

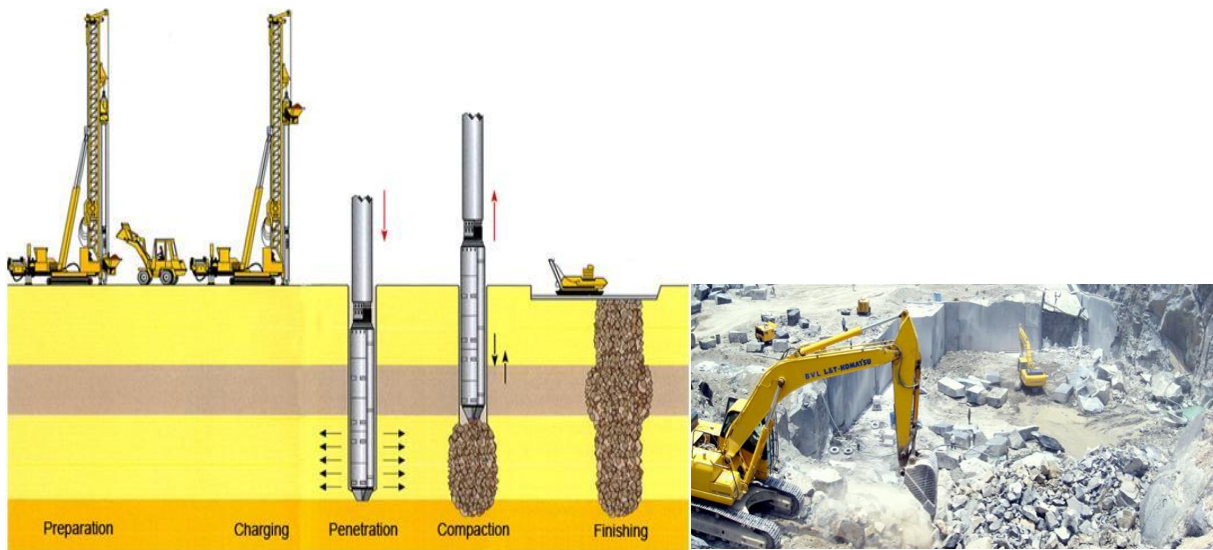
SIM ENGINEERING PVT.LTD

## INITIAL ENVIRONMENTAL EXAMINATION REPORT OF EXPLOITATION OF GRANITE AND DOLERITE RESERVES

In Kel Seri area, District Neelum, Azad Jammu and Kashmir

Green Planet Consulting Services

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## **Executive Summary**

### **Introduction**

Exploitation of Granite and Dolerite in Kel Seri area, District Neelum, AJ&K is a project being proposed by the SIM Engineering (proponent Sardar Farooq Khan and Muhammad Majeed Khan). The extracted dimension stone includes Granite and Dolerite which are originated from igneous rocks as the results of crystallization of magma that cooled far below the earth's surface.

Granite is mainly composed of Quartz and feldspar, with minor amount of mica, amphiboles and some other minerals. On the other hand Dolerite is composed of two essential and several accessory minerals. The essential minerals are plagioclase feldspar and pyroxene, which together constitute 60% and 80% of the total composition. The accessory minerals are quartz, orthoclase, chlorite and magnetite. Quartz, orthoclase and chlorite may comprise 20% to 40% of the rock while the magnetite composition may be 2% to 3% (Leaman, 1993).

This mineral composition usually gives dimension stones a red, pink, gray or white color with dark mineral grains visible throughout the rock. Because granite is so hard, people sometimes use it for building stone or statues and many objects that we encounter in daily life. These include counter tops, floor tiles, paving stone, curbing, stair treads, building veneer and cemetery monuments.

Dimension stones rocks of Neelum valley are composed of grey granite having several exotic iso-grade patterns like zebra and eye catching black to dark green dolerites. These rocks form a largest dimension stone complex in the Kel Seri locality. There are three main textural varieties of grey granite are present in the locality. These varieties are ranging from spectacular fine grained statuary grade to porphyritic types.

SIM engineering by hiring an Environmental Consultant has prepared the Initial Environmental Examination Report to submit it to EPA to get Environmental Approval for exploitation of explored dimensions stones at the said site.

The Green Planet Consulting Services was hired by the proponent for the study. The Consultant established a team to conduct IEE studies and prepare report for submission to AJK EPA to comply with section 11 of the Environmental Protection Act-2000.

### **Legislative Framework**

Exploitation project for dimension stones has been assessed in accordance with and to comply with the existing legal framework on the environment of the Azad Jammu and Kashmir State and Pakistan. Laws, rules, and regulations that apply to this plant are enlisted below;

- National Conservation Strategy
- National Environmental Policy, 2005
- Environmental Protection Agency (Review of IEE & EIA) Regulations 2000

- AJK Environmental Protection Act, 2000
- National Environmental Quality Standards

### **Project Description**

Exploitation of Dolerite and Granite stones from Kel Seri area, District Neelum, Azad Kashmir is a worthy step towards the development of faraway areas like the said. As exploitation of dimension stones are good quality stones which are not only essential for industrial application (they are used to make beautiful tiles for building construction, floors and stairs etc. but also a pronounced demand of local people at domestic level and as well as national and international levels. Apart from this the proposed project will also a good step for the employment opportunities to the local residents.

The objective of this document is to record environmental and social issues and measures planned to mitigate all the adverse impacts of the proposed project to make it environmentally, socially and economically sustainable and acceptable. The document will also service as an evidence of compliance of AJK Environmental Protection Act-2000 in order to get Environmental Approval for the (Dolerite /Granite) exploitation project from the AJK EPA. The proposed project will provide, as said earlier, valuable stones for commercial purposes. The project outputs will contribute in local development and provide employment and income generation opportunities to number of locals.

The scope and extent of the project is described as under;

- The length of exposure is approximate 3000m, with average width of the rock is 2500m, and its inferred depth factor is 400m and the volume of the rocks is 3000 million m<sup>3</sup> with specific gravity of 3.00.
- The site is located in Kel seri area; district Neelum AJK at 34°50'0.80"N and 74°22'19.89"E coordinates.
- All of the area was taken under mining concession by the proponent under AJK Mining Concession Rules 2002 from the Directorate of Mineral Development to explore and exploit the Granite and Dolerite stones as decorative tiles from Kel seri, Azad Kashmir.
- The project of Granite and Dolerite exploitation will include loader, compressors, drill machines, spares for drilling, hose pipes, shovels, pick axes, trolleys, hammers, livers, ropes, filters and filling machines etc.
- A total of 18.6535 million are expected to be invested on the project of exploitation of Granite and Dolerite stones which include salary, machinery and equipment, road, huts and extraction activities etc.
- There would be 20 – 25 skilled and unskilled workforce required for the said work.

### **Description of the Existing Environment**

#### **Physical Environment**

Neelum Valley is a 200 km long bow-shaped thick forested region in Azad Kashmir, Pakistan. It is named after the Neelum River, which flows through the length of the valley. The valley is situated in the north-east of Muzaffarabad, running parallel to Kaghan Valley. The two valleys are only separated by snow-covered peaks, some over 4,000 meters (13,000 ft) above sea level. The valley is located at Latitude 34.5891° N and Longitude, 37.9106° E. Neelum Valley is the largest district of Azad Kashmir having an area of 3,621 km<sup>2</sup>.

The IEE summarizes the available baseline data on physical environment within the principal area of interest i.e. the area of project influence.

### **Geography / Geology**

The proposed project site is located in Kel Seri area, District Neelum, AJK. The Neelum valley is situated to the North & North East of Muzaffarabad and running parallel to the Kaghan Valley. The geographical features enhance the natural beauty of the Valley. Its elevation, a mere 2,000 feet at the start, gradually rises till it attains a respectable height of 8,000 feet. On both sides there are high mountains and peaks. Nearly all the forest wealth of Azad Kashmir is to be found in this part of the State. Neelum is a beautiful valley containing about 370 small and large villages and near about two hundred thousand population. It starts from Chelhana and goes till Taobut 250 km long. It is named Neelum due to its river, curving like the snake with transparent sky colored water.

The area has different soil types that have been derived from parent material of different origins as parent material plays an important role in determining characteristic of the soil. Soils of residual slopes have originated from shales, granite, dolerites, sandstone, mudstone and clays.

### **Land Use and Land Cover**

The lands on the hills generally belong to the Forest Department of AJK and bear forests of pine trees. The lands on the high benches within hilly areas, however proprietary, are used for cultivation and settlements. Major forest types of the area include subtropical evergreen dry broad-leaved forests, subtropical chir pine forests and temperate broad leaved and coniferous forests. A large proportion of the area consists of uncultivable waste including forest. The important forest species are deodar (*Cedrus deodara*); kail (*Pinus excelsa*); cheer (*Pinus willichiana*); sufaida (*Populus euramericana*) and spruce (*Abies pindro*). The few important grass species found in the area are *Cenchrus ciliaris* (Buffel grass), *Digitari sanginalis*, *Setaria pallide*, *Poa pratensis* and *Arunda donax*.

### **Soils**

The area has different soil types that have been derived from parent material of different origins as parent material plays an important role in determining characteristic of the soil. Soils of residual slopes have originated from shales, granite, dolerites, sandstone, mudstone and clays. The texture of the primary soils varies from moderately fine to moderately coarse depending upon the rock type from which these have developed. However, the secondary



soils are mostly moderately coarse textured. The soils of the raised terraces in floodplains are generally devoid of the stony material. The soils of lower terraces generally contain varied quantities of pebbles, cobbles and boulders.

### **Climate and Meteorology**

May to October from the scorching heat of plains to the high land basin of Neelum Valley is indeed an escape from hell to the cold breezes of paradise. The temperature remains in between 65°F to 90° F during the summer season, while in winter season temperature which remains in between -2°C to 6°C which is considering as minimum temperature of the V shaped valley. Heavy snow fall starts in upper areas in November usually. From May to November the climate is very pleasant and cool and chill winds blows. There are frequent landslides during the summers, and snow slides on this road during winters.

### **Rainfall and Humidity**

Azad Jammu and Kashmir has a very diverse climate; ranging from sub-humid subtropical, to moist temperate, dry cold temperate, very cold temperate to snow deserts in extreme north. The mean annual rain fall varies from 800 mm to 1600 mm. The snowline in winter is 1,200 meter above sea level, while in summer it rises to 3,300 meters. In extreme northern fringes of the AJ&K State there are permanent glaciers and ice caps.

### **Temperature**

The temperature remains in between 18°C to 32°C during the summer season, while in winter season temperature which remains on average in between -2 °C to 6°C. On the other hand during winters temperatures falls down below -12 frequently at nights. From May to November the climate is very pleasant and cool and chill winds blows. There are frequent landslides during the summers, and snow slides on this road during winters.

### **Hydrology and Water Resources**

Major water sources of Neelum valley are the varieties of glacial lakes, which consist of a huge amount of perpetual snow and ice and eventually turned into many glacial lakes that flow through the area. The Neelum River is the largest tributary in Jhelum river basin. It originates out of glacial melts from surrounding mountain peaks. Neelum River, which curves along the 200-kilometre valley, trailing westwards along the Line of Control (LoC) until it finally submerges into the Jhelum on the outskirts of Muzaffarabad. The River is famous for ice cold water and trout fish. A sizeable part of the cultivated area of the district is not having the assured irrigation facilities and the agriculturists have to depend on the vagaries of weather. Maize, Wheat and Paddy is the principal crop of the district. Maize is harvested in Kharif season, whereas wheat in Rabi season.

### **Surface Water**

Surface water sources mainly consist of glacial lakes such as Chitta Katha and Ratti Gali located in Neelum valley at the 13,500 feet (4,100 m) and 12,130 feet (3,700 m) respectively.

These lakes are having a popular tourist destination. Many local and migratory birds, especially ducks and geese, inhabit the lakes.

### **Ground Water**

Neelum valley is a beautiful district of Azad Jammu and Kashmir which is a land with beautiful mountains and foothills. The major ground water sources are hot springs and glaciers which are rarely used for drinking purposes due to the limited supply of drinking water in the valley. On the other hand majority of the population uses bore-hole water for drinking purposes. During the rainy season the rain water seeps into the mountains oozes and results in the formation of different springs, which were used by the local inhabitants to carry out different activities.

### **Air Quality and Noise Level**

In general there are no major sources of air pollution, i.e., no industries, exist in the project area except road traffic in the valley. The ambient air quality data is been collected from secondary data. The existing ambient air quality of the study area serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning further development in the area. All the parameters of NEQS were found well within limits except the noise level, which was found in range of 54.7 to 62.3 (dBA) in the day time because of road traffic.

### **Description of Biological Environment**

The ecological conditions of the area focusing on the aquatic ecology, flora, mammals, birds, and reptiles and amphibians are covered in the study. The diversity in these groups has been described along with the population and conservation status of the species. The habitat of the study area has been characterized based on biological and physical factors and its spatial delineation is provided.

### **Vegetation and Land Cover**

Major forest types of the area include subtropical evergreen dry broad-leaved forests, subtropical chir pine forests and temperate broad leaved and coniferous forests. Biotic and a-biotic factors play an important role in assessing vegetation composition of different areas.

### **Fish Fauna**

Neelum river is generally rich in fish diversity. As the river almost entirely runs across the Line of Control, being the main cause for Kashmir conflict there is a feeling of uncertainty among the inhabitants, many of them have migrated to safer places, which has left the river banks scarcely populous and kept the river in perfect conditions for growth of fish.

