. Northern bypass of Vayk Gorge is recommended as planned. Access roads shall be carefully designed to avoid damages to the juniper forest lands.



Figure 7-29: Affected houses at village Saravan / Kirs

There are 8 houses in ROW (Northern Alternative would not affect houses), on the left side of old ROW and beyond Shamb Line. Safety distances should be carefully checked.

5.) Vorotan Line:

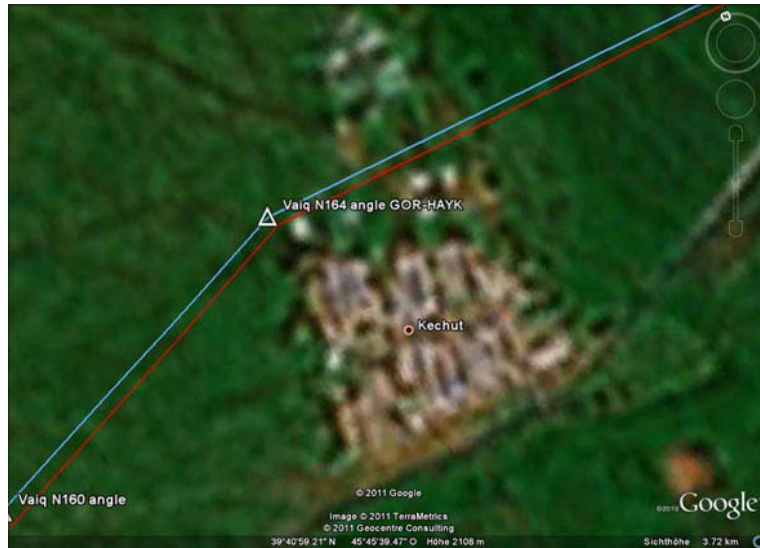


Figure 7-30: Village Kechut

A potentially affected settlement has been identified at village Kechut. Careful design should be able to avoid resettlement needs.

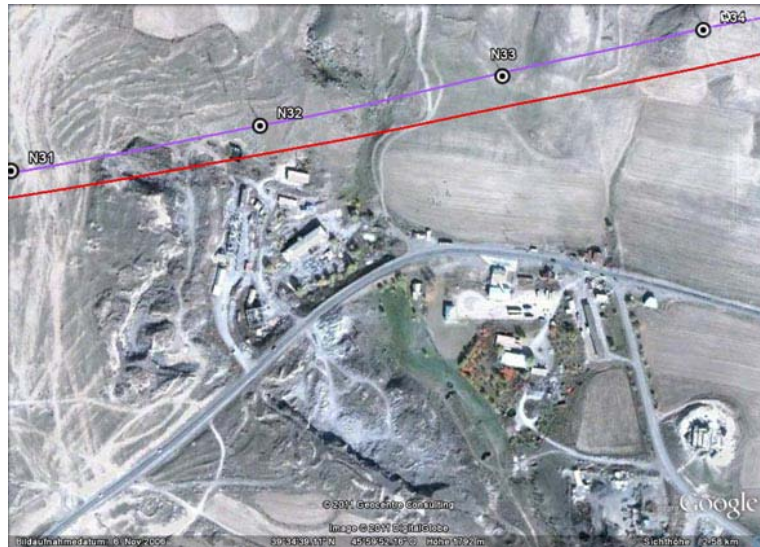


Figure 7-31: Potentially Affected Settlement near Shaki at Vorotan1 N 32



Figure 7-32: Potentially Affected Settlement near Shaki at N 32

After cross-check: The potentially affected house at N32 is a warehouse / workshop and safety distances of 7,5 m are met with present design.

If all suggested bypass sections around villages are constructed the necessity to relocate PAPs will be significantly reduced compared to a corridor that follows the existing line. Considering a potential line reconstruction using exactly the corridor of the old line routing approximately 100 houses would be potentially affected. A replacement of the line 50m next to the old corridor would affect more than 100 houses, especially in Gavar, Yeranos, Dzoragyugh, Shatin, Salli, Vayk etc.

Considering the suggested bypasses the number can be reduced to Zero; a careful estimate is made with max. 20 houses. In specific cases, i.e. for houses located far below the line in a valley, not all houses need to be removed from the ROW. The surface of a house is estimated as 225 m² for Cat.1 and 2 houses and 400 m² for Cat. 3 and 4 houses. Price of a house construction has been estimated at 50,000 / 75,000 USD for Cat. 1 and 2 and 100,000 / 150.000 USD for Cat. 3 and 4. Category 5 refers to multi storey buildings of various sizes for which no estimate has been available. However this estimate is very general and will be subject to individual assessment in case of affected buildings by an independent licensed assessor. (see Resettlement Policy Framework (RPF)). A relocation package that ensures full restoration of people's livelihoods will have to be established in the Resettlement Action Plan (RAP).

Avoidance of displacement is a priority issue. Bypasses shall be created in order not to affect settlements wherever technically feasible.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Loss of Houses and Livelihood Involuntary Displacement	■ ■	■	Long term	Direct

7.2.7. Gender Aspects

The construction of the line may increase existing Gender disparities, as benefits from construction work will be earned mostly by men and access and control over compensation payments are likely to be at the disposal of men and not of women, which increases the probability that the family will benefit less.

There is a considerable percentage of single women headed households in the area, who are among the most vulnerable people. If resettlement issues arise single women headed households the same procedure applies as for vulnerable people.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Gender Aspects	■ ■	■	Short term	Indirect

7.2.8. Vulnerable People

In the investigation area the incidence of poverty is between 35% and 60% depending on the region. These figures include urban areas, where poverty incidence is expected to be lower. In remote areas and above 1500 m altitude poverty incidence is generally considerably higher. People make a living from subsistence based agriculture and shepherding. Most of the poor people are vulnerable to trends, shocks and seasonality, meaning that a reduction in rainfall due to climate change, unexpected events like earth quakes or simply at the end of the winter season brings them to the edge of sustaining their livelihood.

Potential impacts as expropriation of land or damages to crops could reduce the livelihood base of vulnerable people to the extent that their livelihood is critically endangered. Most of the vulnerable people do not have land titles or own very little land. In this case already the loss of a surface of a tower foundation could result in vulnerability. In most cases safe drinking water, medical assistance, education etc. are also issues of concern.

The lack of social capital and trust in institutions and legal support makes people below the poverty line especially vulnerable to injustices regarding compensation payments and resettlement. Full livelihood restoration as suggested in OP 4.12 means that people additionally to cash compensation receive the support to build up a future livelihood. A formal cooperation with specialised NGOs is suggested.

As mentioned above vulnerable people will not address their grievances / complaints in public and often do not seek legal support even if they perceive a situation to be unjust. It is suggested that during construction process a social researcher investigates potential grievances individually with the affected households. Otherwise, many justified complaints will never be made and therefore impossible to address, preventing full livelihood restoration and thereby violating safeguard principles.

Livelihood improvement measures should be designed with participation of the concerned PAPs. Examples could be drinking water supply, energy efficient stove program, micro credit facilities and in case of considerable compensation payments, consulting how to save and invest the compensation money.

Households below the poverty line and otherwise vulnerable households may lose their livelihood base if impacted by the Project / loss of land or relocation. In this case, a special livelihood support program shall be implemented.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Vulnerable people	■■■	■■	Long term	Direct

7.2.9. Local Workforce

During the construction period local workforce will be employed for the construction of towers and stringing procedures. This will contribute to much needed monetary income in remote rural areas and towns, where the industrial basis has eroded. However the income generation opportunity is not of long term duration.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Local Workforce	■■■	✦	Short term limited to construction period	Direct

7.3. Social Impacts during Operational Phase

7.3.1. Land Use

An area of 100 m² per tower will have to be expropriated and partly sealed for tower foundations as a permanent impact (of the construction phase). The remaining land of the line corridor can be used as agricultural land or as pasture land without restriction. Maintenance works are not expected to have a major social impact. Minor impacts, as damages to crops during maintenance works will have to be compensated.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Land Use	■	■	Long term	Direct

7.3.2. Electricity Supply

An increased stability of the electricity supply, especially if a raising demand is expected, is a locally positive impact of the Project. An increased efficiency / reduction of transmission losses in the electricity network will be regionally positive.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Electricity Supply	■■■	+ ++	Long term	Direct

8. Summary of Impacts

Tab. 8-1: Impacts during design phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Line Routing	In line sections Vardenis, Vayk ■■■■ In line sections Noratuz, Lichk, Vorotan I ■	■	Long term	Direct	The sensitivity of the area for the line routing is high because numerous historical sites can be found along the proposed transmission line. Selection of line routing in order to avoid resettlement activities to the greatest extent possible; avoidance of any protected areas; minimal ground clearance will be sufficient so that no negative interference with the traffic occurs in case of road crossings.
Access Roads	In line sections Vardenis, Vayk ■■■■ In line sections Noratuz, Lichk, Vorotan I ■■	■■	Long term	Direct	Highest sensitivity of the investigation area regarding the construction of access roads has to be stated for line sections Vardenis and Vayk because of crossing of historical sites as graveyards located beneath the surface and in mountainous areas. The necessity to construct access roads to the line corridor represents the biggest impacts of the Project regarding protection of flora, fauna, and historical sites. The line routing will be selected with focus on minimising access roads by routing it along existing paved roads. Existing tracks will be used to the greatest extent possible.

Extent of impact:

■■■■	=	high
■■■	=	medium
■	=	low
○	=	nil
+	=	locally positive
++	=	regionally positive

Extent of sensitivity

■■■■	=	high
■■■	=	medium
■	=	low

Tab. 8-2: Impacts during construction phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Soil and Erosion	In line sections Vardenis, Vayk ■■■ In line sections Noratuz, Lichk, Vorotan1 ■	In line sections Vardenis, Vayk ■■ In line sections Noratuz, Lichk, Vorotan1 ■	Long term	Direct	In the steep mountainous slopes the sensitivity of the terrain for erosion is high. Removal of topsoil around tower feet will be minimised. Topsoil will be brought back after construction and soil will be replanted when towers are erected in steeper slopes. New access roads not needed anymore after having finished the construction will be rehabilitated and replanted. Erosion prevention measures for access roads as road-side plantation with bushes and drainage systems will have to be implemented.
Landscape and Visual Aspects	■	■	Short term during construction	Direct	In most parts of the line routing the old line will be replaced by the new ones. There are also numerous other transmission lines running nearby the proposed corridor. The influence on the landscape during construction is time limited. In order to reduce the visual impact the old line towers shall be dismantled completely.
Noise	■	■	Short term during construction	Direct	Due to the limited time of the construction period the annoyance of the population by noise generated during construction activities will be low. For workers a proper HSE Management Plan will address the issue 'noise'. All workers will be fitted with PPE as ear plugs etc.
Air Quality	■	■	Short term during construction	Direct	Due to the limited time of the construction period the impacts on ambient air quality by vehicle exhausts will be low. Machines and vehicles will be checked regularly to minimise exhausted pollutants.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
<u>Water Resources</u>					
a) Groundwater	■■■	■	Short term during construction	Direct	A proper HSE Management Plan will be in place during construction phase. There is only a small risk of groundwater pollution by e.g. oil/fuel spills of machines and trucks which can be avoided by proper maintenance.
b) Surface Water	■■■	■			Beside oil/fuel spills soil run-off during construction could pollute surface waters. However, the pylon locations will be far away from surface waters, because only small rivers and creeks have to be crossed.
Flora and Fauna	■■	■	Short term during construction	Direct	Most of the land to be crossed consists of agricultural land not providing any specific habitat for endangered or threatened plant or animal species. However, near the corridor some important habitats can be found for birds (e.g. Lake Sevan National Park) and big mammals. In some parts a high burden caused by many other lines has to be stated. Forest areas are not crossed by this transmission line. The planned line crosses neither Jermuk nor Herher Forestry Reserves. However, in several locations trees have to be felled and in one area a small patch of forest is traversed by the line resulting in 3.5 ha of deforested land. The present design of the transmission line avoids a migratory corridor of mammals between Khosrov Reserve and Iran, which is located on the southern side of Arpa valley, whereas the line passes on the northern side.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Protected Areas and Wetlands	■ ■	■	Short term	Direct	<p>The proposed line runs partly through the buffer zone of Sevan National Park and by-passes the Yeghegis Wildlife Reserve. Fortunately, the transmission line is located on the hillside and not the lake side of the main road and runs through rocky terrain and grassland that are not particularly sensitive, especially as the existing line has already impacted the area.</p> <p>In case of Yeghegis Reserve the planned bypass of village Shatin will be constructed on the opposite hillside, officially belonging to the edge of the reserve, but separated from the main reserve by the road and the village. The existing line touches the reserve and shall be dismantled completely. This would create a positive (visual) impact for the reserve.</p> <p>The planned transmission line crosses neither Jermuk nor Herher Forestry Reserves.</p>
Solid Waste (generated by construction activities and by workers)	■ ■	■	Short term during construction	Indirect	<p>Some line sections will be erected in remote areas without proper landfills. The sensitivity of the line corridor for solid waste is assessed to be medium.</p> <p>The generation of solid waste will be minimised by a proper waste management implemented by the construction contractor.</p>
Dismantling of old Line		+	Long term	direct	<p>According to information obtained by HVEN it has not been decided yet what happens to the old line. In discussion are following scenarios:</p> <ul style="list-style-type: none"> • The old line will be untouched as spare line • The old line will be untouched and towers/conductors will be used as spare parts elsewhere • The old line will be dismantled and the dismantled towers and conductors will be stored elsewhere as spare parts • The old line will be dismantled and the iron parts will be recycled.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Health and Safety	■ ■	■	Short term during construction	Direct	The construction contractor will develop an appropriate Health, Safety and Environment Management System (HSEMS) and implement it during the construction phase.
Nuclear Power Plant Safety	■ ■	Assessment not possible	Short term during construction	Indirect	<p>The implementing agency and construction contractor will have to inform the authorities responsible for the safety of the nuclear power plant in advance about any planned power cut or immediately in case of a spontaneous / accidental power cut of the existing line during construction works.</p> <p>It is strongly recommended to develop a detailed risk analysis and to set up an effective emergency plan to exclude any risk for the power supply of the nuclear power plant during construction.</p>
Historical and Cultural Sites	■ ■ ■	■	Short term during construction and long term impacts by the physical presence of towers	Direct and indirect by the physical presence of the line (visual aspect)	<p>Historical sites will be avoided by by-passing them or will be over-spanned e.g. in case of graves located below the surface. Representatives of the Department of Protection of Monuments and Historical Sites / Department of Cultural Heritage will accompany the construction contractor during the design phase and determine the exact tower location according to their requirements (see also Chapter 9.1.1). Same procedure will be applied for location of needed new access roads.</p> <p>In case of chance finds, the construction has to be stopped immediately and the Department of Protection of Monuments and Historical Sites has to be informed to agree on further steps (as according to Armenian Law).</p>
Infrastructure	■	■	Short term during construction	Direct	Minimal ground clearance will be sufficient that no negative interference to the traffic occurs in case of road crossings. Proper traffic management will avoid negative impacts on traffic as far as possible.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Power Supply to the Public	■■■	■	Short term, during construction	Direct	During construction some new towers have to be erected at the same places like the old ones. This makes it necessary to cut the power supply of the old 220 kV line for one to two weeks. At this time the power supply between the Northern and Southern part of the country is ensured by a second 220 kV line (Shamb Line).
Power Supply to Nuclear Power Plant	■■■	Assessment not possible		Indirect	There is a risk that during this construction period the power can be cut totally if an accident of fatal error happens to the second power line, resulting in frequency variations possibly impacting the nuclear power plant negatively. In this case a repair team will be able to fix the line within 10 to 15 hrs.
Land Use and Land Acquisition	■	■■	Long term	Direct	Land acquisition for all tower foundations, access roads, relocation of houses will be necessary, as the line corridor will be a new corridor for the entire Project (except for approx 10 towers in 3 locations where the old ROW will be used). Land acquisition for approximately 820 towers will be necessary (100 m ² per tower) equalling 8.2 ha of land, which is estimated to be private land for at least 50% of the territories concerned. Additionally, land has to be acquired to compensate house owners that need to be relocated or lands have to be purchased and given in exchange to resettle them.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Loss of Houses and Livelihood Involuntary Displacement	■ ■	■	Long term	Direct	<p>If all suggested bypass sections around villages are constructed the necessity to relocate PAPs will be reduced significantly compared to a corridor that follows the existing line.</p> <p>Regarding the old line routing approximately 100 houses are located in the ROW, for the present bypass areas the number can be reduced to Zero; a careful estimate is made with max. 20 houses. In specific cases, i.e. for houses located far below the line in a valley, not all houses need to be removed from the ROW.</p> <p>The surface of a house is estimated as 225 m² for Cat.1 and 2 houses and 400 m² for Cat. 3 and 4 houses.</p> <p>Avoidance of relocation is seen as a priority issue. A relocation package that ensures full restoration of people's livelihoods will have to be established in the Resettlement Action Plan.</p>
Gender Aspects	■ ■	■	Short term	Indirect	<p>The construction of the line may increase existing gender disparities, as benefits from construction work will be earned mostly by men and access and control over compensation payments are likely to be at the disposal of men and not of women. This will increase the probability that the family benefits less.</p> <p>There is a considerable percentage of single women headed households in the area that are among the most vulnerable people. If resettlement issues arise in this case the same procedure applies as for vulnerable people.</p>
Vulnerable people	■ ■ ■	■ ■	Long term	Direct	<p>Households below the poverty line and otherwise vulnerable households may lose their livelihood base if impacted by the Project / loss of land or relocation. In this case, a special livelihood support program shall be implemented.</p>