The most famous varieties of fishes found in Neelum River include Brown trout (*salmo trutta fario*), Rainbow trout (*salmo gairdri*), and Snow trout (*shizothorax*), Shuddgurn etc.

### **Large Mammals**

A number of mammalian species including common leopard, black bear, barking deer, jackal, fox and rhesus monkey were reported in Azad Jammu and Kashmir in past (Akbar and Anwar 2011; Roberts 2005). Overall diversity of large mammals was much lower as compared to adjacent areas like Pir Lasura National Park where 45 barking deer are residing (Zulfiqar *et al.*, 2011) and frequent sightings of yellow-throated marten, small Kashmiri flying squirrel and common leopard are reported (Manzoor *et al.*, 2013).

### **Small Mammals**

Seventeen species of small mammals have been reported from the study area belonging to eleven families and five orders. The species *Rattus rattus*, *Mus musculus* and *Suncus murinus* are the dominant rodent and insectivore species, *Pipistrellus kuhlii* and *Scotophilus heathii* are common chiroperan species and *Lutra lutra* represents the rare but widely distributed carnivore species in the study area. The species *Lutrogale perspicillata* (Otter) is vulnerable species (IUCN 2010).

### **Reptiles and Amphibians**

Total 21 species of herpetiles including six amphibians and 15 reptiles were recorded in the area. Out of the recorded 21 species, three are endemic to Pakistan including two lizards; Agrore valley agama (*Laudakia agrorensis*) and Rohtas gecko (*Indogekko rohtasfortai*) and one snake; slender blind snake (*Typhlops ductuliformes*). None of the three recorded endemic species during the survey have yet been evaluated by IUCN or listed for evaluation of their conservation status in IUCN Red List of Threatened Species.

### **Avifauna**

A total of 61 species belonging to 32 families are reported in the area. The area is a transitional zone between plains and foot hills of Himalayas. It provide the diverse habitat to the birds species such as winter migrant from higher altitude and summer migrant from lower altitudes. The critically endangered species, the white rumped vulture (*Gyps bengalensis*) and endangered Egyptian Vulture (*Neophron percnopterus*) have been reported in the area.

## **Description of Socio-Economic Environment**

### **Social Set-up**

In Azad Kashmir there are poor and rich people, there are families of commoners and families of high birth and there are politically powerful elites and comparatively powerless people who are expected only to follow commands and obey orders. According to G. Mir (2009), the social classes of Azad Kashmir are formed in three categories i.e. upper social class; middle social class and working social class.

## **Social Composition**

Neelum is composed of diverse communities. People of different faiths live peacefully in the district. Races like Gujjars, Bakerwals, Mughal, Awan, Syeds, Kashmiris and Rajputs, are residing in specific / distinct locality in the district. Gujjars mostly reside on the slopes of mountains. They have small pieces of land for cultivation and cattle for supplementing their economy. The mother tongue is a great cementing factor of the Pahari speaking people because they remain so closely associated with each other that cultural ethos transcend all that of distinct beliefs and faiths. People have simple eating habits.

## **Political and administrative setup**

The District Neelum have 2, subdivision, 09 union council and 88 small and large villages. Athmuqam is the capital city of Neelum Valley. It has been administratively divided into two sub-districts: Athmuqam and Sharda. District administration is headed by a Deputy Commissioner. He supervises the activities of the nation building departments in the district assisted by Assistant Commissioners at the sub-division level.

## **Economic Profile**

Residents of the Neelum district have diverse but limited means of livelihoods including farming, livestock, poultry farming, government service (both civil and military), and business and overseas employment. Industry is minimal in terms of contributions towards livelihoods. Majority of the rural population still relies on agriculture for its livelihood. However, there is discrepancy between source of income between rural and urban areas because 84% of income generation is derived from professions which are urban base, such as service/jobs, skilled labor, business and remittances.

## **Education**

AJK's literacy rate is estimated at 65%, which is higher than Pakistan's national average of 55%. Of the literate population, males constitute 77% and females 23%, according to the Pakistan Bureau of Statistics. Majority of the people above then 30% is uneducated in one of the village of district Neelum as there are no sufficient educational facilities in Gurase Valley in past whereas Government have provided primary, middle and high schools in the valley, while the students have to go outside the valley for college and university education. But on the other hand this statistic is now changing and the literacy rate that is recorded in Neelum valley is about 51%.

## **Housing**

The housing pattern is lavish in terms of size and construction as more than 88% of the structures are pukka, made of cement and bricks with RCC structures. Only 5% houses and structures are kacha, made of mud and stone, whereas 6% structures are a combination of kacha and pakka.

### **Water Supply and Sanitation**

According to Government of AJK, currently the majority of households do not have drainage facility (68%). The 1998 census report shows that the facility of drinking water inside the house was available to only 16.28% of the housing units while a large proportion 83.72% of the housing units, used outside sources as drinking water. According to the reports of PWD (Water Supply Branch) and LG&RD Department in 2005 the situation was that, out of a total 6604 urban houses, 1390 had access to piped drinking water which makes 21% of these houses.

### **Gender Issues**

The women have no formal role in the authority structure of the nearby villages. They are about 48% of the population in these villages; the literacy rate for above 10 years of female population is 67% (80% for males). The traditional attitude of not sending the girls to school is changing now, because the parents understand that the basic education is necessary for each individual regardless of sex. Most of the women stay at home and only travel outside the village in case of visiting to shrines, relatives, and going to weddings and hospitals in nearby towns.

### **Cultural Heritage**

Cultural notions of Neelum valley inhabitants are reflected in different walks of life. Azad Kashmir is famous for making traditional handicrafts and artifacts. Mostly women are used to make hand woven and knotted Cashmere Shawls, Pashmina Shawls and Carpets.

Some cultural sites of Neelum valley, Azad Jammu and Kashmir also have cultural importance and residents have associated with these places.

Sharda Fort, also known as Sharda Peeth, is an ancient fort and a national heritage monument in Neelum Valley, Azad Kashmir, Pakistan. Situated at an altitude of 1981 meter near the Neelum River, it is a major tourist attraction in Neelum Valley.

Chitta Katha Lake is located in Shonter valley, Azad Kashmir, Pakistan at the altitude of 13,500 feet (4,100 m). Chitta' in local language means White and 'Katha' means water reservoir, so it is a reservoir of crystal clear water. "Chitta Katha Lake" is a deep bowl shaped body of water is mostly snowbound during the year.

However the proposed project would not cause any impact on these sites.

### **Impact Identification, Assessment and Mitigation Measures**

In the examination study the potential impacts of the proposed projects have been identified and evaluated which are likely to occur during the developmental and exploitation phases of the project. Further to mitigate the significant adverse impacts of the proposed project different measures are proposed to avoid, minimize and reduce consequences of the project activities.

**Physical Environmental Impacts:** The soil related impacts due to exploitation of dimension stones (Granite and Dolerite) may include *soil erosion, top soil removal, slope stability, dust generation and soil contamination*. The exploration activities may generate excavated soil, debris and construction waste will lead to contaminate the surrounding environment.

Vehicles and machinery operations, during exploration and developmental phase can cause air pollution by exhaust emissions and generation of dust. It can increase the concentration of carbon oxides, sulphur oxides, nitrogen oxides and particulate matter. These emissions can deteriorate the air quality in the immediate vicinity of the area.

Mitigations: To control soil erosion and soil contamination the vehicles will be moved on designated routes. To avoid exhaust emissions machinery and vehicles will be kept tuned and muffled. To control dust emissions water will be sprinkled on sites to further reduce the generation of dust in the air.

Ecological Impacts: Vehicles movement, dust of the project activities by settling on the leaves may cause some impacts on vegetation loss and/or micro fauna loss.

Keeping this in the view and the ground reality, it is evident that the dimension stones exploitation activities would not be causing any major damage to vegetation and/or fauna. The noise of the project activities may affect avifauna however maximum efforts will be exerted to minimize noise generation. It is evident that the project would not cause any significant ecological impact however following measures would be taken to further reduce the impacts.

Mitigations: The project will not cause any significant ecological impact. However, noise generation will be kept minimized to avoid disturbing avifauna. Dust emissions will be reduced by sprinkling water. Night time operations will not be carried out to avoid impacting Nocturnal species. The site area will be vegetated after closing of activities after moving towards the next point. Trees will also be planted to improve ecological settings. Trees plantation will also cordon off the site activities and would be a step towards improvement of landscape views.

Socio-Economic Impact: As the site is not in congested area and it will not cause any traffic congestion as only few vehicles will be on the move during the project activities. There are no residents around the site or any business activities which could be affected by the operations. However, the activities can cause noise, generate dust, and solid waste which will be minimized by adopting appropriate mitigation measures.

It provides business opportunities to the locals which is further generating employment opportunities thus reducing un-employment rates in Kel Seri area of District Neelum.

Mitigations: All the project machinery and vehicles will be kept tuned, serviced and muffled to reduce the level of noise. The waste generated will be collected, segregated and placed in bags. The recycle and reuse practices will be adopted to reduce the amount of waste.

Hazard indicating signs will be placed at the risky areas. All the workers will be asked to wear personal protective equipment's. A first aid box will be available 24 hours at the site. Workers will be trained and educated about the standard procedures to be followed in case

of emergency situations. Fire safety measures were taken in case of any fire accidents. Water will be sprinkled around at the exploitation sites to reduce the generation of dust.

### **Impact Mitigation and Management Plan**

An environmental Impact Mitigation and Management plan has been prepared for the project that defines the institutional arrangements required for its implementation. It also provides the implementation mechanism and approach for the recommended mitigation measures identified during the IEE study.

Impact mitigation and management plan provides a delivery mechanism to address the adverse environmental impact of the project during its execution, to enhance the project benefits and to introduce standards of good practice to be adopted for all project works.

A monitoring plan also makes the part of impact mitigation and management plan for the plant operations to ensure the legislative and approval conditions compliance.

### **Conclusions and Recommendations**

On the basis of the overall impact assessment, more specifically, nature and magnitude of the residual environmental impacts identified during this IEE, it is concluded that the considered proposed project for the exploitation of worthy stones is unlikely to causes any significant long lasting impact on the socio-economic, physical or ecological environment of the area provided that the proposed activity is carried out as mentioned in the report, and the mitigation measures are included in this report are completely and effectively implemented.

There are no remaining issues that require further investigation for the proposed project. This IEE is considered adequate for the environmental justification for exploitation of Dolerite and Granite stones in Kel Seri area, district Neelum, Azad Kashmir.

## **1. Introduction**

### **1.1 Background**

Exploitation of Granite and Dolerite in Kel Seri area, District Neelum, AJ&K is a project being proposed by the proponent Sardar Farooq Khan and Muhammad Mojeed Khan (SIM ENGINEERING Pvt Limited). The extracted dimension stones include Granite and Dolerite which are originated from igneous rocks as the results of crystallization of magma that cooled far below the earth's surface.

Granite is mainly composed of Quartz and feldspar, with minor amount of mica, amphiboles and some other minerals. On the other hand Dolerite is composed of two essential and several accessory minerals. The essential minerals are plagioclase feldspar and pyroxene, which together constitute between about 60% and 80% of the total rock composition. The accessory minerals are quartz, orthoclase, chlorite and magnetite. Quartz, orthoclase and chlorite may comprise 20% to 40% of the rock while the magnetite composition may be 2% to 3% (Leaman, 1993).

This mineral composition usually gives dimension stones a red, pink, gray or white color with dark mineral grains visible throughout the rock. Because granite is so hard, people sometimes use it for building stone or statues and many objects that we encounter in daily life. These include counter tops, floor tiles, paving stone, curbing, stair treads, building veneer and cemetery monuments.

Dimension stones rocks of Neelum valley are composed of grey granite having several exotic iso-grade patterns like zebra and eye catching black to dark green dolerites. These rocks form a largest dimension stone complex in the Kel Seri locality. There are three main textural varieties of grey granite are present in the locality. These varieties are ranging from spectacular fine grained statuary grade to porphyritic types.

Kel Seri Mountains offers tremendous potential of granolithic gneisses, showing pronounced iso-grade patterns. These high grade dimension rocks are representing the basement sequence of the area. Essential rock forming minerals are alkali feldspar, plagioclase, quartz, muscovite and biotite with traces of granet. These rocks are entitled medium grained textured. Color varies from light grey to grey depending on proportion of dark mineral constituents.

The proposed project for the exploitation of dimension stones in Kel Seri, Neelum valley AJK not only provide good quality stones(granite & dolerite) as decorative stones which were used as tiles but also provide employment and business opportunities to the locals.

The proponent will keep good standards in providing good quality working environment to his employees and business allies. The proponent through its consultant has prepared Initial



Examination Report to submit it to AJK Environmental Protection Agency (AJK) to get approval for the exploitation and development of the proposed project.

As mentioned above, to comply with the Section 11 of AJK Environmental Protection Act-2000, the Proponent engaged “Green Planet Consulting Services” an Islamabad based consulting firm to prepare Initial Environmental Examination Report. The Green Planet has conducted Initial Environmental Examination (IEE) study to identify and assess major environmental and social impacts and to figure out impact mitigation plan to mitigate significant adverse impacts so that no significant negative impact is left on the environment.

## **1.2 Purpose**

The AJK Environmental Protection Act-2000 under Section 11 requires that project proponent needs to obtain an Environmental Approval from the AJK Environmental Protection Agency for operation and development of projects falling under schedule I or Schedule II of projects categories as set under Azad Jammu and Kashmir Environmental Protection Agency Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2009. The project under consideration falls in Schedule I as it is a small scale exploitation project for Dolerite and Granite and also it does not cause any significant environmental or social impacts. To obtain environmental approval from the Agency, IEE for the proposed project being carried out and the findings are documented.

The objectives of this IEE are to:

- Identify and assess environmental and socio-economic impacts of the project.
- To evaluate the existing environmental conditions and look for improvements in existing conditions for better overall performance.
- To assess post-project conditions if they have changed for better or worse.
- To document all the resources likely to be affected due to the implementation of the Project.
- To determine the existing physical, biological, and socio-economic environmental conditions and the implications of the Project.
- To determine environmental compatibility of the project.
- Figure out and plan measures to avoid, minimize and reduce adverse impacts and compensate for residual impacts.
- Identification and evaluation of the salient environmental impacts.
- Identification of the necessary mitigation measures to minimize the adverse impacts.
- Develop an environmental Impact Mitigation and Management Plan (IMMP) for the plant operations.
- To prepare an IEE Report as per the relevant guidelines for submittal to AJK EPA.

## **1.3 The Project**

The project under consideration is exploitation of Granite and Dolerite stones in Kel Seri area, District Neelum AJ&K.

Kel Seri Mountains offers tremendous potential of granolithic gneisses, showing pronounced iso-grade patterns. These high grade dimension rocks are representing the basement sequence of the area. Essential rock forming minerals are alkali feldspar, plagioclase, quartz, muscovite and biotite with traces of granet. These rocks are entitled medium grained textured. Color varies from light grey to grey depending on proportion of dark mineral constituents.

#### **1.4 The Proponent**

SIM Engineering Pvt Ltd with its directors, Sardar Farooq Khan and Muhammad Mojeed Khan, is the proponent of the project. The Green Planet Consulting Services, an Islamabad based environmental consulting services, has drafted the report on behalf of the project proponent.

#### **1.5 Contact Persons**

For further details, information or any clarifications about this document, the proponent representative or the consultant representative can be contacted and the contact details are given below.

|  |  |
|--|--|
| Proponent's Representative:<br>Sardar Muhammad Farooq Khan<br>Muhammad Mojeed Khan | Kelseri, Neelum District, AJK<br>Cell: 0334-5445262  |
| Consultant:<br>Ms. Samina Parveen  | <b>Green Planet Consulting Services</b><br>Office #3, 1 <sup>st</sup> Floor, Zakki Center, I-8 Markaz, Islamabad<br>Email: gpcs.islamabad@gmail.com<br>Tel: 0340-8444303 |

#### **1.6 Approaches and Methods**

Impact Assessment is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects. Whenever, appropriate social, cultural and health effects are considered as an integral part of impact assessment. Particular attention is given to practical implementation of the assessment to prevent and mitigate significant adverse effects of proposed undertakings. The revised components will be evaluated as follows:

- Identifying possible environmental impacts
- Scoping of impacts to identify more significant impacts
- Evaluating those impacts
- Discussing appropriate mitigation measures
- Devising impact management and monitoring plan

## **1.7 Data Collection**

A generic description of the proposed project and its related activities are collected from the project proponent. Baseline of the area's environmental and socio-economic settings is collected through literature search, field surveys and site investigations and also from the project proponent and local public.

## **1.8 Impact Assessment and Mitigation**

The information collected in the previously is used to assess potential environmental impacts of the proposed project activities. The issues studied include potential impacts on:

- Physical environment of the area
- Biological environment of the area
- Socio-economic environment of the area

Mitigation measures are evaluated to reduce the impacts of project activities on environment.

## **1.9 Documentation**

At the end of the process, an IEE report is prepared with the assessment of project impacts and mitigations measures to be adopted during the execution of the proposed project activities.

After conducting a kick of meeting with the project proponent, a team of experts from the consultant resources is formulated and then the field activities are planned to collect primary data of the site.

Secondary data and information were collected from published and unpublished but authentic resources on physical, biological and socio-economic matters.

For public consultation, the team approaches the public directly to collect their views and concerns about the proposed project.

## **2. Regulatory Review**

Laws, rules, and regulations that apply to this project are enlisted below and it is expected that the project will comply with all of these.

- National Conservation Strategy
- Biodiversity Action Plan
- National Environmental policy, 2005
- The Azad Jammu & Kashmir Environmental Protection Act, 2000
- Conservation of Critical environmental resources
- National Environmental Quality Standards
- Azad Jammu & Kashmir Environmental Protection Agency Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2009

### **2.1 National Conservation Strategy**

Before the approval of National Environmental Policy (NEP) the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment this strategy just exists as a national conservation program. The NCS was developed over a nine-year period (1983-1992) after an extensive consultation process. The Federal Cabinet approved the NCS in March 1992, as the principal policy document for environmental management in the country.

The National Conservation Strategy (NCS) is a broad-based policy statement aimed at achieving environmentally sustainable economic and social development in Pakistan. The three overriding objectives of the NCS are:

- Conservation of natural resources.
- Sustainable development.
- Improved efficiency in the use and management of resources.

Three operating principles are identified to achieve these objectives. These are:

- Greater public participation in development and environmental management.
- A merging of environment and economic decision-making.
- Lasting improvements in the quality of life.

The NCS sets out the basic guidelines for an integrated effort aimed at protecting the environment and natural resources of the country. This broad framework provides a comprehensive point of reference for all agencies, departments, private sector companies, financial institutions, and donor agencies for undertaking systematic efforts to bring about an effective change for sustainable development.

The NCS proposes policies in 14 primary, secondary, and tertiary sectors in order to remediate environmental problems in sustainable way.

- Maintaining soils in cropland
- Increasing irrigation efficiency
- Protecting watersheds
- Supporting forestry and plantations
- Restoring rangelands and improving livestock
- Protecting water bodies and sustaining fisheries
- Conservation of biodiversity
- Increasing energy efficiency
- Developing and deploying renewable
- Preventing and abating pollution
- Managing urban wastes
- Supporting institutions for common resources
- Integration population and environment programmes
- Preserving the cultural heritage

Of these, the policies and measures proposed in nine sectors (agriculture, forest management, rangeland rehabilitation, livestock management, water resources, wildlife, mineral resources, energy, and human settlement) do not have direct relevance to the proposed project. The policies proposed in industrial development, and pollution controls are relevant to the proposed project. The policies for these sectors include the following:

1. Industrial development: Development and enforcement of effective pollution controls; promotion of clean industrial processes and recycling; establishment of incentives for environmentally beneficial or benign industries; development of a policy for siting of industries in areas of low environmental sensitivity; building awareness within industry.

2. Pollution control: Promotion of domestic wastewater treatment technologies that provide for recovery and reuse of water, nutrients, and organic matter; focusing on the regulatory approach for industrial discharge; supporting recovery and use of heavy metals from industrial effluents; promoting biological methods of wastewater treatment wherever practicable; giving priority to areas where there is a risk of groundwater contamination; promotion of proper maintenance of motor vehicles, industrial boilers, and furnaces; encouragement of higher fuel efficiency in motor vehicles; undertaking environmental impact of Zone siting; promotion of reuse and recycling; encouraging marketing assistance for effective use of scavenging systems.

## **2.2 The Biodiversity Action Plan**

The Plan, which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals to conserve biodiversity in the country. The BAP recognizes that an EIA is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an EIA needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

## **2.3 National Environment Policy, 2005**

The National Environmental Policy (2005) provides an overarching framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan.

It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS), 1992, National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. It also provides broad guidelines to the federal government, provincial governments, federally administered territories and local governments to address their environmental concerns and to ensure effective management of their environmental resources.

The objectives of the National Environment Policy are followings:

Conservation, restoration and efficient management of environmental resources;

- Integration of environmental consideration in policy making and planning processes.
- Capacity building of governmental agencies and other stakeholders at all levels for better management of environment.
- Meeting international obligation effectively in line with the national aspiration.
- Creation of demands for environment through mass awareness and community mobilization.

The National Environment Policy has been motivated by the above considerations and is intended to mainstream environmental concerns in all development activities. It briefly describes the key environmental challenges currently and prospectively facing the country. The National Environment Policy is intended to be a guide to action in regulatory reform, programmes and projects for environmental conservation; and review and enactment of legislation, by agencies of the Central, State, and Local Governments. The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of

conservation, than from degradation of the resource. In that regards following objectives were also undertaken.

## **2.4 Azad Jammu & Kashmir Environmental Protection Act, 2000**

The AJK Environmental Protection Act, 2000 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, soil, and noise pollution, as well as to the handling of hazardous wastes. The key features of the law which are directly related to the proposed project are:

- Section-10 (1): "Subject to the provisions of this Act and the rules and regulations made there under no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollution or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards".
- Section-11 (1): "No proponent of a project shall commence construction or operation unless he has filed with the Environmental Protection Agency (EPA) an Initial Environmental Examination (IEE) or, where the project is likely to cause an adverse environmental effect, an Environmental Impact Assessment (EIA), and has obtained from the EPA approval in respect thereof".
- Section-13: "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except (a) under a license issued by the EPA and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party" .

## **2.5 Efficiency in Environmental Resource Use:**

To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output, to minimize adverse environmental impacts.

## **2.6 Enhancement of Resources for Environmental Conservation**

To ensure higher resource flows, comprising finance, technology, management skills, traditional knowledge, and social capital, for environmental conservation through mutually beneficial multi-stakeholders partnerships between local communities, public agencies, the academic and research community, investors, and multilateral and bilateral development partners.

## **2.7 Policy and Procedures for Filing, Review and Approval of Environmental Assessment Reports**

It describes environmental policy and administrative procedures to be followed for filing of environmental examination/assessment reports by the proponents and their review and approval by the concerned environmental protection agencies.

The purpose of Policy and Procedures for Filing, Review and Approval of Environmental Assessment Reports is to establish a policy context and administrative procedures for environmental assessment. It will help to guide project proponent, both public and private and provincial departments and agencies.

The objectives of environmental assessment include:

- To encouraging and providing opportunities for public consultation in environmental aspects of proposal before decision are made.
- To ensure that the proponent of the proposal take primary responsibility for the protection of environment relating to the current proposal, and carry the cost necessary for the environmental protection.
- To facilitate environmentally sound proposal by minimizing adverse impacts and maximizing the benefits to the community.
- To provide a basis for ongoing environmental management, including through the results of monitoring.
- To promotes education and awareness in environmental values.

## **2.8 National Environmental Quality Standards (NEQS)**

The Pakistan Environmental Quality standards (NEQS) are applied in AJK. The NEQS were first promulgated in 1993 and have been amended in 1995 and 2000. The NEQS specify the following standards:

1. Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, and sewage treatment facilities.
2. Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources.

## **2.9 AJK EPA Review of IEE and EIA Regulations, 2009**

The AJK Environmental Protection Act, 2000 provides for two types of environmental assessments: IEEs and EIAs. EIAs are carried out for projects that have a potentially 'significant' environmental impact, and IEEs are conducted for relatively smaller projects with a relatively less significant impact. The AJK EPA Review of IEE and EIA Regulations, 2009



categorizes projects for IEE and EIA and are listed as Schedules I and II, attached to the Regulations, 2009 respectively.

The Act defines the term 'project' as 'any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations.'

The proposed project also came under the above defined terms and it also falls in the Schedule I (D) of the IEE and EIA Regulations, 2009. Therefore, it requires an IEE as per section 11 of the AJK Environmental Protection Act and the same document is submitted hereby to the Agency for approval.

The IEE-EIA Regulations, 2009 also provide the necessary details on the preparation, submission, and review of IEEs and EIAs. The following is a brief step-wise description of the approval process:

1. A project is categorized as requiring an IEE or EIA using the two schedules attached to the Regulations.
2. An EIA or IEE is conducted as per the requirement and following the guidelines.
3. The EIA or IEE is submitted to the EPA.
4. A fee, depending on the cost of the project and the type of the report, is submitted along with the document.
5. The submittal is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.
6. The EPA conducts a preliminary scrutiny and replies within 10 days of the submittal of a report, a) confirming completeness, or b) asking for additional information, if needed, or c) returning the report requiring additional studies, if necessary.
7. The EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively, after issuing of confirmation of completeness.
8. When the EPA accords its approval subject to certain conditions:
  - Before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions.
  - Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE/EIA.
  - An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.

The EPA is required to issue confirmation of compliance within 15 days of the receipt of request and complete documentation.

### **3. Description of the Project**

Exploitation of Granite and Dolerite stones in Kel Seri area, District Neelum, Azad Kashmir is a worthy step towards the development of faraway areas like Neelum valley. The dimension stone from the Kel Seri area is known as Kel Seri section. This area has been identified as hub for the production of dimension stones due to geographical coexisting position of stones varieties, quality and available huge reserves, subject to the establishment of a viable quarrying operation. A gigantic statuary grade granitic mass associated with dolerite clusters and extensive high quality black Garnet schist signifies the area a veritable warehouse of dimension stones.

As explored dimension stones are good quality stones with different colours which are not essential for industrial application (they are used to make beautiful tiles and valuable ornaments) but also a pronounced obligation of local people at domestic level. As these dimension stones are apply to any quarried stone that are fabricated into various sizes, with or without polished surface. The use of these dimension stones for interior and exterior adornment of structures, monuments, shrines, statues etc. can increase their value manifolds. Apart from these benefits the proposed project will also a good step for the employment opportunities to the local residents.