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Local Workforce	■■■	+	Short term limited to construction period	Direct	During the construction period local workforce will be employed for the construction of towers and stringing procedures. This will contribute to much needed monetary income in remote rural areas and towns, where the industrial basis has eroded. However, the income generation opportunity is not of long term duration.

Extent of impact:

- = high
- = medium
- = low
- = nil
- ⊕ = locally positive
- ⊕⊕ = regionally positive

Extent of sensitivity

- = high
- = medium
- = low

Tab. 8-3: Impacts during operation phase under consideration of the proposed mitigation measures

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Landscape	■	■	Long term	Direct	In many parts of the transmission line corridor, a high burden of the landscape caused by many other lines crossing the country and by long distribution lines exists.
Flora	■	■	Long term	Direct	Trees are not to be allowed to grow beneath the line.
Fauna	■	■	Long term	Direct	Lake Sevan is the most sensitive area of the transmission line corridor regarding bird collisions with conductors. Here, some sensitive species are living like herons, pelicans, egrets. However, there are no reports about bird collisions with conductors in this region. No specific mitigation measures are necessary. In other line sections big birds are mostly represented by birds of prey. These species have a good ability to see and are not very sensitive to this threat.
Noise	■ ■	■	Long term	Indirect	Noise emitted by substations or by the conductors (corona effect) will be minimal. Specific mitigation measures are not necessary.
Climate Change	■	+	Long term	Indirect	The increased efficiency of the transmission line is supposed to have a positive impact on climate change.
Electric and Magnetic Fields for the Public at the Workplaces	■ ■	■ ■	Long term	Indirect	From similar projects it can be stated that the relevant internationally accepted limit values for the public will not be exceeded if the minimum safety distance of 7 m to the conductor is kept as recommended.
Land Use	■	■	Long term	Direct	An area of 100 m ² per tower will have to be expropriated and partly sealed for tower foundations. However, the remaining land of the line corridor can be used as agricultural land or as pasture land without restriction.

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect	Comment
Electricity Supply	■■■	+ ++	Long term	Direct	An increased stability of the electricity supply, especially if a raising demand is expected, is a locally positive impact of the Project. An increased efficiency / reduction of transmission losses in the electricity network will be regionally positive.

Extent of impact:

- = high
- = medium
- = low
- = nil
- + = locally positive
- ++ = regionally positive

Extent of sensitivity

- = high
- = medium
- = low

In summary, the results of the investigation demonstrate that the Project will have mostly low impacts on the environment if the proposed ESMP is implemented and all proposed mitigation measures are accomplished.

Several impact areas have to be highlighted:

- Relocation of houses /households within new ROW;
- Land acquisition for towers;
- Damages to crops and trees during land survey, construction of access roads, construction of towers and conductor stringing;
- Avoidance of Historical Sites.

The transmission line passing by the Sevan National Park is located on the hillside and not the lake side of the main road and runs through rocky terrain and grassland that are not particularly sensitive, especially as the existing line has already impacted the area. A potential impact of the transmission line on water birds has been inquired; however, there are no records of bird collisions with the existing line. In addition, Sevan Lake National Park staff has not found any evidence of dead birds below the conductors.

As the forest cover of the area is very low, the impact on forest resources is quantitatively small. The planned line crosses neither Jermuk nor Herher Forestry Reserves. However, in several locations trees have to be felled and in one area a small patch of forest is traversed by the line resulting in 3.5 ha of deforested land. Due to the lack of forests in Armenia the resource is very precious and should not only be compensated in monetary terms. A replanting of forest (twice the amount of felled trees / deforested area) has been suggested by the Ministry of Agriculture.

Visual aspects constitute a negative impact of transmission lines in general. However, regarding the proposed Project the negative impacts have already occurred. In the area concerned there are various overhead transmission lines existing with several hundreds of towers that are often clearly visible from far away, due to the flat landscape (i.e. on Sisian Plateau). Underground cables are not considered as an option for financial reasons as well as due to the partly very difficult terrain.

Depending on the final design of the transmission line, between about 20 and 100 households may have to be resettled. In order to mitigate this fact a Resettlement Action Plan shall be elaborated during the final land survey, including census, detailed inventory of losses and a socio-economic survey. The RAP shall be based on the Resettlement Policy Framework (RPF) prepared by FICHTNER within the present assignment.

Land acquisition of 820 new towers will affect approximately 8.2 ha of different categories of land on which new tower foundations will be built. It is estimated that 50% of this land will be private land. The individual area of the tower is small enough not to cause a vulnerability situation in itself. However, placing of towers into gardens, fruit tree orchards or vineyards should be avoided.

Damages to crops will occur during land survey, construction of access roads, construction of towers and conductor stringing. The damages have to be evaluated and fully compensated. In case of severe damages to property or vulnerability of PAPs a livelihood restoration package will be detailed in the Resettlement Action Plan (RAP).

A prominent issue during investigation of the proposed line corridor was that numerous historical sites occur within the ROW. Wherever possible, these sites have to be by-passed. At other sites, an over-spanning has been agreed. A member of the local Department for the Protection of Monuments and Historical Sites and the Department of Cultural Heritage will supervise fixing of the exact locations of the towers and access roads.

Furthermore, it is strongly recommended to develop a detailed risk analysis and to set up an effective emergency plan to exclude any risk for the functioning / power supply of the nuclear power plant during construction of the new 220 kV OHL.

Other impacts as employment of unskilled workers during construction and a more reliable power supply for the national grid will be positive. An indirect positive impact will be a better power supply in the rural areas in future when the corresponding distribution network is also rehabilitated.

Consequently, it can be concluded: if all proposed mitigation measures are implemented, the **Transmission Line Reconstruction Project Hrazdan to Shinuhair** can be constructed and operated **without having significant adverse impacts** on the social and ecological environment in the investigation area and its surroundings.

9. Environmental and Social Management Plan

9.1. Mitigation Measures

9.1.1. Mitigation Measures for the Design

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Avoidance of cultural and historical sites	<ul style="list-style-type: none"> • Selection of the OHL corridor that bypasses most of the sites • Minimization of the length of access roads • Selection of location of access roads to avoid any specific site • Local experts will accompany designer to check whether cultural sites will be affected by the final corridor and to advise if over-spanning is possible or if a bypass is needed. 	CC	<p>Included in construction costs</p> <p>10.000 USD for local experts team to accompany final design engineer</p>	During final routing
Minimisation of resettlement needs	<ul style="list-style-type: none"> • Selection of the OHL corridor with minimum resettlement actions/ relocation of households required • Utilisation of long span towers in order to bridge valleys and increase distances of the conductors to houses • Construction of bypasses around all major affected villages. 	CC	Included in construction costs	During final routing

9.1.2. Mitigation Measures for the Construction Phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Soil / Erosion	<ul style="list-style-type: none"> • Minimization of removing topsoil at tower sites. • Bringing back the topsoil to its original place after having finished the erection of the tower. • Replanting of grass/shrubs at tower sites in steeper slopes. • Careful selection of locations for access roads. • Erosion prevention measures at access roads. • Rehabilitation of new access roads not needed anymore. 	CC	Included in construction costs	During construction
Landscape and visual impacts	<ul style="list-style-type: none"> • Complete dismantling of the old line. 	CC	Included in construction costs	After construction
Noise exposure of workers and of local population during construction activities	<ul style="list-style-type: none"> • Optimisation of transportation management to avoid needless truck drives; avoidance of truck movements in residential areas at least during night-time. • Reduction of speed of trucks crossing residential areas. • Utilization of low sound power mechanical equipment like bulldozer, air compressor, concrete pumps, excavator, concrete mixer etc. whenever possible. • Regular maintenance and service of building machinery and other during construction works. • Shut down or throttling down of noisy machinery to a minimum. • Utilization of ear protection devices by the workers if they are exposed to high noise levels (included in the construction site HSE Management Plan). 	CC	Included in construction costs	Before starting construction and during construction period

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Air pollution (dust, exhausts etc.) during construction activities	<ul style="list-style-type: none"> • Limitations of size, weight or axle loads of vehicles using particularly difficult roads. • Reduction of speed and limited movement of vehicles. • Optimised transportation management to avoid needless truck trips. • Routine service and regular maintenance of vehicles and machines to reduce engine emissions. • Burning of rubbish on site must be strictly forbidden. 	CC	Included in construction costs	During construction period
Pollution of groundwater during construction	<ul style="list-style-type: none"> • Good and regular maintenance of all vehicles and machines used on site is mandatory. Maintenance activities of the vehicles shall be performed in regular service stations. • Maintenance and re-fuelling of the construction equipment shall be done only on sealed and enclosed areas (careful handling and careful maintenance, especially of the fuel tanks). • On site storage of fuel, engine oil and lubricants in locked tanks and on sealed and shadow roofed areas. • All wastes generated through the use of fuel, engine oil and lubricants like drums and containers shall be collected and disposed of properly. • Staff training to increase awareness of waste minimisation and appropriate waste disposal. 	CC	Included in construction costs	During construction period
Pollution of surface water especially during rainy seasons	<ul style="list-style-type: none"> • All liquid materials and lubricants shall be stored in closed containers or barrels. • Construction material as bags of cement etc. shall be stored in containers in order to avoid rinsing out. • Temporary sewage treatment facilities shall be provided for the construction site and the labour camp. 	CC	Included in construction costs	During construction period