#### **3.1 Purpose**

SIM Engineering Pvt Ltd had already acquired Mining lease of Granite and Dolerite deposits of Kel Seri area of District Neelum AJK through the department of Mineral and Industrial Development AJK. The mining lease is acquired to explore and exploit the Granite and Dolerite decorative stones as tiles.

The exploration work for granite and dolerite reserves was done in three phases by the SIM engineering Pvt Ltd and the proponent.

- During the first stage of exploration attempt was done to evaluate the reserves of granite and dolerite in Kel seri area, district Neelum AJK.
- In the second attempt 2200 million ton of granite and 1400 million tons of dolerite garnet grade schist reserves were estimated.
- In the last phase of exploration work based on the recommendation of reserves estimation a market survey was done by the SIM engineering which essentially consist of mining, cutting, polishing and sale of dimension stones in the local industry.

The objective of this document is to record environmental and social issues and measures planned to mitigate all the adverse impacts of the proposed project to make it environmentally, socially and economically sustainable and acceptable. The document will also service as an evidence of compliance of AJK Environmental Protection Act-2000 in order to get Environmental Approval for the exploitation of economically viable stones (Dolerite and Granites) from the AJK EPA. The proposed project will provide, as said earlier, valuable

outputs in the form of Granite and Dolorite tiles and associated products for commercial and as well as domestic purposes. This project will also fulfil the local needs. The outputs will contribute in local development and provide employment and income generation opportunities to number of locals.

### **3.2 Project Location:**

The project site is located in Kel Seri, District Neelum, Azad Kashmir. Kel Seri area is underlain by attractive green coloured dolerite rocks and artistic fashioned grey textural grey to light grey varieties of granulitic gneisses. Kel Seri Mountains offer tremendous potential of granulitic gneisses, showing pronounced migmatitic textures. Four artistic fashioned grey verities have been marked in the area. Lofty Granite Mountains of the section indicate a huge resources potential of dimension stones.

Fine grained grey granitic mass about 1000 m thick is extensively outcropping over an area of about 2 Km long belt. Inferred reserves of this granitic mass calculated on the basis of length, average thickness and assumed depth are about 3 billion tones. A block from this gigantic mass has been selected and mapped for quarry development on the top of Kel Seri area. The reserves of this block based on dimensions are therefore conservatively calculated 90 million tonnes.



**Figure 3-3-1: Indicates the project site location (Source: Google Earth)**



**Figure 3-3-2: Shows project site cover and location area (Source; Google Earth)**

### **3.3 Project Alternative**

Alternative analysis has been considered as an integral part of the IEE study. The technical feasibility, economic viability and environmental acceptability will govern the alternative analysis. The project proponent hired Green Planet as consultant for the assessment of environmental impact and economic viability of different alternatives as No project option etc.

The alternatives are examined in order to maximize the project benefit and minimize the adverse impact.

No implementation or “no project option” of the proposed project prevents the implementation of the project and may limit socio-economic development. The exploitation phase of the proposed project will provide numerous benefits to the local people. The major benefits are employment opportunity to local people, impact on local economy due to increased economic activities and enhancement of technical skill during developmental and exploitation phases.

If the proposed project is not implemented, the local people of the remote area of Kel Seri area district Neelum will lose socio-economic benefits.

### **3.4 Scope and Extent of the Project:**

The scope and extent of the project is described as under;

- The site will be taken on lease for exploitation under AJK Mining Concession Rules 2002 from the Mining and Industrial Development Department.

- Daily roughly 200 litres of water will be required, which will be fetched from natural springs.
- Approximate 2 residential rooms were constructed in the vicinity of project area for labour working there.
- Construction and installation of 1MG HPP for electric generation which can be utilized during the project activities.
- Camp will be established at mining area for geologist/mining staff.
- The project machinery will include loader, compressors, drill machines, spares for drilling, hose pipes, shovels, pick axes, trolleys, hammers, livers, ropes, filters and filling machines.
- A total of 18.6535 million are expected to be invested on the work during developmental and exploitation phases for Granite and Dolerite stones which include salary, roads, huts and exploitation work etc.
- The exploitation work will be undertaken by compressors and drill machines.

**Table 3-1: Estimated amount of dimension stones (Dolerite/Granite) Reserves in Kel Seri area**

| <b>Measured Granite</b> | <b>Dolerite measured</b> | <b>First phase mineable reserve</b>  | <b>Total reserved</b>          |
|-------------------------|--------------------------|--|--------------------------------|
| 2200,00                 | 1400,00                  | Granite best 1000<br>Medium 700<br>Low grade 500<br>Dolerite low 400<br>Best grade 500 | Granite:2200<br>Dolerite: 1400 |

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**Table 3-2: Machinery required for project activities**

| <b>Sr. No</b> | <b>Machinery</b>   | <b>Required amount</b>  |
|---------------|--|---|
| 1             | <ul style="list-style-type: none"><li>• Wheel loader</li><li>• Drilling machines</li><li>• Cutting machines</li><li>• Compressor/generator</li><li>• Crane</li></ul> | <ul style="list-style-type: none"><li>• 1 set</li><li>• 2 set</li><li>• 2 set</li><li>• 1 set</li></ul> |
| 2             | Pneumatic drill machines   | 4   |
| 3             | Machinery and equipment's for cutting and polishing  | 3   |

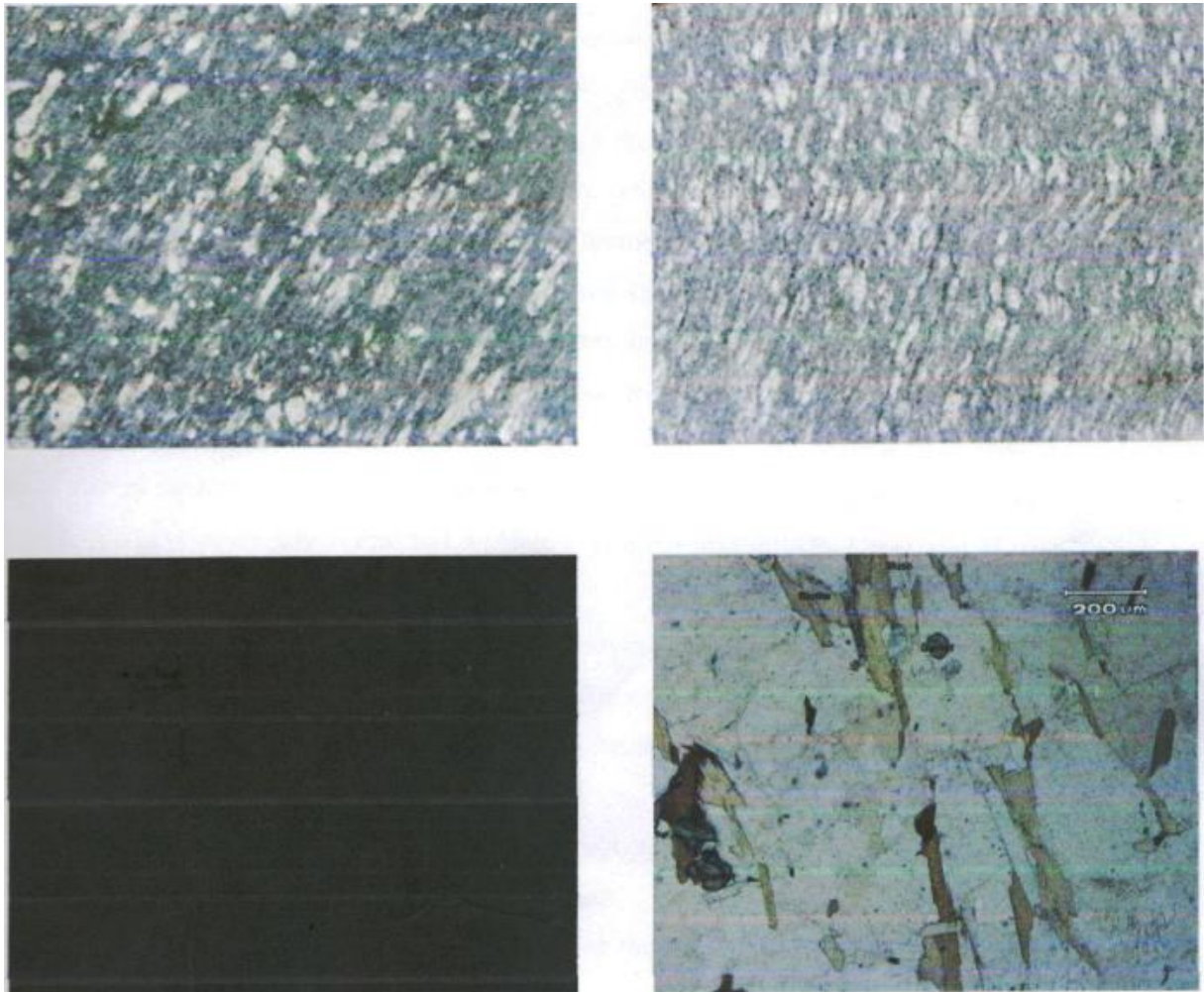
### **3.5 Project Site Land Acquisition:**

The project site land will be taken on lease from the AJK Government Directorate of Mineral Development under AJK Mining Concession Rules 2002.

### **3.6 Project Site Surroundings:**

The project site is located in Kel Seri area, District Neelum, AJK. The project site is far-away from the residential area. There are no housing areas near the site. As the project site is mostly covered by common grass. However, disperse to dense vegetation is present in the nearby areas of the proposed dimension stones (Granite and Dolerite) exploitation site.





**Figure 3-3: Granite and Dolorite reserve of Kelseri area**

## **4. Description of Environment**

### **4.1 Physical Environment:**

Neelum Valley is a 200 km long bow-shaped thick forested region in Azad Kashmir, Pakistan. It is named after the Neelum river, which flows through the length of the valley. The valley is situated in the north-east of Muzaffarabad, running parallel to Kaghan Valley. The two valleys are only separated by snow-covered peaks, some over 4,000 meters (13,000 ft) above sea level. The valley is located at Latitude 34.5891° N and Longitude, 37.9106° E.

Neelum Valley is the largest district of Azad Kashmir having an area of 3,621 km<sup>2</sup>.

Excellent scenic beauty, panoramic view, towering hills on both sides of the noisy Neelum river, lush green forest and attractive surroundings makes the valley a dreamy place. The valley is connected from Muzaffarabad by Neelum road, which leads up to Kel. The road condition from Muzaffarabad to Athmuqam is very good and suitable for any kind of transport. From Keran to Kel road condition is not well and not suitable for low floor vehicles. In winters road onwards Keran block due to heavy snowfall and it is very difficult to reach upper parts of the valley. To escape hot plains during May to October Neelum Valley is best place to enjoy endurable temperature which remains in between **18°C** to **30°C** during day time. Snow fall starts in upper areas in November usually. Newly constructed road runs halfway up the valley, and a 4WD track continues for much of the rest. From Muzaffarabad Buses and Wagons go to Athmaqam (least recognized town in valley), and passenger 4WDs go till Kel.

A fair weather read opens the valley to tourists up-to Kel, 155 Kilometers from Muzaffarabad, of which about 150 Kilometers has been black topped while the remaining portion is being mottled. Buses move daily on this route and accommodation facilities are also available in the rest houses of places of tourist attraction.

The IEE summarizes the available baseline data on physical environment within the principal area of interest i.e. the area of project influence. Reconnaissance visits and physical field surveys were carried out to collect the data. Validation of this information is done through the data from secondary sources, satellite imagery study and published literature. The identification of physical characteristics of the region and assessing their existing conditions is imperative to predict the possible environmental impacts of the proposed project.



#### 4.1.1 Geography/ Geology

Neelum Valley is situated to the North & North East of Muzaffarabad and running parallel to the Kaghan Valley. The geographical features enhance the natural beauty of the Valley. Its elevation, a mere **2,000** feet at the start, gradually rises till it attains a respectable height of **8,000** feet. On both sides there are high mountains and peaks. Nearly all the forest wealth of Azad Kashmir is to be found in this part of the State. Neelum is a beautiful valley containing about 370 small and large villages and near about two hundred thousand population. It starts from Chelhana and goes till Taobut 250 km long. It is named Neelum due to its river, curving like the snake with transparent sky colored water.



The whole valley is full of beautiful and fascinating sceneries. Neelum Valley is dipped in beauty. Neelum valley about 252 km long and 3620 sq km curvature shaped with majestic pine, fir and deodar trees, lies north-south of Muzaffarabad. This ninety-mile long kingdom of vegetation is ripped apart by the indigo blue Neelum river which flows serpentine down hills to merge itself into the river Jhelum at Domail. Domail, the confluence of two mighty rivers, presents highly fascinating scene of youthful embrace. This heart-warming spectacle is most soothing to the eye.



Neelum Valley is formed by the Neelum River that flows in Azad Kashmir. Running through the Lesser Himalaya, the 200 km Neelum River is Azad Kashmir's main attraction. The Neelum River and a side valley, the Jagran Nala, are stocked with trout. Trails cross several 4000 meter high passes into the Kaghan Valley.

The valley is characterized by beautiful grass covered hills with sparse tree cover up-to Pateka. However, as the Neelum River flows alongside the road from Muzaffarabad leading along the valley up-to Machiara, the sceneries in this area are exhilarating but the scenic beauty of the Neelum valley is paralleled by no other place in the world. It is a valley of fountains, springs, waterfalls, flowering trees and plants. Geographically too, it is a hospitable valley. The swaying lush green forests, snowcapped mountains, streams singing

songs of joy and fast flowing river Neelum, all go together to make it naturalist's wonderland. This area is also ideal for mountain tourism. A part of Nanga Parbat Massif falls in this area which is dominated by "Sarwaali Peak" (6326 meters) the highest mountain in Azad Kashmir. Shounter Hill tops are covered with green forests and the fields are lush green with crops.

The central and north-western parts of Neelum valley areas comprises of two main tectonic units:

- The Lesser Himalayan Crystalline Unit (LHC)
- The Higher Himalayan Crystalline (HHC)

These two units are separated from each other by the Main Central Thrust (MCT). The two units are characterized by a similar stratigraphy and share a common low grade metamorphic assemblage. They, however, differ in the intensity of the imprints of the Himalayan metamorphism. Upper Paleozoic to Mesozoic Himalayan meta-sedimentary cover comprising para-gneisses, schist's, marbles, amphibolite's, calc-schists and impure quartzite.

#### 4.1.2 Drainage:

The glacial resource of northern Pakistan represents a unique resource of fresh water vital for agricultural, industrial, and hydropower generation. A major part of the snow and ice mass of the Pakistan's Himalayan region is concentrated in the watershed of the Indus basin. The glaciers of Kashmir lie in Mangla watershed which is drained by Jhelum River contributing about 16 percent flows to the Indus River system. The glacial environment is an important economic component of tourism and an influential factor in high mountain ecology. The glaciers, which consist of a huge amount of perpetual snow and ice, are found to create many glacial lakes. These glaciers as well as glacial lakes are the sources of headwater of our main Indus river system. Glaciers react very sensitively to climate fluctuations, and thereby provide some of the clearest evidence of ongoing climate change.

Studies have revealed that the rate of Himalayan glaciers melt is increasing and that they are receding faster than in any other part of the world (Eccleston, 2008). According to Kaul (2005), there are 6500 glaciers in the Himalayan regions in India and out of which 3136 glaciers are in the mountain belt of Jammu and Kashmir. Of the major 327 glaciers in the Himalayas, 60 are in Kashmir and Ladakh. Due to their subsequent depletion, annual flows would be much lower which would inevitably affect the performance of dams. Half a billion people in the Himalaya-Hindukush region and a quarter billion downstream who rely on glacial melt waters could be seriously affected (Gilani, 2010). Glacier thinning and retreat in the Himalayas has resulted in the formation of new glacial lakes and the enlargement of existing ones.

The glacial lakes are formed on the glacier terminus due to the recent retreating processes of glaciers (Meyer et al. 1993). The water in the lakes was accumulated from the melting of snow and ice cover and by blockage of the end moraines of glaciers. Most of these lakes are located in the down valleys close to the glaciers.

The major sources of irrigation are variety of lakes and small water channels in the valley. The habitants of the region badly dependent upon these small lakes for water resources for domestic and agricultural purposes. The women and girls of the houses come to the lakes and fetch water for daily uses. However safe drinking water availability is not accessible in the region and they have to use lakes water for drinking purposes.



The variety of lakes found in the valley includes:

**Chitta Katha Lake** is located in Shonter valley, a sub valley of Neelum valley at the altitude of 13,500 feet (4,100 m). The lake is accessible from Kel by a 20 kilometers jeep track and then 5 kilometers hiking trek. Kel is the base camp to this lake.



**Shounter Lake** is a small lake located in Shounter valley at the altitude of 10,200 feet (3,100 m). It is accessible from Kel by a jeep track.

**Ratti Gali Lake** is located in Neelum valley at the altitude of 12,130 feet (3,700 m). The lake is accessible from Dowarian by a 17 kilometers jeepable track and then 2 km hiking trek. Dowarian is the base camp to this lake.

**Saral Lake** is located in Neelum Valley, Azad Kashmir, Pakistan at an altitude of 13,600 feet (4,100 m). Sharda is the base camp to this lake.



The main source of drainage in the valley of Azad Jammu and Kashmir is Neelum river which originates from Krishansar Lake in the vicinity of Sonamarg and runs northwards to Badoab village where it meets a tributary from the Dras side and runs westwards along the Line of Control in Jammu and Kashmir. It is fed by many glacial tributary streams on its way. It enters Azad Kashmir in the Gurez sector of the Line of Control, and then runs west until it meets the Jhelum River in Muzaffarabad. The Neelum River is 245 kilometers long, it covers 50 kilometers in Jammu and Kashmir and the remaining 195 kilometers in Azad Kashmir. There are different kinds of fishes found in abundance in the Neelum River. As the river almost entirely runs across the Line of Control, being the main cause for Kashmir conflict there is a feeling of uncertainty among the inhabitants, many of them have

immigrated to safer places, which has left the river banks scarcely populous and kept the river in perfect conditions for growth of fish.

The most famous varieties of fishes found in Neelum River are:

- Brown trout (*salmo trutta fario*)
- Rainbow trout (*salmo gairdneri*)
- Snow trout (*shizothorax*)
- Shuddgurn
- Anyour

#### 4.1.3 Elevation Bands/Relief:

Neelum Valley is situated at the North & North-East of Muzaffarabad Azad Kashmir, running parallel to Kaghan Valley. The two valleys are only separated by snow-covered peaks, some over 4000m above sea level. Its elevation, a mere 2,000 feet at the start, gradually rises till it attains a respectable height of 8,000 feet. On both sides there are high mountains and peaks. Nearly all the forest wealth of Azad Kashmir is to be found in this part of the State.

Elevation of different towns and villages of the valley are given below:

Keran and Upper Neelum are located at a distance of about 91 Km from Muzaffarabad, Azad Kashmir. Keran and Upper Neelum are situated on the right bank of the river Neelum at 1524m above sea level with fascinating scenery. The panoramic lush green valley is profound in fruit and wildlife.

Sharda is a breath-taking green spot at an altitude of 1981m. Shardi and Nardi are two mountain peaks overlooking the valley, reputedly named after legendary princess Sharda. It has a captivating landscape with numerous springs and hill-sides covered with trees. On the right bank, opposite Sharda, the Neelum is joined by the Surgan Nallah along which a track leads to Nurinar Pass and through it to the Kaghan Valley.

Kel is a small valley situated at a height of 2097m. This is another picturesque place in the Neelum Valley. The Shounter Nallah joins river Neelum at this place and leads to Gilgit Agency (Northern Areas) over the Shandur at 4420m.

#### 4.1.4 Land Use and Land Cover:

The lands on the hills generally belong to the Forest Department of AJK and bear forests of pine trees. The lands on the high benches within hilly areas, however proprietary, are used for cultivation and settlements. Vegetative cover plays an important role for the quality of soil especially in hilly and mountainous areas such as Azad Jammu and Kashmir where erosion is a major threat to the ecosystem and productivity. Major forest types of the area include subtropical evergreen dry broad-leaved forests, subtropical chir pine forests and temperate broad leaved and coniferous forests.

Irrigation facility is available, but the flow of river continuously eroding away the tract which is prime agricultural land and famous for production of high quality rice. Different studies show that over last 2-3 decades about 2400 acres of precious agriculture land, along with 555 houses in 13 villages have been disappeared from the scene, which worth billions of rupees. So for the protection of the beautiful land different projects were proposed and aim to study the feasibility of riverbed alignment to protect further loss of land and properties in the area with the reduction in land erosion subsequent to construction of bund at appropriate location.

Neelum is a valley of fountains, springs, waterfalls, flowering trees and plants. Geographically too, it is a hospitable valley. The Neelum Valley, 90 miles long bow-shaped with majestic pine, fir and deodar trees, lies north-south of Muzaffarabad. This ninety-mile long kingdom of vegetation is ripped apart by the indigoblue Neelum river which flows serpentine down hills to merge itself into the river Jhelum at Domail. Tao Butt is an example of vegetational generosity of the liberal nature. The spot is donned with all delicacies and niceties. The forest wealth abounds in the Neelum Valley. Deodar, pine, fir, wild walnut, strawberry and hosts of other high statured trees and other types of wild growth and herbs are the treasure of the valley. Besides being invaluable in economic terms, the variety of natural growth offers captivating scenery. Shunder Hill tops are covered with green forests and the fields are lush green with crops.

In Arrang Kel, a small village (34.48 N and 74.21 E) in Neelum Valley located in dry temperate zone with deodar, fir and spruce as the major conifer species, a walnut (*Juglans regia*) tree planted in 1924 has started bearing fruit only ten years back. Growth of the trees planted in this area since 1991 has been vigorous as compared to early planting. People attribute this abrupt change in fruiting and growth of walnut tree due to increasing temperatures during last two decades. The villagers say that the snow melt in the past used to commence from 15 May onwards but now snow melt starts in early April, one month before the usual time. In 2008, some villagers made a strange observation, first time finding mushrooms growing on snow. *Viburnum nervosum*, locally called Guchh, a shrub growing vigorously in moist and dry temperate forests as an under growth species used to flower during April but is now flowering early in January/February.

In Arrang Kel and other villages, small farmers would grow short season buckwheat as an alternate crop with maize (corn) to ensure production of buckwheat, as maize would sometime fail to ripe due to cold climate. But now people for sure knowing that maize can be grown successfully have abandoned alternate cropping.

About fruit tree planting in this area, people believe that in the past they were not successful but in recent years they have observed that cherry plants planted ten years back have now started bearing fruits, although they are still not happy with the quality of fruits. Previously people did not have enough walnuts to sell in the local market, but now successful walnut fruiting and planting has been possible due to warm temperatures. Yet another observation by the local people reveals that growth of natural broad-leaved plants such as Acer and Walnut has increased as compared to associated conifer species. Many subsistence farmers believe that with rising temperatures, attack of rodents on crops has been increased.



#### 4.1.5 Soils

AJK falls within the Himalayan orogenic belt. As such, its topography is mainly hilly and mountainous characterized by deep ravines, rugged, and undulating terrain. The northern districts are generally mountainous while southern districts are relatively plain. The mountain ecosystems are relatively unstable and have low inherent productivity. Within this fragile environment, however, there is a great variety of ecological niches upon which people base their livelihood. Small land holdings and scarcity of cultivable land are the main factors limiting on-farm income.

The area has different soil types that have been derived from parent material of different origins as parent material plays an important role in determining characteristic of the soil. Soils of residual slopes have originated from shale's, granite, dolomites, sandstone, mudstone and clays. The soils formed in river are alluviums which are comprised of materials transported by the Jhelum River and its tributaries from wide variety of rocks occurring in the catchments of these channels.

The texture of the primary soils varies from moderately fine to moderately coarse depending upon the rock type from which these have developed. However, the secondary soils are mostly moderately coarse textured. The soils of the raised terraces in floodplains are generally devoid of the stony material. The soils of lower terraces generally contain varied quantities of pebbles, cobbles and boulders.

Based on the location the soil can be broadly grouped into three categories:

- Soil of mountain plateau is generally leached and relatively infertile.
- Soil of mountain slopes is gravelly loam, shallow and deficient in organic matter.
- Soil of inter-mountainous valleys is alluvial with a high agricultural potential.

#### 4.1.6 Climate and Meteorology:

May to October from the scorching heat of plains to the high land basin of Neelum Valley is indeed an escape from hell to the cold breezes of paradise. The temperature remains in between 65°F to 90° F during the summer season, while in winter season temperature which remains in between -2°C to 6°C which is considering as minimum temperature of the V shaped valley. Heavy snow fall starts in upper areas in November usually. From May to November the climate is very pleasant and cool and chill winds blows. There are frequent landslides during the summers, and snow slides on this road during winters.

Depending on the altitude that varies from 360 meters in the south to 6325 meters in the north, AJK has a wide range of climatic conditions. The south has dry sub-tropical climate while the north most moist temperate. There is significant variation in the rainfall pattern across different regions both in terms of amount and distribution. Average annual rainfall ranges from 1000mm to 2000 mm. In the northern district 30% to 60% precipitation is in the shape of snow. In winter snow line is around 1200 meters while in summer it is 3300 meters. Average maximum temperature ranges from 20°C to 32°C while the average minimum temperature range is 04°C to 07°C.

Weather of Neelum valley is quite erratic. However the climate can be divided into four seasons namely spring, summer, autumn and winter.

#### 4.1.7 Rainfall and Humidity:

Azad Jammu and Kashmir has a very diverse climate; ranging from sub-humid subtropical, to moist temperate, dry cold temperate, very cold temperate to snow deserts in extreme north. The mean annual rain fall varies from 800 mm to 1600 mm. The snowline in winter is 1,200 meter above sea level, while in summer it rises to 3,300 meters. In extreme northern fringes of the AJ&K State there are permanent glaciers and ice caps.

Monsoon hazards in AJ&K emerge as a result of heavy precipitation and subsequent flooding along the Jhelum and Neelum rivers and through flash flooding in numerous hill torrents across the State. However, the simultaneous occurrence of riverine and flash floods, heavy precipitation and cloud burst phenomenon can worsen the impacts of monsoons instigated disasters in the State. Depending on the intensity of monsoon precipitation and climate changes, AJ&K is vulnerable to both sudden and expected hydro-meteorological disasters which require integrated surge and quick response.