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Loss of trees	<ul style="list-style-type: none"> • Compensation is paid for felled trees either to the private owner or to the Forestry Department / SNCO. • Demarcation of communal land for re-plantation of trees. • Use of old ROW for plantation of trees wherever suitable. • Determination of necessary lay down areas together with the environmental site manager to prevent the cutting of trees. • Protection of large trees which are not required to be cut but which are located adjacent to the construction site with wooden barriers to prevent unintended destruction. However, from the site visit it is not expected to find large trees within the line corridor in a significant number, if any. • Marking of the extent of the lay down areas and the routing of the access roads. 	HVEN	50.000 USD	During fixing of the final routing (final land survey)
Disturbance of animals living in and nearby the corridor	<ul style="list-style-type: none"> • The line corridor will be located mainly outside of designated forest/reforestation areas, woodland and wetland areas • Instruction of the employees not to disturb animals; hunting shall be prohibited in general. 	HVEN CC	Included in construction costs	During design and construction phase
Protected areas and wetlands	<ul style="list-style-type: none"> • The line routing was selected in such a way to avoid crossing of any protected areas or Ramsar Wetlands. 	HVEN CC		During design phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Solid waste	<ul style="list-style-type: none"> • Development of a Waste Management Plan within the HSE Management Plan considering following principles: (i) waste management hierarchy of avoidance-minimisation-reuse-treatment-disposal; (ii) segregation of waste; (iii) minimisation of construction waste by good technical planning; (iv) training of staff. • Implementation of a Waste Management System. • Steel parts gained during dismantling of the old line shall be reused or recycled. 	CC	Included in construction costs	Prior start of construction and during construction phase
Workers health and influence of workers on local communities	<ul style="list-style-type: none"> • Development of an HSE Policy for the construction phase. • Development of an HSE Management Plan for the construction phase (shall include a Waste Management Plan). • Installation of an HSE Management System (HSEMS) during the construction phase. 	CC	Included in construction costs	Prior start of construction
	<ul style="list-style-type: none"> • Make sure that all workers have a health insurance • Put in place sufficient sanitation facilities for workers. • Provision of HIV/AIDS protection equipment for workers. • Implementation of health and safety workshops for construction workers. • Installation of warning signs “Danger of Electrocution” at towers, substations etc. • Accommodation of workers in adjacent towns has the first priority. In the case that construction camps are necessary these will be located in accordance with relevant municipal authorities. 			During construction
Impacts on climate	<ul style="list-style-type: none"> • The Project itself will have only very marginal impacts on the climate during the construction phase. Some specific measures to reduce exhausts from machines and vehicles are given above. 	CC	Included in construction costs	During Construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Effects on historical and cultural sites	<ul style="list-style-type: none"> • Identification of known historical and excavation sites and sensitive areas for unknown historical sites together with local experts of the Department for the Protection of Monuments and Historical Sites of RA during final routing / land survey. • Training of the construction workers to stop earth or foundation works immediately if there are any signs for historical or cultural sites. • Report of chance finds immediately to the Ministry of Culture, Department for the Protection of Monuments and Historical Sites of RA. • Agree with representatives of the Department for the Protection of Monuments and Historical Sites of RA if towers can be shifted a few meters forward or backward in case historical excavation sites are touched. • Agree with the Department for the Protection of Monuments and Historical Sites of RA where over-spanning of historical sites is possible and where bypasses of important cultural sites have to be realised. • Agree with Ministry of Culture if compensation for restoration or excavation of selected important areas is an option in order to maintain line routing at other (less important) sites. 	HVEN, CC	Included in construction costs	During detailed land survey and during construction process
Infrastructure	<ul style="list-style-type: none"> • Ensure that traffic is not interfered by construction through proper traffic management. 	CC	Included in construction costs	During construction
Infrastructure	<ul style="list-style-type: none"> • Dismantling of towers of the old line will reduce the existing impact on the landscape (less towers than before). 	HVEN/CC	During construction	During construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Power supply of the nuclear power plant	<ul style="list-style-type: none"> Development of a detailed risk analysis and elaboration of an appropriate emergency plan in case of accidental cut of electricity power during construction especially in periods where the power flow of the old 220 kV line has to be interrupted for construction purposes. 	HVEN	unknown	Prior start of construction
Loss of crops and trees during design phase / land survey	<ul style="list-style-type: none"> Prior information of PAPs that plantations / trees (i.e. apricots, almonds etc) are likely to be affected during the design phase / land survey. Limitation of cutting trees and crops wherever feasible. Compensation for all damages caused during the land survey 	HVEN, CC	Included in construction costs	Before and during design phase / land survey
Loss of crops and soil degradation through construction activities	<ul style="list-style-type: none"> Utilisation of existing main roads and village tracks for the construction traffic as far as possible. Limitation of construction of access roads. Careful selection of access tracks/paths. Line stringing shall be carried out with minimal interference to the ground / crops, helicopter stringing for sensitive areas (i.e. town of Gavar). Location of laydown areas close to existing roads in non-productive areas to minimise interference with agricultural activities and to facilitate site clean-up and rehabilitation. Careful routing of the access road to minimize the impacts on agricultural land. Limitation of the construction activities to selected areas within the construction corridor. Demarcation of the extent of the laydown areas. Minimizing surface of and damage caused by workers' camps (if applicable). 	CC	Included in construction costs	During construction phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Loss of crops and soil degradation through construction activities	<ul style="list-style-type: none"> • Compensation payments for PAPs for damages and loss of crops. • Documentation of compensation payments. • Presence of a person to receive complaints during the construction process. 	HVEN, International Consultant	Estimate not possible at present	During construction phase
Involuntary resettlement; loss of houses and livelihood	<ul style="list-style-type: none"> • Development of a Resettlement Action Plan (RAP) including PAP census, detailed inventory of losses, socio-economic surveys based on the present Resettlement Policy Framework (RPF). 	HVEN, International Consultant	Estimate not possible at present	During land survey
Loss of land for towers, access roads and affected houses	<ul style="list-style-type: none"> • Compensation payments for PAPs for expropriation of land. • Documentation of compensation payments for expropriation. • Presence of an impartial person to receive complaints during the construction process. 	HVEN, International Consultant	Estimate not possible at present	Before and during construction phase

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Involuntary resettlement; loss of houses and livelihood	<ul style="list-style-type: none"> • Line routing shall be selected to minimize the need to displace people. • Public consultation about resettlement options with PAP incl. land for land compensation. • Shifting of towers for a few meters to avoid resettlement wherever necessary and possible. • Payment of full compensation for lost property and support for new house construction, incl. moving allowance, legal support and livelihood restoration to a minimum pre-project level. • An accessible grievance mechanism has to be put in place and communicated to PAPs (see RPF). • Equal involvement of male and female members of the household in resettlement decisions. 	HVEN, International Consultant	Estimate not possible at present	Immediately after land survey/ design of final routing
Livelihood restoration and improvement	<ul style="list-style-type: none"> • Consultation with PAPs about their development priorities in the framework of RAP development. • Health awareness workshops for workers by a specialized NGO. • Support of vulnerable households (especially women headed households) with a micro-credit / revolving fund program managed by a Women NGO. • A saving and investment support program shall be carried out to support sustainable utilization of compensation payments. • Liaison with development projects of national and international organisations to avoid duplication (i.e. UNDP etc.). 	HVEN, Consultant, NGOs	300,000 USD	After land survey
Grievance mechanism	<ul style="list-style-type: none"> • Implementation of an accessible grievance mechanism for PAPs to address complaints at the local level. • Monitoring of grievances through consultation with PAPs during construction process by an independent consultant. 	HVEN	25,000 USD	During and after construction

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Gender	<ul style="list-style-type: none"> • Zero tolerance for sexual harassment at the work place or in workers' camps / overnight locations. • Woman headed households need to be considered especially during public consultation, census and monitoring for empowerment, economic and legal support. 	CC	Included in construction costs	During construction
Gender	<ul style="list-style-type: none"> • Strengthen district administrations on gender issues (i.e. receive complaints by women). • Cash compensations shall be made in presence of male and female household members. • Bank accounts shall be accessible both for male and female household members. 	HVEN / RAP Consultant	No extra costs	During final land survey / expropriation Inventory
Vulnerable People	<ul style="list-style-type: none"> • Special livelihood support for very poor, marginalised people, women-headed households, ethnic minorities and refugees. 	HVEN	Included in livelihood restoration and improvement costs	During final land survey / RAP

9.1.3. Mitigation Measures for the Operational and Maintenance Phases

Issue / Potential Impact	Action	Action Party	Costs	Date for Implementation
Seismic activities	<ul style="list-style-type: none"> The design of towers will be adopted to the seismic risk level in the investigation area. 	CC	Included in construction costs	During design phase
Flora	<ul style="list-style-type: none"> Herbicides for ROW clearing measures will not be used. 	HVEN	Included in operational costs	During operation
Electric and magnetic fields	<ul style="list-style-type: none"> A minimum safety distance of 7 m from a house to the closest conductor has to be respected. From other similar projects it can be reasonably assumed that in this distance the limit values for electric and magnetic fields for the public are not exceeded. It has to be mentioned that Armenian standards only require a minimum distance of 6 m. 	CC/ HCEN	Included in design	During final land survey
Land use	<ul style="list-style-type: none"> Land within the ROW can further be used for agricultural purposes. Compensations for damaged crops during maintenance. 	HVEN	Included in operational costs	During operation

9.2. Monitoring Measures

9.2.1. During Construction

During the field visits, the performed meetings and the preparation of this report it became very obvious that the occurrence of numerous settlements and historical sites along the line corridor represent the core issues in the elaboration of mitigation measures to this Project.

Therefore, re-routing of the line is recommended in order to avoid settlements and important historical sites.

Due to the nature of the Project, the detailed line routing and selection of the tower sites will be performed by the construction contractor. It is strongly recommended that a team of the Historical and Cultural Monument Protection Agency of the Ministry of Culture together with staff of the Institute of Archaeology and Ethnography joins the land surveyors of the construction contractor during the detailed line routing. These experts shall have the opportunity to select access roads and tower locations at sites where a maximum protection of the expected remnants is ensured.

In addition, construction site audits shall be performed by an international expert to ensure that all requirements as stipulated in this ESMP to the Project are fulfilled. Such an HSE Construction Site Audit shall be performed three times a year with special focus to the period of performing the detailed land survey.

General aim of the final line routing has to be:

- Avoidance of historical sites
- Avoidance of settlements in ROW to minimize resettlement activities
- Avoidance of protected or ecological sensitive areas.

9.2.2. Operational Phase

During operation, when the line is under full load, it is recommended to measure the electric and magnetic fields under the lowest clearance and at housings located nearby the line (especially in case where houses are located within the ROW). Objective is to show that the internationally accepted permissible limits of 5 kV/m and 100 μ T, respectively, are not exceeded.

9.2.3. Monitoring of Compensation Payments

The monitoring measures are designed to ensure the effective and timely implementation of compensation and resettlement activities.

As there is no similar experience with the construction or rehabilitation of transmission lines in Armenia since Soviet times, the implementation of compensation and relocation activities in compliance with Armenian laws and international safeguards will have to be closely monitored.

Limitations are foreseen concerning asset valuation mechanisms/licensing procedures, timely compensation payments and prior information, consultation and participation of project affected people. The enforcement of the existing laws is considered to be a major gap between the national framework and the international safeguards. A further issue is the eligibility status of un-registered land users. Here, the safeguards of the World Bank have to be applied and all affected land-users have to be fully compensated.

Armenian law does not foresee a monitoring system of compensation payments. So far, monitoring has been done as a follow up of complaints and law suites by PAPs. In order to correspond to international standards, it is recommended to have compensation procedures and payments monitored by an independent, international monitoring team, who is familiar with the local context.

The monitoring activities should review the project progress in three steps:

1. Before the start of the final design / land survey

- Communication and division of tasks between institutions on ministerial, national and district level involved in the compensation process
- Process of public information and consultation on the regional and local levels (Marzes)
- Process of expropriation incl. land acquisition contracts and expropriation records as well as valuation and negotiation mechanisms
- Criteria which determine the necessity of resettlement.

2. After land survey and before the start of the construction work (Performance monitoring)

- Timeliness of compensation payments to all affected persons
- Effectiveness of linkages with savings and investment program as well as revolving fund program in order to prevent increased vulnerability
- Existence and functioning of the grievance mechanism
- Reactions of PAPs.

3. After the completion of the construction work (Impact monitoring)

- Effective implementation of resettlement activities (Resettlement Action Plan)
- Effective implementation and results of the grievance mechanism
- Post-displacement livelihood situation
- Effective implementation of livelihood improvement measures.

Most of the tasks will be under the responsibility of the construction contractor. The ESMP will have to be part of the contract. Oversight of the

construction process and implementation of internal and external monitoring mechanisms would be under the responsibility of HVEN.

As a specialized Social and Environmental (S&E)-Department does not exist yet, the creation of such a department and qualification/training of staff is recommended.

After the completion of the construction work, an independent audit should be carried out by an international expert or at least an auditor experienced in international good practice in order to check out the adequacy of the compensation payments and the effectiveness of the resettlement.

This could be used as training on the job for HVEN S&E staff.

If the livelihood of resettled people has not been restored before construction an additional program for livelihood restoration should be implemented.