#### 4.1.8 Temperature:

The temperature remains in between 18°C to 32°C during the summer season, while in winter season temperature which remains in between -2 °C to 6°C. Heavy snow fall starts in upper areas in November usually. From May to November the climate is very pleasant and cool and chill winds blows. There are frequent landslides during the summers, and snow slides on this road during winters.

#### 4.1.9 Wind:

Cools and chill winds are continuously blow in the V shaped valley from month of May to November when the climate is very pleasant. As winds can decided the dispersion of air pollutants and are an important aspect in any environmental examination study. Movement of air pollutant is dependent on the speed and direction of wind, while it also dependent upon temperature and humidity. They can also affect the dispersion of pollutants in a specific area. There is no complete data set available for wind speed and direction in the plant area. To provide a general picture of these factors, observations were carried out during the physical survey.

#### 4.1.10 Hydrology and water resources:

Hydrology of AJ&K is mainly characterized by the presence of glaciers and variety of lakes that are passing through the state. Hydrology is concerned with the movement, distribution, and quality of water on earth surface and underground, including the hydrologic cycle, water resources and environmental watershed sustainability. The glacial resource of northern Pakistan represents a unique resource of fresh water vital for agricultural, industrial, and hydropower generation. A major part of the snow and ice mass of the Pakistan's Himalayan region is concentrated in the watershed of the Indus basin. The glaciers of Kashmir lie in Mangla watershed which is drained by Jhelum River contributing about 16 percent flows to

the Indus River system. The glacial environment is an important economic component of tourism and an influential factor in high mountain ecology. The glaciers, which consist of a huge amount of perpetual snow and ice, are found to create many glacial lakes. These glaciers as well as glacial lakes are the sources of headwater of our main Indus river system. Glaciers react very sensitively to climate fluctuations, and thereby provide some of the clearest evidence of ongoing climate change.

The major sources of irrigation are variety of lakes and small water channels in the valley. The habitants are badly dependent upon these small lakes as water sources for domestic and agricultural purposes. The women and girls of the houses come to the lakes and fetch water for daily uses. However safe drinking water availability is not accessible in the region and they have to use lakes water for drinking purposes.

Water is a limiting factor in Azad Jammu and Kashmir and land is not being used according to its potential. It needs no explanation that there is acute shortage of water for both drinking and irrigation purpose despite the fact that the average annual rainfall of the area is 1600 mm. Due to high rainfall, steep slopes and impervious nature of the geological formations, a considerable portion of the runoff goes waste without being utilized for irrigation and drinking purpose. In addition the erosion of the top fertile soil has considerably added to the increase in the sedimentation in the Mangle Reservoir, as a result of which about 34000 acre-feet of sediment per year fill the Mangle Reservoir, reducing its overall life. If the present erosion trend continues unabated the top soil will be completely lost and result in vanishing of the forest with subsequent environmental consequences.

#### **4.1.11 Surface Water:**

Major water sources of Neelum valley are the varieties of glacial lakes, which consist of a huge amount of perpetual snow and ice and eventually turned into many glacial lakes that are flow through the area.

The Neelum River is the largest tributary in Jhelum river basin. It originates out of glacial melts from surrounding mountain peaks. Neelum River, which curves along the 200-kilometre valley, trailing westwards along the Line of Control (LoC) until it finally submerges into the Jhelum on the outskirts of Muzaffarabad. The River is famous for ice cold water and trout fish. The River derives its name either due to its sky color water or due to the precious stone "ruby (Neelum)" that is found in this area. High specific discharge and steep gradient of the river below Dudhnial offer promising sites for hydropower development. Of particular interest are those spots where the river bed drops by 5-20 meter in level over a short length forming rapids. These rapids offer opportunities of hydropower development by damming the flow in order to further raise the natural head. Depending upon the height of dam, a low head - high discharge power plant could be up on the main river flow on these rapids.

Chitta Katha Lake is located in Shonter valley, a sub valley of Neelum valley at the altitude of 13,500 feet (4,100 m). The lake is accessible from Kel by a 20 kilometers jeep track and then 5 kilometers hiking trek. Kel is the base camp to this lake.

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Saral Lake is located in Neelum Valley, Azad Kashmir, Pakistan at an altitude of 13,600 feet (4,100 m). Sharda is the base camp to this lake.

#### 4.1.12 Ground Water:

Neelum valley is a beautiful district of Azad Jammu and Kashmir which is a land with beautiful mountains and foothills. The major ground water sources are hot springs and glaciers which are rarely used for drinking purposes due to the limited supply of drinking water in the city.

The majority of the town population uses bore-hole water for drinking purposes. The rain water seeps into the grounds at the mountains oozes out at places in the form of springs. However, limited quantity of groundwater is available that is exploited for supply of potable water to the town. The consumptive requirement of the communities at other places is generally met from the spring water. It has been observed that the settlements are located where spring water is available in addition to the availability of level ground for housing and cultivation. Water quality parameters of the surface/spring water, which is the main source of water in the area, have to be studied.

#### 4.1.13 Air Quality and Noise level:

In general there are no major sources of air pollution, i.e., no industries, exist in the project area except road traffic in the valley of Neelum, AJK. The ambient air quality data is been collected from secondary data. The existing ambient air quality of the study area serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning further development in the area.

Environmental protection Agency (EPA) Azad Jammu and Kashmir is established for the monitoring of air quality and protection. Along with air quality monitoring, the EPA AJK also manage pollution, wastes and hazardous substance from different environmental compartments. EPA has monitored criteria air pollutants such as CO, NO<sub>x</sub>, SO<sub>x</sub>, O<sub>3</sub> and Suspended Particulate Matter (SPM) at different locations in Azad Jammu & Kashmir. Indoor air quality is also monitoring for CO, NO<sub>x</sub>, SO<sub>x</sub>, PM<sub>2.5</sub>, Formaldehyde, Asbestos, Radon, VOCs and Fungi in schools, hospitals and homes. These studies are being useful for formulating baseline Air Quality in AJ&K.

## 4.2 Description of Biological Environment

The ecological baseline study of the area focuses on the aquatic ecology, flora and faunal species of the area. Floral and faunal species study is being carried out at micro and macro level and this will cover trees, herbs, mammals, birds, reptiles and amphibians groups. The diversity in these groups will be described along with their population and conservation status. The habitat of the study area has been characterized based on biological and physical

factors and its spatial delineation is provided. The ecological baseline study focused on the following components:

- Assessment of vegetation and land cover classification,
- A thorough investigation of aquatic ecology particularly fish and invertebrates
- Assessment of wildlife, on each of the following components;
- Large mammals (carnivores/ungulates)
- Small mammals
- Birds
- Reptiles and Amphibians
- Floral Diversity of the Area

#### 4.2.1 Vegetation and Land cover:

Vegetative cover plays an important role for the quality of soil especially in hilly and mountainous areas such as Azad Jammu and Kashmir where erosion is a major threat to the ecosystem and productivity. Major forest types of the area include subtropical evergreen dry broad-leaved forests, subtropical chir pine forests and temperate broad leaved and coniferous forests.

Vegetation composition varies from one place to another due to various biotic and abiotic factors. The area comprises of moist temperate forests of Azad Jammu and Kashmir, which are located near fault line and these forests are disturbed either naturally or due to anthropogenic activities.

Due to climate Azad Jammu and Kashmir (AJK) Himalayan range embodies a diverse and characteristics vegetation distribution over a wide range of topographical variation (Champion et al., 1965; Malik et al.; 2007). According to Champion et al., (1965); Ahmed et al., (2006) the AJK have both moist and dry temperate forests types. These moist and dry temperate sites have a number of coniferous tree and broad leaved species comprising of *Abies pindrow*, *Cedrus deodara*, *Picea smithiana*, *Pinus roxburghii* and *Pinus wallichiana*. From the last few decades these forests are heavily impacted and in bad shape due to anthropogenic factors reported by various ecologists, biologist and foresters (Malik et al, 1994).

At high altitudes, mix forests of *Pinus roxburghii* and *Pinus wallichiana* are present. *Quercus incana* was also found with this species in mix forests. Other common species which are present in association with *Pinus roxburghii* were *Carissa spinarum*, *Dodonaea viscosa*, *Berberis sp.* and *Myrsine Africana*. At higher altitudes, it was found with *Desmodium concinium*, *Indigofera spp.* and *Linocera spp.* At lower elevations it was present in combination with *Olea ferruginea*, *Bauhinia variegata*, *Punica granatum* and *Acacia modesta*.

There are a number of studies focusing indigenous knowledge of flora. The study conducted by Ahmad, et al. (2012) of ethno botanical inventory about plants paves way to assess their

usage and impacts associated thereof. The use of plants as medicine is slowly increasing in the developed world because they have minor or no side effects. Documentation of indigenous knowledge, particularly medicinal values of plant species, provided various modern drugs. Pakistan has a rich diversity of plants that are being used by local communities for medicinal purposes.

An ecological survey based on the phytosociology of Azad Kashmir, and major portions of Northern areas of Pakistan was conducted by Chaudhri (1957b). *Viburnum nervosum*, *Podophyllum* spp., *Viola serplenis*, *Adiantum venustam*, *Geranium wallichianum*, *Valerians wallichii*, *Fragaria vesca*, *Dryopteris* spp. and *Impatiens* spp. were observed. The plant wealth of humid forests was described in a book by Champion et al., (1965). They focused on the main characters of humid forests which play key role in the establishment of coniferous forests in the northern areas as subtropical forests of pine species. They also extend to dry temperate areas and up to some extent into subalpine forests. The forest structure resembles with those of North of Europe (temperate zone) and North America. The diversity in these forests was low that's why monospecific forests were more dominating than that of mixed forests. The altitudinal gradient and aspect were important factor in species distribution. Conifer species were more dominating in these forests with 80% canopy cover. The remaining 20% constitutes evergreen underground flora. *Taxus wallichiana* was also found in these forests. They explained the climatic factors affecting the presence of forest vegetation. Most influencing factors were temperature and precipitation.

Different studies reveal that the forest species consist of 39 vascular plants belonging to 36 genera and 28 families. In the study area, 5 species (12.82%) were recorded critically endangered, 6 spp. (17.95%) endangered, 10 spp. (25.65%) vulnerable, 11 spp. (28.21%) secure or least concerned, and 6 spp. (15.38%) rarely distributed. Neelum valley is one of the most exploited areas by the plant collectors and local inhabitants in Azad Kashmir. Medicinal plants are collected by poor villagers of the Sharda as a part time job, not only for their own requirement but also for economic reasons (Haq *et al.*, 2010).

Medicinal plants like *S. lappa*, *A. heterophyllum*, *G. wallichianum*, *J. dolomiaea*, *A. bracteosa*, *B. amplexicaule*, and *B. lyceum* are on the verge of extinction due to high rate of consumption (Khan, 2008). Morel collection is an important activity during spring season. The villagers take keen interest in collection of morels as it provides them a source of income. The moist temperate Himalaya of Pakistan requires special attention for the conservation of environment and the sustainable use of natural resources. The decrease in forest cover and associated major changes in community composition has led to the decline of indigenous medicinal plants resources and their traditional knowledge (Ibrar, 2003). Endemic and rare taxa of an area are the most vulnerable because of restricted geographic ranges and specific habitats (Haq *et al.*, 2010). The plant communities in the study area have been largely disturbed due to deforestation for fuel, over consumption of medicinal resources for the treatment of diseases, population explosion, increased tourism and lack of awareness (Khan, 2008). Indiscriminate cutting, not only the forest area is declining, but valuable indigenous species are in danger and if this inclination continues, the ultimate result would be the extinction of these species from the area.

The data shows that these forests are faced with the problems of overgrazing and deforestation (Malik & Malik, 2004). The factors like poverty, over population, lack of access to remote areas, unavailability of alternates of energy sources are major causes for severe depletion of Himalayan forests. The local communities use forest species as their main source of fuel wood, timber and fodder. The simultaneous increase in the demand of forest products and population has not only deteriorated the condition of these subtropical forests but also affected the species diversity and community structure. *Fraxinus raiboearpa* was the plant that is confined to few localities in north Pakistan and east Afghanistan. World Conservation and Monitoring Centre (WCMC) and Species Survival Commission (SSC) of IUCN have prepared a list of species with different categories of threats in their wild habitats and provide some management and conservative's measures to control their extinction in order to protect their habitat and survival.

#### 4.2.2 Fish Fauna

The main source of drainage in the valley of Azad Jammu and Kashmir is Neelum river which originates from Krishansar Lake in the vicinity of Sonamarg and runs northwards to Badoab village where it meets a tributary from the Dras side and runs westwards along the Line of Control in Jammu and Kashmir. It is fed by many glacial tributary streams on its way. It enters Azad Kashmir in the Gurez sector of the Line of Control, and then runs west until it meets the Jhelum River in Muzaffarabad. The Neelum River is **245** kilometers long; it covers **50** kilometers in Jammu and Kashmir and the remaining **195** kilometers in Azad Kashmir. There are different kinds of fishes found in abundance in the Neelum River. As the river almost entirely runs across the Line of Control, being the main cause for Kashmir conflict there is a feeling of uncertainty among the inhabitants, many of them have immigrated to safer places, which has left the river banks scarcely populous and kept the river in perfect conditions for growth of fish.

The most famous varieties of fishes found in Neelum River are:

- Brown trout (*salmo trutta fario*)
- Rainbow trout (*salmo gairdri*)
- Snow trout (*shizothorax*)
- Shuddgurn
- Anyour

Among the recorded species, majority of fish fauna belongs to the family Cyprinidae which is comprised of 13 species. Other 8 species are divided among seven families in such a way that five families are represented only by one species and the rest two each by two species. Among the fish fauna of the project area, two species are endemic in Pakistan including AJK, one is endangered, two are Vulnerable, and one is Near Threatened. Quite a good number of species are commercially important. The species *Tor putitora* and *Clupisoma garua* are considered among the esteemed fishes and have very high commercial value. The fishes *Labeo dyocheilus*, *Cyprinus carpio*, *Cirrhinus reba*, *Labeo dero*, *Ompok bimaculatus* and *Mastacembelus armatus* are also quality food fishes.

#### 4.2.3 Benthic Invertebrates fauna:

Benthic macro invertebrates are an important part of the food chain, especially for fish. Many invertebrates feed on algae and bacteria, which are on the lower end of the food chain. Some shred and eat leaves and other organic matter that enters the water. Because of their abundance and position as 'middlemen, in the aquatic food chain, benthos plays a critical role in the natural flow of energy and nutrients (Williams & Feltmate, 1992). Ali (1971) reported five orders of benthic invertebrates including Oligocheats, Ephemeroptera, Trichoptera, Chironomidae and Tabanidae from the northern lakes of AJ&K. But it provided very limited information about assemblage benthic macro invertebrates and organisms were identified up to order level. Present study provides first comprehensive account on benthic macro invertebrate fauna of the area.

#### 4.2.4 Large Mammals:

Large mammals, especially carnivores, are hard to grasp directly in the field. Therefore it is challenging to study these animals particularly when their numbers are too small and populations are scattered. So, the best way is to go with some indirect approaches like sign surveys are interviews from local people to get maximum information about these species. A number of mammalian species including common leopard, black bear, barking deer, jackal, fox and rhesus monkey were reported in Azad Jammu and Kashmir in past (Akbar and Anwar 2011; Roberts 2005). Status of most of these species is still unknown in the area due to lack of scientific studies in the area.

Overall diversity of large mammals was much lower as compared to adjacent areas like Pir Lasura National Park where 45 barking deer are residing (Zulfiqar et al., 2011) and frequent sightings of yellow-throated marten, small Kashmiri flying squirrel and common leopard are reported (Manzoor et al., 2013).

Gurase Valley in District Neelum Azad Kashmir is the most captivating but remote and backward area of the Neelum valley situated in the north-east of the Muzaffarbad, the capital city of Azad Kashmir. This area is the heart of sustainable tourism in Azad Kashmir because of its lush green natural beauty.

The area is full of marvelous flora and fauna and enriched with natural resources like rivers, natural springs, forest and minerals. There is a number of rare species in Gurase Valley which are now at the last breath due to illegal hunting, deforestation and habitat degradation. Govt. of Azad Kashmir has declared the valley as a National Park to protect and wise use of Natural resources for the conservation and income generation of local community.

The Park is located in district Neelum, covering an area of 52,817 ha, lying between 2,017m to 4,345m elevation. Neelum River divides the park into two parts while the human population resides on both side of Neelum River in the park area. The park is surrounded by Line of Control in the east, peaks of Qammary heights in the north Astor, Northern areas. The park falls under the Sharda division and Guraze Range of AJK Forest Department. The area harbor a number of endangered species like Himalayan Musk Deer, Marmot, Brown Bear and black bear including a number of birds and plants species. They depend upon

livestock to fulfill the requirement of meat and milk. After agriculture and livestock, timber logging is the Major industry for local people. Sometime they use to hunt different wild animals and birds to earn their livelihood.

Different studies were conducted in the study area for the assessment of faunal species, threats associated to them and what conservation measures were taken to maintain their population in their respective habitats. During a survey six small villages of the Azad Jammu and Kashmir are visited for the inventory of animal species found in those areas. It is estimated that total of 1350 animals' including 600 goats' species, 300 species belongs to sheep family, 220 cows and 230 buffaloes were randomly inspected. The carnivore species exists in area include leopard (*Panthera pardus*), Snow leopard (*Uncia uncia*). Leopard cat (*Prionailurus bengalensis*), Black bear (*Ursus thibetanus*), Asiatic jackal (*Canis aureus*), Red fox (*Vulpes vulpes*) Yellow throated martin (*Martes flavi- gula*) and Golden eagle (*Aquila chrysaetos*). There are 42 recorded mammal species (Baig, 2004) and 100 bird species including both migratory and resident (Hassan, 2004), while few species of reptiles (approximate number equals to 25) and amphibians (7 species) have also been recorded (Baig, 2004). High species richness in AJ&K represents diversity in habitats, which is due to great variations in extreme altitudes and slopes of mountains. On the other hand due to harsh environment people work for grazing and farming and they utilize the forest land and faunal species habitat for their welfare purposes which leads to the decline in their number because of habitat loss at large extent (Myers et al., 2000).

Snow leopards which are categorized as endangered species by the IUCN and listed in the red list of IUCN are found in the remote town of the Rawalakot in Azad Jammu and Kashmir. A common leopard (*Panthera pardus*) was killed by a group of hunters in the outskirts of a little town Dadyal, which is located near the Mangla Dam, confirms Javaid Ayub Director Wildlife and Fisheries Department of Pakistan controlled Kashmir. Initially villagers noticed the snow leopard near settled areas and contacted a local official who told them to scare it away with firecrackers. They killed it instead. Their defense for the cat's death was protecting human life; however no verified attack on a human by a snow leopard has ever taken place, according to the Snow Leopard Trust. Snow leopards are known to be very wary of humans and remain far away in mountainous areas. They only time they may be aggressive is when they have cubs and people are getting to close to them. As the Common Leopard has been included as a "Near Threatened" category in IUCN red data list. Globally, The IUCN Red List of Threatened Species is widely recognized for evaluating the conservation status of plant and animal species. Pakistan is one of the few countries in the world that harbors the cat family of rare animals.

#### 4.2.5 Small Mammals:

The area has good biodiversity with meager forests around. There is abundant aquatic vegetation mixed with agriculture fields on the both sides of the Neelum River having perennial and deciduous scrub forest on the hillsides providing enough shelter and food to the terrestrial fauna. As the area is thickly populated, the forest around the plant area is over-exploited by livestock grazing, firewood cutting and encroachment etc. which results in

the depletion of suitable habitat for wildlife, coupled with the indiscriminate killing of the animals.

Seventeen species of small mammals have been reported from the study area belonging to eleven families and five orders. The species *Rattus rattus*, *Mus musculus* and *Suncus murinus* are the dominant rodent and insectivore species, *Pipistrellus kuhlii* and *Scotophilus heathii* are common chiroperan species and *Lutra lutra* represents the rare but widely distributed carnivore species in the study area. The species *Lutrogale perspicillata* (Otter) is vulnerable species (IUCN 2010). This species is reported in good numbers in the study area due to easy availability of the food in the form of large sized fish and also due to availability of shelter for this species in the form of crevices in the hills found in and around the Poonch River. The species *Herpestes edwardsi* and *Herpestes javanicus* are included in the CITES APPENDIX III. These species have a trade pressure for their skins exported to different countries. These skins are used for manufacturing the purses and the decoration pieces. None of the other species of small mammals have any conservation status and are also common in the area. The species of fruit bats, viz., *Rousettus leschenaultii* (Fulvous Fruit Bat) is quite common in the area found hanging on the fig trees.

#### 4.2.6 Reptiles and Amphibians:

The available works on the herpetology of the area include those by Khan (1989, 1998, 1999, 2000), Khan (1996) and Manzoor et al. (2013). Khan and Khan (2000) described a new subspecies of Coluber snake *Coluber rhodorachis kashmirensis* from Azad Kashmir. Khan (1999) described two new species and a subspecies of blind snakes of Genus *Typhlops* from Azad Kashmir and Punjab. The new species included; *Typhlops madgemintonai* and the subspecies included; *Typhlops madgemintonai shermanai*. The Holotype of the other new species *Typhlops ahsanai* was also collected from Azad Kashmir. Khan (1998) described a new subspecies of Diard's blind snake *Typhlops diardi platyventris* belonging to the Genus *Typhlops*. Khan and Khan (1996) described the Ophidian fauna of the State of Azad Jammu and Kashmir and recorded 25 ophidian species belonging to five families and 17 genera. Khan and Tasnim (1989) described a new species of frog of the Genus *Rana*, Subgenus *Paa* from Southwestern Azad Kashmir. Manzoor et al. (2013) while assessing the biodiversity of the Pir Lasura National Park in Azad Kashmir reported six amphibian and 24 reptilian species.

Total 21 species of herps including six amphibians and 15 reptiles were recorded in the area. Out of the recorded 21 species, three are endemic to Pakistan including two lizards; Agrove valley agama (*Laudakia agrorensis*) and Rohtas gecko (*Indogekko rohtasfortai*) and one snake; slender blind snake (*Typhlops ductuliformes*). The recorded three endemic species occupy a vast distribution range in the country. *Laudakia agrorensis* is found in almost all the mountainous areas, *Indogekko rohtasfortai* occupies vast distribution range in the Salt Range whereas; *Typhlops ductuliformes* is a common species in plain areas. None of the three recorded endemic species during the survey have yet been evaluated by IUCN or listed for evaluation of their conservation status in IUCN Red List of Threatened Species. None of these endemic species are protected under the AJK Wildlife Act 1975 or AJK Wildlife Ordinance 2013.

#### 4.2.7 Avifauna:

Birds are considered as important health indicators of the ecological conditions and productivity of an ecosystem (Li and Mundkur, 2007). While addressing the environmental problems of an area, birds can be used as very appropriate bio-indicators suggesting the status of biodiversity in general (Bhatt and Joshi, 2011).

Different studies were conducted for investigation of varieties of avifaunal species founded in the Neelum valley, AJ&K, Pakistan. According to one survey conduction, a total of 61 species belonging to 32 families were recorded during the. It provide the diverse habitat to the birds species such as winter migrant from higher altitude and summer migrant from lower altitudes. This renders higher bird diversity and species richness. Analysis of data on residential status revealed that out of 61 bird's species, 76% were year round resident, remaining were summer breeders, winter visitors and passage migrant. The order Passeriformes was the most dominant order with highest value of relative abundance. The passerine birds dominated the diversity with 40 species as compared to non-passerines, which were 21 in number.

We also studied the species diversity in selected sites of study area. Irrespective of altitudinal variation house sparrow was dominant species in urban areas. Similarly the Indian roller (*Coracias benghalensis*), red vented bulbul (*Pycnonotus cafer*) and white cheeked bulbul (*Pycnonotus leucogenys*) were also recorded across the study area. The two species of woodpecker, scaly bellied woodpecker (*Picus squamatus*) and grey capped pygmy woodpecker (*dendrocopos canicapillus*) and Jungle babbler (*Turdoides striatus*) dominated the forest area (dominated by chir pine). Green bee eater (*Merops orientalis*), pied Cuckoo (*Clamator jacobinus*), rose ringed Parakeet (*Psittacula krameri*), common myna (*Acridotheres tristis*), Brahminy starling (*Sturnus pagodarum*) and scaly breasted munia (*Lonchura punctulata*) were dominated in the agricultural lands. A single sighting of Asian paradise flycatcher (*Terpsiphone paradisi*) was also recorded while surveying the study area. The transitional habitat between cultivated land and thick forest of chir pine dominated the diversity of passerines birds such as the species of common stone chat, pied bush chat, Indian robin, flycatcher and warbler. The species of wagtail were also recorded near the water resources. Rollers inhabit scattered trees, scrublands, cultivated fields and urban parks or gardens. The main threats include loss of suitable habitat due to changing agricultural practices, loss of nest sites and use of pesticides (Kovacs et al., 2008).

The Habitat destruction, anthropogenic pressure in the form of tree cutting, firewood collection, grass cutting, and cattle grazing were also observed in these study sites. At several locations, nests of various bird species were observed on ground as well in bushes and on the other hand grazing pressure and cutting of bushes was quite evident. The rivers and stream provide suitable habitat for grassland species as well as stream dwellers and migratory water birds. These areas are open to human access and interference.

Intensive biomass extraction (mainly through grazing and fuel wood collection) can bring change in vegetation structure and composition of the forest, leading to changes in bird species composition (Shahabuddin and Kumar, 2005).



### **4.3 Description of Socio-Economic Environment**

#### **4.3.1 Social Setup**

A social class is a homogeneous group of people in a society formed on the combined basis of Occupation, Education, Income and place of residence (Saunders P, 2001). In Azad Kashmir there are poor and rich people, there are families of commoners and families of high birth and there are politically powerful elites and comparatively powerless people who are expected only to follow commands and obey orders. According to G. Mir (2009), the social classes of Azad Kashmir are formed in three categories i.e. upper social class; middle social class and working social class.

- The upper social class people have high level of financial sources to live a luxury life. They are entrepreneurial level professionals, leaders, top management of company and high ranking government professionals.
- The middle social class people own an adequate amount of money for their normal daily life consumptions. They hold a middle level paying professions like low ranking government jobs, middle management jobs, owning small to medium size businesses.
- The working social class people are not much more educated. They are not having a good jobs and their income is also very low. They can hardly manage money for their daily life consumptions. They build one or many rooms in a house but not cemented, electricity and clean drinking water is almost not available in their houses.