9.2.4. Summary of Monitoring Measures

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored/ type of monitoring equipment?</i>	When <i>is the parameter to be monitored- frequency of measurement or continuous?</i>	Why <i>is the parameter to be monitored (optional)?</i>	Cost		Responsibility	
						Install	Operate	Install	Operate
D e s i g n	Maximal avoidance of social and environmental impact during design phase	Satellite Images with final routing, field visit	Monitoring by independent consultant	During final design	Ensure that final design minimizes environmental and social impacts			WORLD BANK	HVEN
C o n s t r u c t i o n	Realisation of mitigation measures	Construction site	Audit by an independent international consultant	3 times a year during construction activities	Ensure that the proposed mitigation measures are realised		50,000 USD per year in total 100,000 USD	HVEN	HVEN
	Monitoring of compensation payments for crop damages during erection of towers and stringing	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensure that the farmers get sufficient compensation for lost crops		60,000 USD per year in total 120,000 USD	HVEN / Consultant	HVEN
	Monitoring of compensation payments for land acquisition for tower sites	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensure that the owners get sufficient compensation for acquired land				

Phase	What <i>parameter is to be monitored?</i>	Where <i>is the parameter to be monitored?</i>	How <i>is the parameter to be monitored/ type of monitoring equipment?</i>	When <i>is the parameter to be monitored- frequency of measurement or continuous?</i>	Why <i>is the parameter to be monitored (optional)?</i>	Cost		Responsibility	
						Install	Operate	Install	Operate
C o n s t r u c t i o n	Monitoring of compensation payments for displacement actions	Construction site	Audit by an independent international consultant	Permanently during construction activities	Ensure that affected households get sufficient compensation for acquired properties / effective relocation and livelihood restoration including provision of new house		60,000 USD	HVEN / Consultant	HVEN
O p e r a t i o n	Electric and magnetic field	Buildings remaining within the ROW	Electric and magnetic field measuring devices	Once after the start of the operation of the OHL	To document that internationally accepted limits for electric and magnetic fields are met	EMF-Meter 15,000 USD	Staff of HVEN	HVEN	HVEN

Further specific monitoring activities during construction period will have to be implemented related to:

Impact of/on	Monitoring Activity
Line Routing	Visual control (in Google Earth/ Field Visit) of final line routing including selected bypasses by independent expert to make sure that environmental and social impacts are effectively mitigated
Access Roads	- Control of low impact construction standards - Record keeping of length built and length rehabilitated/ decommissioned after project completion.
Surface Water	- Visual control of downstream water quality (turbidity), regular measurements of upstream / downstream basic parameters (pH, temperature, conductivity, redox state), plan for detailed analysis (e.g. for hydrocarbons) if pollution / spills are suspected. - Visual control that any temporary bridges are properly constructed, do not cause deterioration of river bed and are dismantled after completion.
Groundwater	Selection of existing wells for baseline analysis of basic parameters (see above) and 1-2 measurements during construction period and after completion.
Land Use / Waste Management	Visual control of economic land use, proper topsoil management, erosion control and post construction site restoration. This should be reviewed in the final design also and in the field checked for design compliance. Visual control and record keeping of proper waste disposal, including recycling.
Noise	Short term impact during construction, no specific monitoring necessary.
Vehicle Emissions	Maintenance records of trucks and machines.
Construction Waste	Visual control that construction waste is effectively managed.
Traffic Safety	Short term impact during construction, no specific monitoring necessary.
Work Safety /Sanitation	Included in construction Site Audit.
Physical Cultural Heritage	Photo-documentation of key sites close to alignment before start and after completion of construction, visual control that

Impact of/on	Monitoring Activity
	sensitive areas are fenced off and secured against unintended damage by construction activities.
Tower Locations and Construction	Visual control that towers are located with minimum local environmental impact and that construction activities are restricted to as small an area as possible (incl. access roads).
Affected Houses / Resettlement	Visual control and photo-documentation of resettlement activities and re-installation including GPS data.
Public Information and access to justice	Control of reports and survey if public consultation requirements have been fulfilled and if PAPs are satisfied with the level of consultation, respect of Aarhus Convention
Grievance Mechanism	Social survey by independent expert to find out if grievances have been settled.

9.2.5. Training of HVEN Staff

At HVEN there is no Social/Environmental Department and no prior experience of international requirements exists concerning transmission line construction or rehabilitation.

The creation of a Social/Environmental Department in HVEN and a training of qualified staff are therefore highly recommended. Trainings should focus on the application of World Bank safeguard policy and monitoring procedures (see also Chapter 6.3 in RPF).

Provision for training requirements is of about 50,000 USD.

10. Costs of ESMP Implementation

Measure	Costs [USD]
Mitigation measures during design	10,000
Mitigation measures during construction	375,000
Mitigation measures during construction for compensations and resettlement needs	3,000,000 - 7,000,000*
Mitigation measures during operation and maintenance	none
Monitoring Measures	295,000
Training for HVEN HSE staff	50,000

* Depending on resettlement needs and valuation results in final design stage

11. Overall Findings and Recommendations

It can be concluded that the **Transmission Line Reconstruction Project Hrazdan to Shinuhair** can be constructed and operated **without having significant adverse impacts** on the social and ecological environment in the investigation area and its surroundings, if all proposed mitigation measures are implemented.

Careful line routing will help to minimize impacts on cultural and historical sites especially in areas where the remnants are still unearthed. Precondition is the involvement of members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture in the selection of the final routing done by the construction contractor. Especially the construction of access roads and the final location of towers have to be implemented very carefully to avoid any sensitive historical area, making future excavation activities possible. In case of chance finds of historical artefacts the construction process has to be stopped immediately and the local representative of the Department for the Protection of Monuments and Historical Sites / Department of Cultural Heritage has to be contacted.

The proposed line including the suggested bypasses will not cross sensitive zones of Protected Areas. Involuntary displacement and relocation can be mitigated to an absolute minimum. If the priority to avoid involuntary displacement is respected by the construction contractor and bypasses are carefully designed, involuntary displacement can be totally avoided.

It is strongly recommended to develop a detailed risk analysis for the stability of the Armenian power grid during construction of the new overhead line and to set up an effective emergency plan to exclude any risk of power supply failure of the nuclear power plant during construction of the new 220 kV OHL.

The overall construction shall be supervised by an independent international expert. The duty of such an HSE Audit shall be to ensure that the requirements stipulated in the Environmental and Social Management Plan to this Project are fulfilled. Focus shall be put on:

- Avoidance of houses in the ROW to minimize resettlement, if possible to zero;
- Avoidance of historical sites;
- Avoidance of protected or ecological sensitive areas.

These extensive supervision activities are necessary because the elaboration of detailed design features including detailed line routing is not known yet. The determination of the details is shifted to the construction contractor and could therefore not be covered by this study.

It is also recommended to dismantle the old line in total and to recycle steel parts or to take them as spare parts. This would help to minimise environmental impacts caused by the physical presence of the OHLs.

Within HVEN an Environmental and Social Department does currently not exist. It is recommended to implement such a department and train the staff regarding all health, safety and environmental aspects including social aspects that will invariably arise during construction and operation of overhead lines and their associated substations.

It is recommended that the World Bank takes on the responsibility to make sure that the ESIA is read and understood by the selected designer of line routing / Construction Company. The ESMP and RPF have to be part of the tender documents. A review of the final design by independent social and environmental experts is recommended.

In cooperation with the World Bank and the design monitoring experts, HVEN will give the directive to redesign sections that have been identified within the ESIA or are identified during the course of the design process.

A significant change of line routing i.e. from valleys on the mountain side would have important environmental impacts, especially as it would then almost certainly lead through Protected Areas. This would result in a change of the Category of the project from Category B to Category A and make the present ESIA unsubstantiated.

There are several areas where tradeoffs between social and environmental impacts are expected. Whereas a construction of bypasses to the old line on the mountain side may have less social impacts, the environmental impacts will be higher. On the other hand, the corridor parallel to the old line is expected to have higher social impacts and less environmental impacts. It is argued that a careful design will be able to balance the impacts, avoiding resettlement as the highest priority, without increasing environmental impacts i.e. by long access roads or crossing protected areas and without affecting cultural heritage sites. Also quite often, design options are able to reduce environmental as well as social impacts at the same time as i.e. in town of Gavar (N1-N6 Lichk line). For more details refer to chapter 6 and 7 as well as Annex 12.3.

Line section	Tower No.	Location	Impact Criteria	Recommendation
Noratus	N 96 – N 149	Villages Lchashen, Lchap, Hayravank	Planned line is near to villages on village development land, A new bypass would not represent major environmental impacts	Design of new bypasses linking towers N96-N134 and N134-N149 should be considered in order to move away from villages and lake shore zone
	N171, N171A; N172 And	Town Gavar	Massive Involuntary resettlement needs to be avoided. Trees in old line corridor Houses under the line	Use old towers before and after Kamo Substation / incurring power cut. Alternatively study possibilities of underground cable, which would also increase experience in Armenia with this type of technology

Line section	Tower No.	Location	Impact Criteria	Recommendation
Lichk	N 1- N 6	Town Gavar	Avoidance of Involuntary resettlement in town of Gavar	First five towers of Lichk line should be reconstructed in old corridor in order to avoid resettlement and cutting of forest. Study possibilities of underground cable for this section.
	N 48- N 84	Bypass of Village Yeranos, Dzorgyugh etc.	Avoidance of involuntary resettlement as a priority issue	Bypass of villages needs to be constructed to avoid resettlement as a priority. Bypass should be designed not to affect cultural sites. Alternatively an underground cable would be a smart option in this section (cost effectiveness compared with large bypass should be studied)
Vardenis	N1; N2	Village Lichk	Property issues; plots earmarked for house construction, village development; no houses directly affected.	PAP consultation, transect with community leader, study of potential bypass corridor
	N4 – N18	Village Verin Getashen	Property issues; plots earmarked for house construction, village development; no houses directly affected.	A bypass from bypass angle tower 15 of Vardenis Line before Lichk SS to N18 Lichk line should be considered in order not to affect village extension land
	- N36	Bypass of village Madina	Ancient settlement of Sanei Gomesh is situated in bypass area.	Bypass needs to be reconsidered in order to avoid cultural heritage site and involuntary resettlement
	N100- N107	Selim Pass Road	- Avoid Erosion and problem of little construction space	Consider bypass on mountain ridge
	N 107 – N144	Village Taratumb	- Avoidance of resettlement in bypass area. Still 11 houses affected.	A line routing in the valley should be reconsidered
	N 151 – N 178	Village Shatin	- bypass of village Shatin represents risk of erosion (esp. access roads), but avoids resettlement; N 151 located in private garden	Bypass of village is necessary to avoid resettlement
Vayk	N7 – N 13	Village Agarakadz or	Avoidance of Resettlement	Bypass of village as corridor of old line is narrow. Underground cable as an option.
	N ?	Malishka / Arpa	Narrows between river, village and mountain	Use old towers / incurring power cut or study

Line section	Tower No.	Location	Impact Criteria	Recommendation
		Narrows	- a bypass via mountain would have undesirable environmental impacts especially because of access roads; - a bypass via the village would have undesirable resettlement impacts	possibilities of underground cable, which would also increase experience in Armenia with this type of technology
	N 48 – N105	Vayk Gorge	Reconstruction parallel to old line would have big social impacts. The bypass over the mountains has limited environmental impacts, but juniper forest and migration corridor is on the other side of valley	Planned bypass of Vayk Gorge shall be constructed; Old line in Vayk Gorge needs to be dismantled completely
	N 120 – N123	Village Saravan	Planned parallel line ROW affects several houses	Bypass shall be deviated to the North.
	N 132- N134	Forest Area Vorotan Pass	The oak forest area before Vorotan Pass is rather small and not very dense. Access is possible without needing to cut many trees.	Minimize tree cutting; Over-Spanning is recommended.
Vorotan 1		Entire Line	Minimization of Access roads and destruction of grass land by trucks.	Avoidance of settlements and cultural sites should not be problematic

It is recommended to bring the ESIA to the attention of the selected construction contractor and to include ESMP / RPF as integral part of the tender documents.

The role of the World Bank is to monitor safeguard compliance during design and construction phase.

In order to comply with World Bank safeguards on public consultation and Aarhus Convention the information and consultation with PAPs is crucial and needs to start during the design phase and continue throughout the construction process.

- Information of PAPs with brochures, announcements via local TV, Radio, newspaper during the design stage.
- Focus Groups with PAPs during design stage including consultation protocols in every affected village
- Transects with Community leaders of every affected village during design including minutes of visit

- Transects with representatives of Department for the Protection of Historical Monuments during design phase including consultation protocols/minutes
- Development of RAP including census, inventory of losses and social survey if compensation and resettlement was satisfactory for PAPs
- Respect of consultation periods
- Additional monitoring of public consultation process and functioning of grievance mechanism.

12. Annexes

12.1. Record of Meetings

Date	Agency/ Institution	Place	Name and Position of Person consulted	Reason for Visit
07. Feb 2011	World Bank, Armenia	Yerevan	Ani BALABANYAN Operations Officer, Sustainable Development Department Arthur KOCHNAKYAN Infrastructure Economist	General Project procedure, time schedule
07. Feb 2011	Ministry of Energy and Natural Resources High Voltage Electric Networks	Yerevan	Aram PETROSYAN Deputy Chief Engineer Simon IGITBASHYAN Chief Engineer	Status of the Project Status of line routing
09. Feb 2011	American University of Armenia, GIS- Center	Yerevan	Karen AGHABABYAN Director	Maps of Project area, information about fauna and flora within the Project area
09. Feb 2011	Ministry of Nature Protection State non- commercial organization	Yerevan	Henrik GRIGORYAN Deputy Director Arthur ALINASYAN Expert on Environmental Impact Assessment	Environmental permitting procedure in Armenia
10. Feb. 2011	Ministry of Energy and Natural Resources	Yerevan	Levon VARDANYAN Head of the Department of Development	Line routing, general Project aspects
09. Feb 2011	World Bank, Armenia	Yerevan	Ani BALABANYAN Operations Officer, Sustainable Development Department Arthur KOCHNAKYAN Infrastructure Economist	Time schedule of the Project
09. Feb 2011	Consultant and legal services COINS	Yerevan	Apetnak Poghosyan Director	Legal aspects and institutional framework of compensation and resettlement procedure
09. Feb 2011	WWF Armenia	Yerevan	Karen MANVELYAN, PH.D. DIRECTOR Siranush GALSTYAN Head of Conservation	Protected areas crossed by the line corridor, fauna and flora within the investigation area
11 Feb 2011	Ministry of Agriculture	Yerevan	Ruben PETROSYAN Chief Forester	Forest areas crossed by the line corridor, compensation aspects
12. Feb 2011	Cultural Monument Protection Department of Vayots Dzor and Syunik	On site	Gagik Navasadyan Expert	Cultural sites between Shinuhair and Spandarian

Date	Agency/ Institution	Place	Name and Position of Person consulted	Reason for Visit
12. Feb 2011	Cultural Monument Protection Department of Vayots Dzor and Syunik	On site	Grigor BABADJANYAN EXPERT	Cultural sites between Sapnadarian and Yegegnadzor
13. Feb 2011	Cultural Monument Protection Department of Vayots Dzor and Syunik	Yegegnadzor	MRS. DOVLATIAN HEAD OF DEPARTMENT Grigor BABADJANYAN EXPERT	Cultural sites between Vayk and Selim Pass
13. Feb 2011	Cultural Monument Protection Department of Gegharkunik and Kotayk	Martuni	Gagik Hasyan Expert Norik Matirosyan Expert	Cultural sites between Selim Pass and Hrazdan
14. Feb 2011	Consultant and legal services COINS	Yerevan	Apetnak Poghosyan Director	Legal aspects and institutional framework of compensation and resettlement procedure
15. Feb 2011	Administration of Lake Sevan National Park	Sevan	Arpine HOVHANNISYAN Expert for Tourism and Recreation Karen BABAYAN Landscape Planer	Possible impacts of proposed transmission line and National Park; biodiversity and tourism aspects
16. Feb 2011	Historical and Cultural Monument Protection Agency of the Ministry of Culture of the RA	Yerevan	S. ARAQELYAN Head of Agency S. MOUSOYAN Deputy Head of Agency S. SHAKARYAN Head of the Department for Protection and Usage of Cultural Monuments and Historical Environment N. HAZEYAN Chief expert of Gegharkunik and Kotayk regional branches G. BABADJANYAN Chief expert of Vajoc Dzor and Syunik regional branches MS. DOVLATYAN Regional Department for protection of culture reserve and historical environment Head of Department	Historical and cultural sites along the transmission line routing
18. Feb 2011	Institute of Archaeology and Ethnography NAS RA	Yerevan	Dr. Husik MELKOYAN Head of Medieval Archaeological Department Dr. Gagik SARGSYAN Associate Director	
18. Feb. 2011	WWF Armenia	Yerevan	Tigran MELKUMYAN GIS Specialist	Actual maps of protected areas along the line corridor.

Date	Agency/ Institution	Place	Name and Position of Person consulted	Reason for Visit
29. March 2011	World Bank	Yerevan	Wolfhart Pohl, Martin Lenihan	Clarifications / Preparation Public Consultation
30. March 2011	HVEN office	Yerevan	Public Consultation / see participant's list	Public Consultation on Draft ESIA
31. March 2011	Municipality of Gavar	Gavar	Public Consultation / see participant's list	Public Consultation on Draft ESIA
31. March 2011	Municipality of Yeghegnadzor	Yeghegnadzor	Public Consultation / see participant's list	Public Consultation on Draft ESIA
1 April 2011	Municipality of Sisian	Sisian	Public Consultation / see participant's list	Public Consultation on Draft ESIA

12.2. Record of Field Visits

Date	Place	Reason for Visit
12.Feb 2011	Line Section between Sisian and Yeghegnadzor	General line routing, location of cultural sites, possible relocation need
13 Feb 2011	Line Section between Yeghegnadzor and Lichk	General line routing, location of cultural sites, possible relocation need
15. Feb 2011	Line Section between Lichk and Hrazdan	General line routing, location of cultural sites, possible relocation need
15. Feb 2011	National Park Lake Sevan	Sensitive sites and restricted areas
31. Mar 2011	Municipality of Gavar	Public Consultation
31. Mar 2011	Municipality of Yeghegnadzor	Public Consultation
01.Apr 2011	Municipality of Sisian	Public Consultation

12.3. Impact Identification List

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
Noratuz line	46.82 km	Hrazdan SS -Kamo Substation (Gavar town N173)	Towers old line: 173 Approx angle towers new line: 27	Land acquisition for tower foundations; damage to crops and trees during land survey, construction of towers, stringing procedure; construction of access roads	Develop a Resettlement Action Plan (RAP) during final land survey, incl. census, ownership status with Cadastral information, Inventory of Losses, Social Survey, Land acquisition & expropriation procedure, PAP consultation
		Bypass N21-N67	Reason for Bypass: Deviation to Gres I line by means of auxiliary supports underneath the “Marash” and “Kentron” circuits, dismantling and installing new line in old corridor	Private Lands, Agriculture	Bypass is chosen for technical reasons.
		Lchashen Village Bypass N67-N89	Reason for bypass: Avoid village Lchashen	Cultural Heritage, National Park Area, Resettlement	Bypass is necessary.
		Lchashen Village	Historical Excavation Site/ Fortress 2 km South of Village Lchashen	Cultural Heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or overspan relevant site.
		Lchashen Village	Military Area min. distance 700 m	Military Area	Check situation during technical design.
		T17, N30, N 89, N 110, N138	Drilling points	nil	Geological Information

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		Shore of Lake Sevan N 89-N116	Protected Area, Buffer zone of Lake Sevan National Park	Water-Birds	The line being on the western side of the road has only limited impact on bird life of Lake Sevan
		Village Lchap	Replacement affecting houses and lands in new ROW	10 Houses, Private Lands, Agriculture in new, parallel ROW	New bypass beyond settlements in order not to affect any houses between N113 and N128 should be considered
		Village Hayravank	Lake shore village, crossing of private fields / agriculture behind village	Private Lands, Agriculture 3 Houses, 1 Barn affected in parallel new ROW.	A bypass from N134 to N146 (or N163) would not affect any settlements and should be considered.
		Town Gavar (end Kamo SS)	Plan: Replacement of line in old line corridor at least four towers before Kamo SS	Powercut 1.5 weeks	Old line corridor shall be used for towers N170 to 172 (KAMO SS)
Lichk line	25.46 km	Kamo SS (town Gavar) – Lichk SS (N 84)	Towers in old line: 84 Approx. new angle towers: 10	Land acquisition for tower foundations; damage to crops and trees during land survey, construction of towers, stringing procedure; construction of access roads	Develop Resettlement Action Plan (RAP), incl. Census, Ownership status with Cadastral information, Inventory of Losses, Social Survey, Land acquisition & expropriation procedure, PAP consultation
		Gavar town N1-N5	Crossing of town, incl. multi-storey houses, houses are in the valley (safety distance); plan to use Old Corridor.	16 Houses would be affected in new parallel ROW, trees, 2-3 weeks power-cut	Old ROW to be used from N1 to N5 in order to avoid resettlement. Trees that need to be cut shall be compensated and replanted in appropriate area.

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		N 5-6	Agricultural land, private land, garden with trees	1 house affected at 30 m distance in planned parallel new ROW	Extension of use of Old ROW to N 6 or careful check if safety distances are met.
		N35-N36	Church on shore of Lake Sevan, otherwise agricultural fields without settlement, 1.7 km from line	Visual impact / tourism, Birds	No recommendation
		N36-N48	Road near lake shore, 300 m from lake shore road, more than 1.5 km from waterline, 60 m above water level	Birds, Visual aspect/tourism	No recommendation
		N48-N84 (Lichk Substation), villages Yeranos, Vardadzor, Dzoraghyuk, Tzovasar, Lichk	Bypass of villages Yeranos, Vardadzor, Dzoraghyuk, Lichk, 3 houses or barns in bypass section, near angle point 14 If bypass is not selected big impact of displacement (approx. 50 houses)	Agricultural lands, private lands, 50 houses in new parallel ROW	Construction of bypass (or use of old ROW) is necessary to avoid settlements.
		N48-N84 (Lichk Substation), villages Yeranos, Vardadzor, Dzoraghyuk, Lichk	Fortresses in bypass area at angle point 5, 7,11 (exact identification missing)	Cultural heritage, historical sites	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
Vardenis line	46.634 km	N1-N184	Towers in old line: 184 New angle towers: 33	Land acquisition for tower foundations; damage to crops and trees during land survey, construction of towers, stringing procedure; construction of access roads	Develop Resettlement Action Plan (RAP), incl. Census, Ownership status with Cadastral information, Inventory of Losses, Social Survey, Land acquisition & expropriation procedure, PAP consultation
		N5-N15 Village Verin Getashen	Line slightly above (30 m) village Verin Getashen, min. distance 110m	Private lands	Land acquisition procedure, consultation of PAPs
		N15-N20	Agricultural fields	Private lands	Land acquisition procedure, consultation of PAPs
		N27-N36 village Madina and village Lernakert 40°05'01.63''N 45°16'09.81''O	Bypass of village Madina and village Lernakert below Aghmaghan ancient volcano (4 km distance), 1-3 houses of village Geghovit may be affected	1-3 houses in bypass section	Design of bypass of village Madina needs to be revised.
		Historical Site of Sanei Gomech in planned bypass of village Madina	Ruins of Church and urateian settlement at 40°05'16''N / 45°15'43''E altitude 2125m	Cultural Heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		Before N62 – N89 Village Yanegh and SelimPass	Bypass section of village Yanegh and SelimPass Most of the houses in old ROW are ruins, some may be used as summer settlement for shepherds	Resettlement	As most of the houses in parallel ROW seem to be ruins, the necessity of a bypass should be checked and if necessary, a bypass should be designed not to affect any inhabited/used houses

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		N89-N95	Remains of General Paskevich Road	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		N95-N100	Old Caravanserai near SelimPass, pass road	Cultural heritage, visual impact	For present design of line the Caravanserai is not in the corridor
		N100-N106	Towers next to pass road	Erosion	Stabilization of slopes during construction
		After N 128 angle	2 Historic bridges 39°55'01''N 45°14'28'' E	Cultural heritage	Bypass should avoid the site.

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		N107 - N144, Villages Aghnjadzor, Taratumb, Karaglukh, Salli	<p>Bypass of villages Aghnjadzor, Taratumb, Karaglukh, Salli on right side of Valley (approx 50-100 m above river): 17 new angle towers for bypass, bridging of side valley (right hand side, West), on slopes, erosion Houses in Taratumb probably below line in ROW,</p> <p>Distance below new angle towers= 770 m, Houses on Slope between 1640 m and 1680 m, no need to place towers in gardens but distance of conductors to houses may be problematic, 11 houses affected, old line affects approximately the same number of houses</p>	<p>Private Lands, 11 houses, private gardens, trees</p> <p>Old line / parallel corridor would affect min. 20 houses of Karaglukh and Salli villages</p>	The bypass of village Taratumb, Karaglukh and Salli villages should be revised.
		N151- N171 Shatin village and Yeghegis Wildlife	<p>Bypass of Shatin village and Yeghegis Wildlife Reserve,</p> <p>Fiels of Shatin village, then Slope, line approx. 40 m above road, if old corridor would be selected at approx 12 houses would be affected, old line touches Yeghegis Reserve</p>	<p>Resettlement, 12 houses in old corridor, private lands, agriculture, Village Shatin and Yeghegis Wildlife Reserve can only be avoided by bypass, Erosion in bypass area</p>	The bypass of village Shatin should be maintained on the western side of the valley, despite difficult construction on steep slope

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		On bypass section near N159	Fortress Dadaiberd / Excavation site, on bypass of village Shatin	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		N171 Village Getap - N184 (Substation Yegegnadzor)	New line avoids 2 houses, goes through private fields, at point 39°45'59.48 N / 45°18'53.52''O above village Getap two houses are at 50 m of planned line. Private Lands and stables within ROW	Private fields, agriculture	Avoidance of resettlement
		N171 Village Getap	Remains of fortress and excavation site on 3 hills above village Getap	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
Vayk line	70.96 km	Yegegnadzor SS – Spandaryan SS N1-N258	Towers in old Line: 258 New angle towers: 74	Land acquisition for tower foundations; damage to crops and trees during land survey, construction of towers, stringing procedure; construction of access roads	Develop Resettlement Action Plan (RAP), incl. Census, Ownership status with Cadastral information, Inventory of Losses, Social Survey, Land acquisition & expropriation procedure, PAP consultation
		N 1	At point 39°45'09.85''N 45°19'19.44''O two houses or stables within ROW of new line	2 stables below the line	No houses, stables and barns below line, but safety distances are met.

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		Village Agarakadzor	Line goes through private fields, apricot plantations, but no houses affected, narrow corridor of old line that does not affect houses	Agriculture fields, horticulture houses in parallel corridor	Bypass corridor needs to be revised.
		Village Malishka	Narrow gorge between village, road, river and rock-face, bypass of village Malishka and Gorge very difficult, if old ROW is not used considerable resettlement issues on northern side of river or environmental concerns on southern side	Power cut	Old ROW needs to be used through the Arpa valley narrows
		Near Village Malishka, 39°43'22'' N / 45°24'35''E	Burial sites, ruins of settlement near Malishka	Cultural heritage	Not directly in ROW
		Between Malishka and Vayk Point 39°42'59'' N 45°25'09'' E	Historical Fortress and remains of town of Moz, not excavated, 7-10 ha	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		Town of Vayk N 48- N120	Bypass of Vaik (North), line passes on hills above valley, highest elevation 1650 m, valley approx 1300 m , new line passes near hydro reservoir, new line passes Juniper open forest land on hills	Partly Juniper open forest lands, damage by access roads	Northern bypass of Vayk Gorge is recommended as planned. Access roads shall be carefully designed to avoid damages,

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		N91	Crossing Road to Jermuk, Herher and Jermuk forest areas are avoided with present design	Over-span of Jermuk Gorge	No recommendation
		N91-N120	Line Crossing between N91 and N120, then new corridor next to old corridor	Design	Better Alternative without crossing lines and deviating new corridor 50 m to North
		Village Saravan 39°43'19.76''N 45°38'44.62''O	3 road crossings, 8 houses in ROW (Northern Alternative would not affect houses), left side of old ROW	Houses, cumulative impact of planned 400 kV line	Northern bypass of village Saravan is recommended to avoid resettlement.
		N132	1 farm at 190 m of old line	Private fields, 1 house	Careful design of line to avoid resettlement
		N132 / point 39°42'32''N 45°40'37'' E	Forest / mostly beech trees on 350 m of line (2,5 ha)	Forest	Compensation for trees, re-plantation in cooperation with Ministry of Agriculture / i.e. Hayantar SNCO
		Near village "Kechut" N148-N164 39°40'50'' N 45°44'45'' E	Historical area (not yet excavated) / 3000 B.C.	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		N164 – N193 Spandaryan Reservoir	Lake of Spandaryan Reservoir, line on left side of old corridor	Private and communal lands	Identification of ownership status and land acquisition procedure, public consultation during design phase
		N222-N258 Spandaryan HPP	Private Lands of village Angeghakot	Private and communal lands	Identification of ownership status and land acquisition procedure, public consultation during design phase

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		39°35'38.05''N 45°57'27.53''O	New Connection of double circuit tower Vaik & Vorotan1	Design	No recommendation
Vorotan-1 line	41.66 km	Spandaryan HPP-Shinuhair SS N1-171	Towers in old Line: 171 Approx. new angle towers: 21	Land acquisition for tower foundations; damage to crops and trees during land survey, construction of towers, stringing procedure; construction of access roads	Develop Resettlement Action Plan (RAP), incl. Census, Ownership status with Cadastral information, Inventory of Losses, Social Survey, Land acquisition & expropriation procedure, PAP consultation
		N1-N32	Private and communal fields	Fields / Agriculture	Identification of ownership status and land acquisition procedure, public consultation during design phase
		N4 near Spandaryan SS	Potential historical site within ROW / Katchkar Stone Site	Cultural heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site.
		N32 village Shaki 39°34'43.83''N 45°59'49.75''O	1 house in ROW at 25 m distance	Resettlement if safety distances are not met.	Careful design to avoid resettlement
		N35-N130	high plains, grazing land, potato fields	Communal & private lands,	Identification of ownership status and land acquisition procedure, public consultation during design phase
		Near N 84 39°31'44'' N 46°08'57'' E	Historical area with old towers	Cultural Heritage	Identify exact location with local experts from Department of Protection of Monuments during design phase and bypass or over-span relevant site

Line Section	km	Place Name / reference tower of old line	Observations / Remarks	Potential Impact	Recommendation
		39°33'22.94''N 46°02'01.83''O	Zorats Carer at 1,5 km of line	Cultural Heritage	Not impacted by present design of line
		N130-N171 Shinuhair SS 29°36'38'' N 46°19'16'' E	High plains between 1500 and 200 m altitude, grazing land	Communal (& private) lands, cumulative impacts with 400 kV line, visual impacts	Identification of ownership status and land acquisition procedure, public consultation during design phase

12.4. Typical Strengths of Electric and Magnetic Fields of a 220 kV line

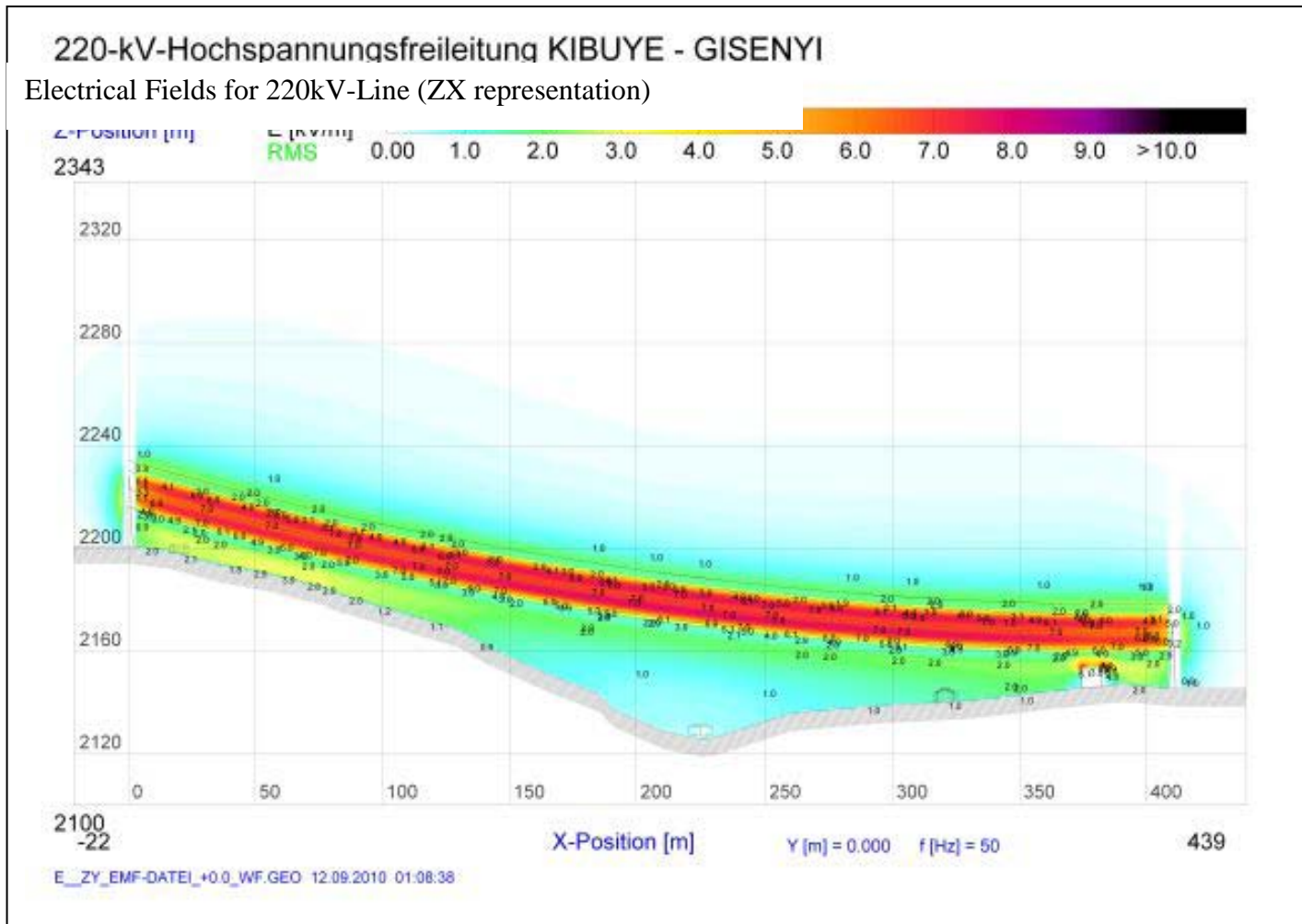


Figure 12-1: Typical vertical pattern of the electrical field of a 220 kV overhead line. The line is crossing a small valley. The limit for public of 5 kV/m is exceeded only very close to the conductors.

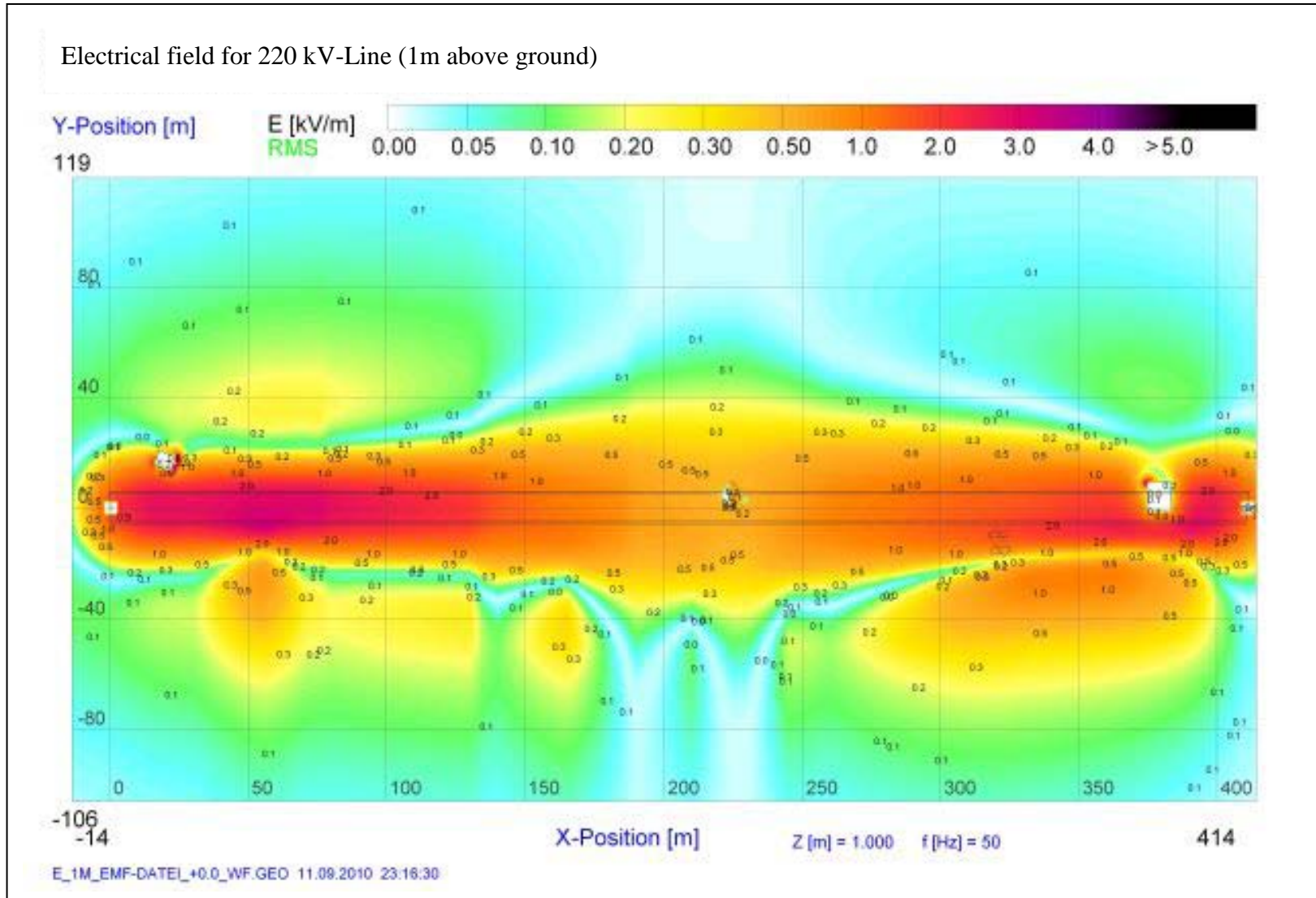


Figure 12-2: Typical horizontal pattern of the electrical field of a 220 kV overhead line in a height of 1 m. The line is crossing a small valley. The limit for public of 5 kV/m is exceeded nowhere.

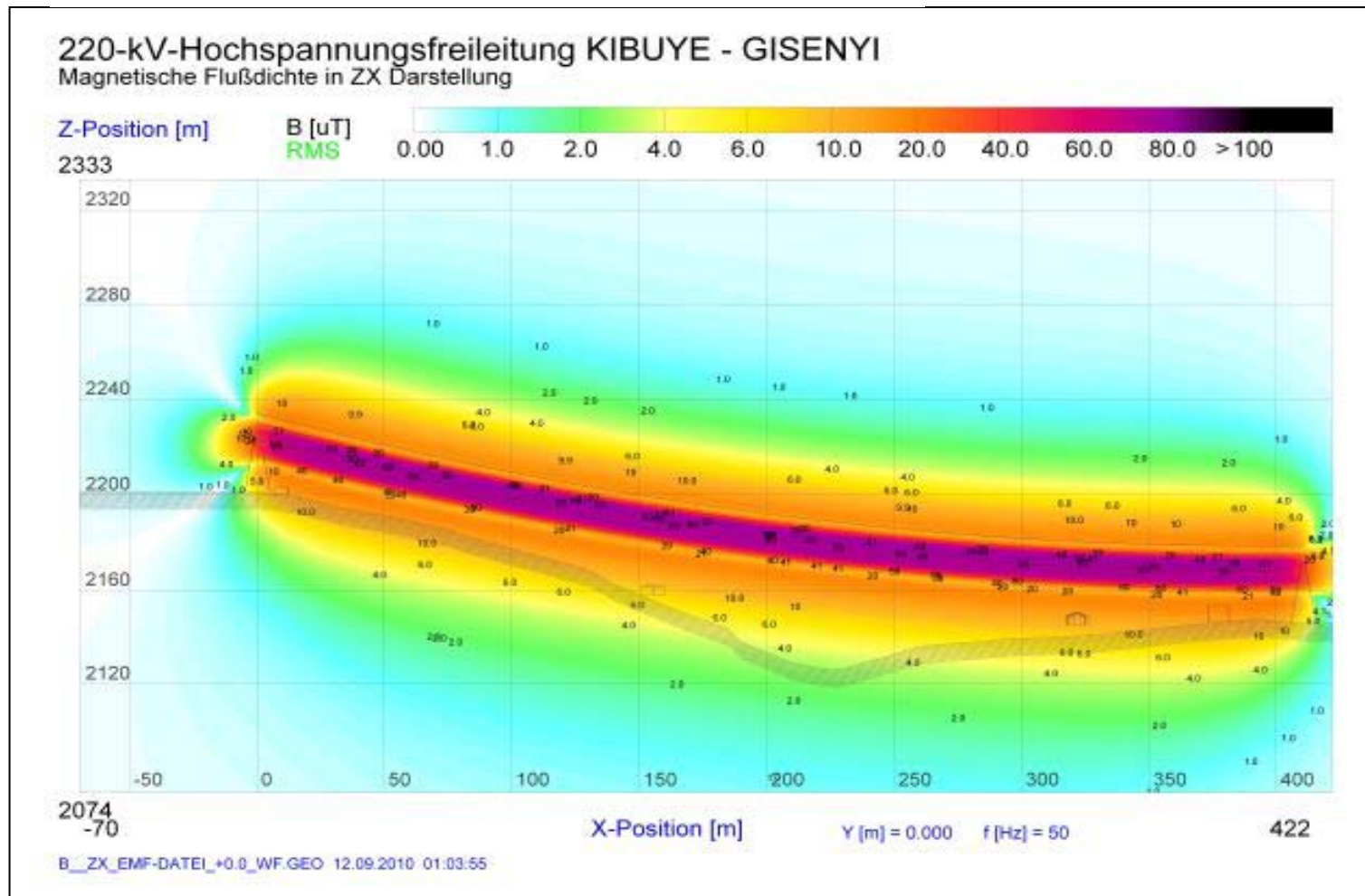


Figure 12-3: Typical vertical pattern of the magnetic field of a 220 kV overhead line. The line is crossing a small valley. The limit for public of 100 µT is exceeded nowhere.

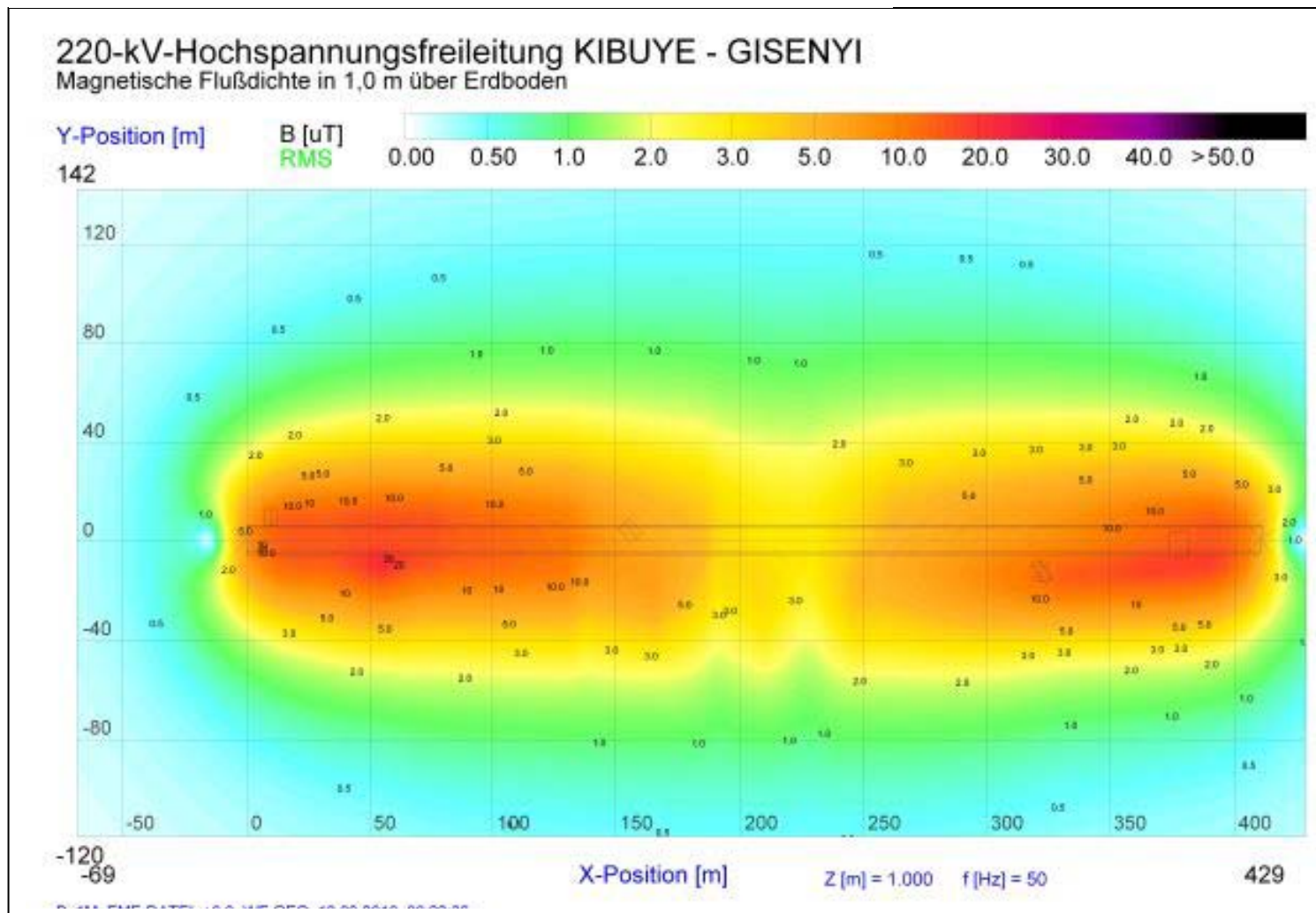


Figure 12-4: Typical horizontal pattern of the magnetic field of a 220 kV overhead line in a height of 1 m. The line is crossing a small valley. The limit for public of 100 μ T is nowhere exceeded.

12.5. Public Consultation Meetings

The public meetings to the ‘Reconstruction of the 220 kV power transmission line from Hrazdan TPP to Shinuhayr substation’ on environmental and social impacts have been announced in two newspapers -Aravot and Hayastani Hanrapetutiun- on March 10 and 11 (scans see below). The draft ESIA and RPF Report have been published at the website of the Ministry of Energy <http://www.minenergy.am/en/en/investment-projects/high-voltage-network> at 9 March 2011.

To all public consultation meetings, the Consultant held a non-technical introduction (with slides) presenting the results of the environmental and social assessment study. This introduction was held with simple, non-technical words understandable also for not highly educated people. It was held in English and translated sentence by sentence in Armenian language. All questions raised in Armenian were translated into English language; the answers to these questions were also translated sentence by sentence into Armenian. The slides to the presentation were given in Armenian and hands out in Armenian language were prepared and presented to the participants of the meetings. Some of the participants took the slides as softcopy on sticks.

This introduction stated who did the investigation, it gave information about the method of investigation and the method of assessment. Environmental and social impacts of the Project were communicated and some examples were shown in detail and an impact summary with recommendation was presented. After the introduction the discussion started. The questions raised and the corresponding answers of all four meetings are given in the following.

YEREVAN 30.03.11

Question/suggestion	Answers
In the ESIA a table for impact assessment is shown. In this table the assessment ‘irreversible’ or ‘not irreversible’ should be added.	The assessment ‘high impact’ as one of the impact levels given in the impact table already implies that an impact is irreversible.
Big concern was expressed on possible impacts on forest areas. Such areas should be avoided to the greatest extent possible.	There is only a forest crossed by the line of about 350m length representing about 0.15% of the total length of 225 km. The forest is degraded oak forest, not many trees would need to be cut.

Question/suggestion	Answers
<p>Who guarantees that there will no impact on sensitive areas e.g. forest areas, alpine habitats etc.</p>	<p>To the Project an ESMP has been developed. This ESMP will be part of the tender documents for the construction contractor and will be an integral part of the loan agreement between HVEN/Ministry of Energy and World Bank. The ESMP contains also the recommendation that the implementation of the ESMP is monitored by independent, international experienced experts. This monitoring might also involve national NGO. In the loan agreement also a set of legal conditions and environmental and safety safeguards standards will be defined. The Armenian Government and HVEN has to implement the Project following this loan agreement. In case of severe violation the financing of the Project could even be stopped.</p> <p>The supervision of the overall project has to be done by the Armenian Environmental Inspectorate.</p>
<p>Are additional studies and consultation meetings planned after finalizing the ESIA study.</p>	<p>No</p>
<p>How the project is classified. The Project should be classified as Category A.</p>	<p>The Project is classified as a Category B project mainly because it is a rehabilitation project. The OHL will be constructed parallel to the old existing line (the old line shall be dismantled and recycled after commissioning of the new line). Only in some parts deviations from the old corridor will be needed to avoid recent built up areas and historical monuments. That means the additional input compared to the old existing line will be very limited.</p>
<p>The implementation of the project should follow Armenian requirements and legislations.</p>	<p>Armenian legal requirements will be respected, then World Bank safeguard requirements. Concerning standards, where the stricter limits are in use either in Armenian legislation or in World Bank Guidelines, these stricter limits will be applied for the Project.</p>

Question/suggestion	Answers
The principles of the Aarhus convention shall be taken into consideration	Will be done more detailed in the final version of the ESIA study
Is the new National Park near Vorotan Canyon taken into consideration	Yes, but this park is not affected by the line corridor.
The old line should be dismantled	Is already recommended in the draft ESIA study
How is the position of the World Bank if household would agree to their resettlement?	World Bank Policy is clear: avoid resettlement activities if possible / at all costs.
	It was agreed that questions and suggestions can also be submitted in written form to HVEN

The participants at Yerevan meeting

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1	Ruben Petrosyan	Armforest	010 650270 ruben.armforest@gmail.com
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GAVAR 31.03.11

Question/suggestion	Answers
CL Lchashen: Cultural heritage is not the only issue in Lchashen village, there are also private lands affected. Will they be considered as well?	During detailed design there will be a complete census and inventory of affected property. Resettlement Action Plan (RAP)
CL Verin Getashen: The existing line is close to the houses of the village. People have lost construction land for the old line already and have never been compensated for this. Now the new line is planned on lands that are earmarked for house construction of the village as the village has no other lands for extension / no replacement land. Therefore a bypass should be suggested. The same problem exists for the village Lichk.	The detailed design will take into account the request and study possibilities for a bypass.
An increased cooperation with the community leaders is necessary.	Yes the further steps of project implementation will be implemented in cooperation with community leaders.
CL Lichk: There are too many towers in village Lichk. We suggest to remove old towers that are not in use. We suggested to move substation from the village but this has never been done. (So Viet Legacy)	The old line will be completely dismantled. The substations are not part of the project.
The maps and reports should be shared with the community leaders.	Yes absolutely. The Public Consultation Planning for the next steps of the project will make accessible and actively share all information related to the project. The documents will be available and openly accessible in all affected municipalities. Community leaders will also be involved in detailed design (i.e. accompany designer to fix line routing) Transect walks are recommended.
The line design should be discussed with municipalities as early as possible in order not to assign land to people in these areas.	The ESIA documents and present line routing are made available in municipalities.
Mayor Gavar: The Gavar Municipality has to agree with the plans.	Further consultations will be made for detailed design and RAP.

Question/suggestion	Answers
Even before final design the design company should investigate every meter of the line together with community leaders.	See above. Transect walks are proposed for further investigation during final design preparation.
Who will pay compensations for the land?	HVEN

The participants at Gavar meeting

	Participants	Gavar Municipality subdivisions	Tel. number
1	Eduard Stepanyan	Head of Land management and land use department of Gavar Municipality	091330636
2	Spartak Avetisyan	Environmental protection Department	093938030
3	Derenik Hovhannisyan	municipal representative	091351642
4	Ivan Asatryan	Head of local and national bodies Affairs Department	098988902
5	Anahit Shahzadyan	Gavar Business Center	094057535
6	Haik Simonyan	Lchap vilage	077436607
7	Ruben Gukasyan	Verin Getashen vilage	094208971
8	Koryun Margaryan	Lchashen vilage	091969669
9	Gnel Grigoryan	Lichk vilage	093238772
10	David Badoyan	Hairivanq vilage	091216190
11	Robert Siravyan	Vardadzor vilage	091550059
12	Vrej Sargsyan	Madina vilage	093430059
13	Armen Pogosyan	Gekhovit vilage	094211545
14	Norik Hazeyan	Agency of Cultural and historical heritage protection	093637019
15	Aram Petrosyan	HVEN	099711231
16	Armen Hovhannisyan	HVEN	091427120
17	Vardan Hairapetyan	HVEN	094481122
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YEGHEGNADZOR 31.03.11

Question/suggestion	Answers
CL Vayk: The present line is running through the town creating many problems. Are there planned bypasses? Will the old line be dismantled?	Bypasses are planned on the top of the gorge (downriver right side) and the old line will be dismantled.
How will environmental impacts be mitigated? Will WWF be involved to mitigate environmental impacts.	<p>Impacts will be mitigated via measures defined in Environmental and Social Management Plan (ESMP), the environmental permit has to be accorded, forest areas, protected areas will be avoided, access roads designed with minimal impact.</p> <p>Direct involvement of WWF is not planned.</p>
Why is the line not designed to cross the mountains instead of valleys with villages?	<p>First, the project is a rehabilitation of an existing line.</p> <p>Second, the environmental impacts are much higher if moving away from existing infrastructure (i.e. roads).</p> <p>Possibilities of bypasses are considered in order to optimize line design and balance environmental and social impacts, reduced to the minimum</p>

The participants at YEGHEGNADZOR meeting

	Participants	Vayots-Dzor Municipality subdivisions	Tel. number
1	Samuel Tarverdyan	Deputy Vayots-Dzor Governor	-----
2	Khachik Aslanyan	urban planning and road construction department	093441484
3	Aram Grigoryan	representative of Vayots Dzor	093550002
4	Vardges Harutjunyan	Yeghegnadzor municipality	2-51-20
5	Roman Mkrtchyan	Cadaastre	077958869
6	Eduard Hovhannisyan	Cadaastre	093228155
7	Hovik Grigoryan	head of Environmental protection Department on Vayots Dzor	028120133
8	Grigor Babajanyan	Agency of Cultural and historical heritage protection	028809057
9	Melanya Dovlatyan	Vayots Dzor museum protection department	093523694
10	Aharon Gabrielyan	Akhnjadzor vilage	093697855
11	Harutjun Sargsyan	Vaiq major	094050404
12	Mesrop Mesropyan	Head of Land management and land use department of Vayots-Dzor Municipality	091909613
13	Nairi Saroyan	Agarakadzor vilage	094632556
14	Samuel Kazaryan	Sali vilage	093412477
15	Qajik Navasardyan	HVEN	093585773
16	Aram Petrosyan	HVEN	099711231
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SISIAN 01.04 11

Question/suggestion	Answers
Did I understand correctly that old towers will be dismantled?	Yes.
Is it not possible to use old towers?	No, existing towers are at end of life span, and due to electricity supply problem (power cut) the old line cannot be dismantled before constructing the new line? Only in few very sensitive areas (Gavar, Malishka) this will be necessary.
How will the land acquisition will take place?	Information of National Cadastre will be used and if the concerned person has legal land title we will discuss for land or cash compensation. (HVEN) Addition: Also compensation if no legal land title. (i.e. legalization procedure, compensation for usufruct)

The participants at SISIAN meeting

	Participants	Syunik Municipality subdivisions	Tel. number
1	Manuchar Mkrtchyan	Sarnakunk vilage	093331256
2	Spartak Simonyan	Spandaryan vilage	093303247
3	Mesrop Amirjanyan	Tsghuk vilage	093358076
4	Surik Harutjunyan	Harghis vilage	093993888
5	Smbat Yeremyan	Shinuhair vilage	077175777
6	Juri Danielyan	Shaki vilage	093924113
7	Marat Petrosyan	Ishkhanasar	093606095
8	Lavrent Arakelyan	Norava vilage	093023252
9	Armen Khachatryan	Angeghakot vilage	055090933
10	Gagik Navasardyan	Agency of Cultural and historical heritage protection	093057195
11	Aram Davtyan	Agency of Cultural and historical heritage protection .	093197478
12	Hovsep Sirumyan	HVEN	093491709
13	Valeri Hairapetyan	HVEN	093711237
14	Suren Stepanyan	Sisian municipality	094999294
15	Kim Aloyan	Sisian municipality	098852727
16	Aram Hakobyan	Sisian municipality	077084886
17	Arustam Arustamyan	Gor-Haik vilage	094405252
18	Aram Petrosyan	HVEN	099711231
19	Armen Hovhannisyan	HVEN	091427120
20	Vardan Hairapetyan	HVEN	094481122
21	Wolfhart Pohl	WB	wpohl@worldbank.org
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Announcement of Public Consultation Meetings

ՀԱՆՐԱՅԻՆ ԶՆՆԱՐԿՈՒՄՆԵՐԻ ԾԱՆՈՒՑՈՒՄ

Հայաստանի Հանրապետության կառավարությունը դիմել է Համաշխարհային բանկին՝ Հրազդանի ջերմային էլեկտրակայանից մինչև Շինուհայրի ենթակայան մոտ 230 կմ երկարությամբ 220 կիլովոլտ էլեկտրահաղորդման գծի վերականգնման օժանդակելու նպատակով: Վերականգնման աշխատանքները չափազանց կարևոր են այս գծի թողունակության և երկրի էներգետիկ համակարգի հուսալիության բարձրացման համար:

Բարձրավոլտ գծի վերականգնման ծրագրի ընդհանուր արժեքը մոտ 46 միլիոն ԱՄՆ դոլար է: Այն իրականացնելու է «Բարձրավոլտ էլեկտրական ցանցեր» ՓԲԸ-ն՝ երկրի բարձրավոլտ էլեկտրական ցանցերի նախագծման, կառուցման, օպերացիոնման և դափնայնման համար լիցենզիայով ընկերությունը: Ծրագիրը ֆինանսավորելու է հենասյունների, դրանց հիմքերի, էլեկտրամատակարարման լարերի և մեկուսիչների փոխարինման աշխատանքները: Վերականգնված գծի գերակշիռ հատվածն անցնելու է գոյություն ունեցող միջանցքով՝ բացառությամբ առանձին հատվածների, որոնք երջանցելու են մի շարք բնակավայրեր:

Ծրագրի նախադասարանման ընթացքում կատարվել է բնադաշտային և սոցիալական ազդեցության գնահատում, որի արդյունքներն ամփոփող հաշվետվությունների նախագծերին կարող էր ծանոթանալ ՀՀ էներգետիկայի և բնական տնտեսության նախարարության կայքից՝ www.minenergy.am:

Ծրագրի բնադաշտային և սոցիալական գնահատման արդյունքների առաջին համարյալն ֆինանսավորմանը տեղի կունենա «Բարձրավոլտ էլեկտրական ցանցեր» ՓԲԸ-ում, 2011թ. մարտի 30-ին, ժամը 14:00-ին, հետևյալ հասցեով՝ Բ. Երեան, Անդրանիկի 1: Հեռ.՝ (37410) 72-00-10, ֆաքս՝ (37410) 72-01-21, էլ. փոստ՝ hvenbec@gmail.com:

Մարզերում հանրային ֆինանսավորմանը տեղի կունենան 2011թ. մարտի 31-ին ժամը 10:00-ին Գեղարքունիքի մարզպետարանում՝ Բաղաբ Գալստ, ժամը 16:00-ին՝ Վայոց ձորի մարզպետարանում՝ Բաղաբ Եղեգնաձոր և 2011թ. ապրիլի 1-ին ժամը 12:00-ին՝ Սիսիանի Բաղաբապետարանում:

Հանրային ֆինանսավորմանը տեղի կունենան բոլոր օպերացիոն կողմերը:

ՀԱՆՐԱՅԻՆ ԶՆՆԱՐԿՈՒՄՆԵՐԻ ԾԱՆՈՒՑՈՒՄ

Հայաստանի Հանրապետության կառավարությունը դիմել է Համաշխարհային բանկին՝ Հրազդանի ջերմային էլեկտրակայանից մինչև Շինուհայրի ենթակայան մոտ 230 կմ երկարությամբ 220 կիլովոլտ էլեկտրահաղորդման գծի վերականգնման օժանդակելու նպատակով: Վերականգնման աշխատանքները չափազանց կարևոր են այս գծի թողունակության և երկրի էներգետիկ համակարգի հուսալիության բարձրացման համար:

Բարձրավոլտ գծի վերականգնման ծրագրի ընդհանուր արժեքը մոտ 46 միլիոն ԱՄՆ դոլար է: Այն իրականացնելու է «Բարձրավոլտ էլեկտրական ցանցեր» ՓԲԸ-ն՝ երկրի բարձրավոլտ էլեկտրական ցանցերի նախագծման, կառուցման, օպերացիոնման և դափնայնման համար լիցենզիայով ընկերությունը: Ծրագիրը ֆինանսավորելու է հենասյունների, դրանց հիմքերի, էլեկտրամատակարարման լարերի և մեկուսիչների փոխարինման աշխատանքները: Վերականգնված գծի գերակշիռ հատվածն անցնելու է գոյություն ունեցող միջանցքով՝ բացառությամբ առանձին հատվածների, որոնք շրջանցելու են մի շարք բնակավայրեր:

Ծրագրի նախադասարանման ընթացքում կատարվել է բնադաշտային և սոցիալական ազդեցության գնահատում, որի արդյունքներն ամփոփող հաշվետվությունների նախագծերին կարող էր ծանոթանալ ՀՀ էներգետիկայի և բնական տնտեսության նախարարության կայքից՝ www.minenergy.am:

Ծրագրի բնադաշտային և սոցիալական գնահատման արդյունքների առաջին համարյալն ֆինանսավորմանը տեղի կունենա «Բարձրավոլտ էլեկտրական ցանցեր» ՓԲԸ-ում, 2011թ. մարտի 30-ին, ժամը 14:00-ին, հետևյալ հասցեով՝ Բ. Երեան, Անդրանիկի 1: Հեռ.՝ (37410) 72-00-10, ֆաքս՝ (37410) 72-01-21, էլ. փոստ՝ hvenbec@gmail.com:

Մարզերում հանրային ֆինանսավորմանը տեղի կունենան 2011թ. մարտի 31-ին, ժամը 10:00-ին, Գեղարքունիքի մարզպետարանում՝ Բաղաբ Գալստ, ժամը 16:00-ին՝ Վայոց ձորի մարզպետարանում՝ Բաղաբ Եղեգնաձոր և 2011թ. ապրիլի 1-ին, ժամը 12:00-ին՝ Սիսիանի Բաղաբապետարանում:

Հանրային ֆինանսավորմանը տեղի կունենան բոլոր օպերացիոն կողմերը:

12.6. Photo-Documentation



Figure 12-5: Hrazdan Shinuhair 220kV T-Line Rehabilitation Project

I) Noratuz Line Section :



Figure 12-6: Noratuz line overview (yellow, bypass areas in red)



Photo: MVVdecon

Figure 12-7: Hrazdan TPP substation



Figure 12-8: Noratuz line towards Hrazdan TPP substation



Figure 12-9: Hayravank Village



Figure 12-10: Rural Livelihood Hayravank Village



Figure 12-11: Hayravank Monastery



Figure 12-12: Last 3 Towers Noratuz Line before Gavar Substation

II) Lichk Line Section :



Figure 12-13: Lichk line Overview (green)



Figure 12-14: Gavar Substation



Figure 12-15: Town of Gavar



Figure 12-16: Cemetery Gavar



Figure 12-17: Overspanning Valley Gavar



Figure 12-18: Yeranos Village



Figure 12-19: House in Yeranos Village



Figure 12-20: Construction on Sevan Lake shore



Figure 12-21: Consultation in Martuni

III) Vardenis Line Section :



Figure 12-22: Vardenis Line Overview (dark blue)



Figure 12-23: House near Village Yanegh



Figure 12-24: Line towards Selim Pass



Figure 12-25: Caravanserai on Selim Pass



Figure 12-26: Village Taratumb



Figure 12-27: Historical Bridges in Yeghegis Valley



Figure 12-28: Landscape / Vegetation of Yeghegis Valley



Figure 12-29: Village Shatin



Figure 12-30: Affected house of village Shatin



Figure 12-31: Bypass Area of village Shatin



Figure 12-32: Present line below Shatin towards village Getap



Figure 12-33: Town of Yeghegnadzor



Figure 12-34: Consultation in Yeghegnadzor

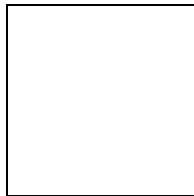


Figure 12-35: Yeghegnadzor Substation

IV) Vayk Line Section :



Figure 12-36: Overview of Vayk Line (light blue)



Figure 12-37: Potentially affected building near Yeghegnadzor



Figure 12-38: Lines at village Agarakadzor towards Yeghegnadzor SS



Figure 12-39: Lines at village Agarakadzor



Figure 12-40: Vineyard in Arpa Valley



Figure 12-41: Village Malishka



Figure 12-42: Arpa Valley narrows at village Malishka



Figure 12-43: Cultural heritage Site at village Malishka



Figure 12-44: Affected Houses in Village Saravan / Kirs



Figure 12-45: Consultation in Village Gndevaz



Figure 12-46: Consultation in Vayk



Figure 12-47: Juniper open forest land in Vayk Gorge

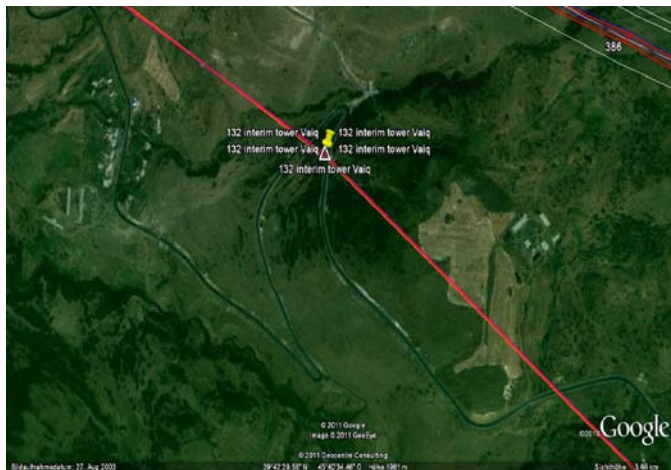


Figure 12-48: Forest area near Vorotan Pass



Figure 12-49: Vorotan Pass towards Jermuk

V) Vorotan(1) line Section :



Figure 12-50: Overview of Vorotan 1 line



Figure 12-51: Affected building in village Shaki



Figure 12-52: Consultation in village Shaki



Figure 12-53: Landscape on Sisian Plateau



Figure 12-54: Existing towers on Sisian Plateau



Figure 12-55: Area of Historical Site on Sisian Plateau

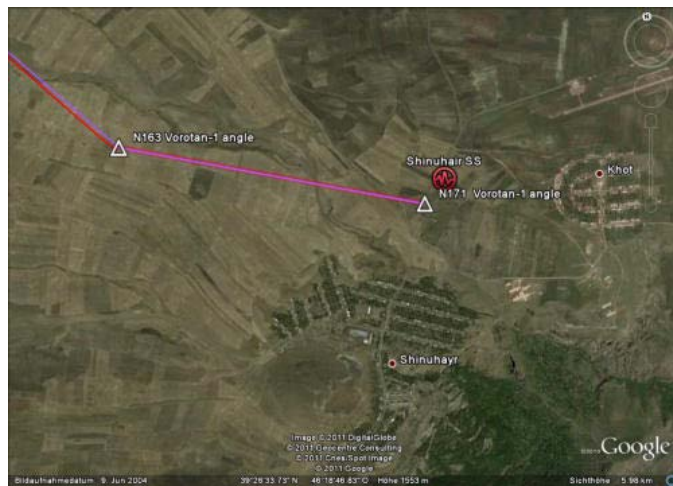


Figure 12-56: Shinuhair Substation (google)

12.7. References

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