Neelum Valley is the paradise of Pakistan with the most deified landscapes, milky streams and blossoming greenery. Neelum Valley is along the Line of Control administered by Pakistan and India along Neelum River, till 2000 it was a highly edgy area where firing from both sides was usual. According to 1998 census the valley have approximate population density of 0.159 million. As Neelum Valley is the district of Azad Kashmir with the population of about 2 million according to the census of 2000 but on the other hand these census could reveal the actual position because now the area is calm and people return back to their homes in Neelum Valley. Some of its famous places like Shounter Pass, Chita Khata, Ratti Gali, Baboon, Noori Top, Sharda, Kel, Surgon and many more are mentioned by famous tourists like Mustansar Hussain Tararr, Ibn-e-Batota etc.

With increasing exposure to market forces and exogenous lifestyle the pattern of interface between different communities also witnessed significant changes. Despite modernization people still rely on pre-modernization social structure and social interaction and politics is largely shaped by social dynamics and power relationships. However, access of opportunities in the country and abroad enabled people to find increasing role in the society.

#### **4.3.2 Demography:**

Neelum is a beautiful valley containing about 370 small and large villages. . According to 1998 census the valley have approximate population density of 0.159 million. As Neelum

Valley is the district of Azad Kashmir with the population of about 2 million according to the census of 2000 but on the other hand the census could reveal the actual position because now the area is calm and people return back to their homes in Neelum Valley. According to one study conducted in 2006, the total area occupied by the Neelum valley is 3621 Km sq. with density (person/Sq.kms) is 42 and growth rate is about 2.80% approximate.

#### 4.3.3 Social composition:

Neelum is composed of diverse communities. People of different faiths live peacefully in the district. Races like Gujjars, Bakerwals, Mughal, Awan, Syeds, Kashmiris and Rajputs, are residing in specific / distinct locality in the district. Gujjars mostly reside on the slopes of mountains. They have small pieces of land for cultivation and cattle for supplementing their economy. Bakerwals are nomadic tribes. Gujjars and Bakerwals speak Gojri whereas rest of the population (excluding Kashmiris) speaks Pahari. The mother tongue is a great cementing factor of the Pahari speaking people because they remain so closely associated with each other that cultural ethos transcend all that of distinct beliefs and faiths. People have simple eating habits. The locally grown wheat, maize and rice are mostly consumed by the populace. Similarly, common dress, both formal and informal, consists of shalwar-kameez (baggy trousers and long shirt) and waist coat. Kashmiri jewelry is also popular among women in Neelum valley.

One of the famous villages of the valley is Sharda, which is most beautiful land with lush green planes, having ruins of an old place of learning, which might be interesting for people doing historical research there. Also there are signs of an old university and was the center of knowledge for the people of China, East and Central Asia. Most people residing in Neelum valley villages are government employees, rest are in different fields. Whereas on upwards mountainy people emerges typical Kashmiri living pattern with houses built of wooden logs, most of them double storied.. Hiking tracks for surrounding mountains are traced by peoples and tourists.

#### 4.3.4 Political and Administrative Set-up:

Azad Kashmir is divided into three divisions (Muzaffarabad, Poonch and Mirpur) and ten administrative districts with Muzaffarabad as the capital of the State. The Muzaffarabad Division comprises of Muzaffarabad, Hattian and Neelum, Poonch Division comprises of Bagh, Haveli, Poonch & Sudhnoti districts whereas Mirpur Division consists of Mirpur, Kotli & Bhimber Districts. These ten districts are further divided into 32 subdivisions, 189 Union Councils and 1771 Revenue Villages. There are 5 Municipal Corporations, 13 Municipal Committees, 18 town committees and 31 Markaz Councils, which are administrated by the LG&RD Department.

The District Neelum have 2, subdivision, 09 union council and 88 small and large villages. Athmuqam is the capital city of Neelum Valley. It has been administratively divided into two sub-districts: Athmuqam and Sharda. District administration is headed by a Deputy Commissioner. He supervises the activities of the nation building departments in the district assisted by Assistant Commissioners at the sub-division level. His major concern is the maintenance of law and order in the district as the District Magistrate and also to look after

the land record as the District Collector. Every line department has a district head to look after its affairs with further hierarchy.

#### 4.3.5 Conflict and Social Tension:

Generally the area is peaceful as there are no chronic social and communal conflicts among the communities living in the area. As the clans (baraderi) system is present and it is divided into different sub- divisions and tehsils so there are no major conflicts present among clans. Each clan has their own heads which can solve the problems and issues of residents peacefully. Owing to social diversity and culture of tolerance in the society, people hailing from different denominations and clans lives in harmony. The state laws are fully enforced in the plant site area. If a conflict arises within the community, the elders resolve the issues amicably or settled through courts of law. Though the role of clerics (ulema) was traditionally limited to marriage, burial and religious guidance, they are increasingly play their role in resolution of conflict among community members.

However some social issues are still exist in AJK which is unemployment a prime concern to AJK's youth. Economic activity generates revenue and creates job opportunities. AJK is a landlocked territory and directly depends on the markets of adjacent areas of Islamabad and parts of Punjab. Areas for potential economic growth such as tourism, hydropower, forestry and minerals all fall under the direct jurisdiction of the AJK Council which is directly controlled by the federal government. The AJK government is not allowed to initiate any project on 52 subjects without the Council's prior consent, which involves a lengthy process. Most young people believe gender empowerment and equality are neglected issues in AJK, with women's contributions toward AJK's development underutilized. The opinion was carefully monitored based on the gender of participants. Almost 80 % of the female youth surveyed believe that they do not have equal opportunities to men, while this view was supported during focus group discussions by almost 65% of the male youth in Mirpur and 40% in Muzaffarabad. The administrative authorities provide some protective measures to control these issues to bring prosperity in the region.

#### 4.3.6 Land Cover and Ownership:

On top of the hills, kail, fir, chir and oak trees are commonly found. Robinia, poplar, and alimthas are grown by people on their farms. In the low land areas mulberry, shisham trees and small bushes are found. Fruit trees include walnut, apple, and wild pear. Fruit and vegetables have great potential of increase in production and marketing. Jackal, fox and hare are commonly found in the forests. In thick forests, birds like wild cock, cuckoo and dove are found.

Neelum valley is known for its scenic beauty and it attracts large number of local and international tourists during the summer season. The areas are rich in natural resources but also very vulnerable to environmental degradation. The earthquake 2005 apart from causing huge losses to life and property has also considerable damaged to the already fragile bio-physical environment. Road network has been severely damaged, whole mountains have been moved cleaved apart, land-sliding has exacerbated, terraced fields have been damaged and forested areas have suffered enormously. A total of 322,250 acres of forested land

across AJ&K and NWFP was damaged. The forest department offices and facilities suffered badly because of the devastation that crippled their smooth functioning.

Agriculture is based on rain fed cropping system and maize is the favored crop of the region. Vegetables and fruit trees predominate and the most important fruits are apple (*Pyrus melus*); pears (*Pyrus communis*); apricots (*Prunus ameriaca*); plums (*Prunus domestica*) and walnuts (*Juglans regia*). A large proportion of the area consists of uncultivable waste including forest. The important forest species are deodar (*Cedrus deodara*); kail (*Pinus excelsa*); cheer (*Pinus willichiana*); sufaida (*Populus euramericana*) and spruce (*Abies pindro*). The few important grass species found in the area are *Cenchrus ciliaris* (Buffel grass), *Digitari sanginalis*, *Setaria pallide*, *Poa pratensis* and *Arunda donax*.

#### 4.3.7 Economic Profile:

People of Neelum have diverse means of livelihood. Farming, forestry and livestock rearing are the main occupations, particularly among rural households. Poultry farming is also common. Besides, ponies and donkeys are kept for carrying load to heights. Due to the topography of the area, it is not possible to establish large industrial units, however, cottage industry is thriving; mainly carpet weaving, furniture making, wood carving, garment making and embroidery work. There are a few textile centers which produce bed sheets and coarse cloth.

Subsistence level farming for corn and wheat is conducted in and around the boundaries of area. Some level of vegetable farming including tomatoes and Spinach are grown as well. The largest industry for is the harvesting of Poplar trees, which are harvested and transported to Pakistan for manufacture of sporting goods. Government employment is a major sector for employment; however, a large section of the population is dependent upon remittances from overseas workers who send money to their relative in Azad Kashmir. Due to lack of opportunity, most citizens are looking for ways to get employment in other countries. Moreover, it is not uncommon for qualified youth from the city to find employment in larger cities like Rawalpindi/Islamabad and Peshawar.

In-Azad Kashmir seasonal migration for employment is very common (ERRA 2007). This signifies that different members in the local/family community seek for alternatives to improve their income. This has certain inferences on the every-day-social life on a household level. Tourism is an alternative for the locals to improve their household income. Some household members travel to Pakistani cities to get a job and increase their household income.

#### 4.3.8 Education:

AJK's literacy rate is estimated at 65%, which is higher than Pakistan's national average of 55%. Of the illiterate population, males constitute 77% and females 53%, according to the Pakistan Bureau of Statistics. At present the gross Enrollment rate at primary level is 98% for boys and 90% for girls (between the age of 5-9). Statistically, AJK has only two government universities – the University of Azad Jammu and Kashmir and University of Poonch Rawalakot – for a population of nearly 4.59 million.

The social sector growth cannot be gauged accurately due to inconsistency in data, however, from available statistics; a decrease has been noted in the number of primary schools in Muzaffarabad and Neelum i.e. from 508 to 488 for girls' schools and from 675 to 643 for boys since 1998.

Majority of the people above then 30% is uneducated in one of the village of district Neelum as there are no sufficient educational facilities in Gurase Valley in past whereas Government have provided primary, middle and high schools in the valley, while the students have to go outside the valley for college and university education. But on the other hand this statistic is now changing and the literacy rate that is recorded in Neelum valley is about 51%.

Along with these Neelum District established an institute especially for the kids learning that named as "Neelum Valley Kid, AJ&K" this seems that the thinking of people is now changing and they come out from their ancestors believing system and better understanding the importance of education not only for boys but also equally necessary element for small girls of the houses.

#### 4.3.9 Housing

The housing pattern is lavish in terms of size and construction as more than 88% of the structures are pukka, made of cement and bricks with RCC structures. Only 5% houses and structures are kacha, made of mud and stone, whereas 6% structures are a combination of kacha and pakka.

The average rooms in a single housing unit are 2-5 in 55% houses, whereas 41% of households have 5-10 rooms and 3% houses are with 10-20 rooms. The entire reported population owned their houses, as no one reported to have rented residential accommodation.

#### 4.3.10 Language:

The official language which is spoken in this valley is Urdu because it can be understood by mostly anyone in the valley so that's the sole reason for it. The local mix of people including Kashmir's speaks their own local languages Kashmiri or Pahari or Hindko. The few of the people living there also follow Punjabi and Pashto as well because some Punjabi's and Pathan's are also doing their business in the valley.

Urdu is the official language of Azad Kashmir but is spoken by only a minority of people. Other languages are Gojri, Kashmiri and Pahari. The dominant language spoken in the state is Pahari, which is very similar to Pothwari and Hindko.

#### 4.3.11 Water supply and sanitation:

The 1998 census report shows that the facility of drinking water inside the house was available to only 16.28% of the housing units while a large proportion 83.72% of the housing units, used outside sources as drinking water. According to the reports of PWD (Water Supply Branch) and LG&RD Department in 2005 the situation was that, out of a total 6604 urban houses, 1390 had access to piped drinking water which makes 21% of these houses.

Health and hygienic condition of the valley is even much worse than any part of life. There are just two BHUs (Basic Health Units) in the whole valley to provide medical aid to the population of the valley. In winter season when the whole valley is ice-covered and temperature falls down from the freezing point, people could not reach to these BHUs and they have to use local herbs for treatment. And many people especially women and children die during winter because of absence of medical facilities. Lady Doctor and gynecologist are still not appointed by the government even in the whole district so a number of the women have to die during pregnancy complications.

#### 4.3.12 Gender issues:

The sex ratio (number of males per hundred females) of the district computed in 1998 is 102.28. It is 101.93 and 104.34 in rural and urban areas respectively. The disabled persons constituted 2.61% of the total population whereby it was 3.08% and 2.13% in male and female population respectively. Among the disabled percentage of crippled was 22.44% for both sexes. The deaf and mute is 9.05 for both sexes. The insane among the disabled constituted 7.08%. The women have no formal role in the authority structure of the district Neelum and nearby villages. Most young people believe gender empowerment and equality are neglected issues in AJK, with women's contributions toward AJK's development underutilized. The opinion was carefully monitored based on the gender of participants. Almost 80 % of the female youth surveyed believe that they do not have equal opportunities to men, while this view was supported during focus group discussions by almost 65% of the male youth in Mirpur, 45% in Rawalakot and 40% in Muzaffarabad.

The literacy rate is now raising as for females i.e. 54.04 % as compared to the males. The traditional attitude of not sending the girls to school is changing now, because the parents understand that the basic education is necessary for each individual regardless of sex. Most of the women stay at home and only travel outside the village in case of visiting to shrines, relatives, and going to weddings and hospitals in nearby towns.

#### 4.3.13 Vulnerable Groups:

There is none falling under the category of ultra-poor as all the households have a monthly income which is above PKR 5,000/- and expenditure accordingly. The high monthly income is because of the remittance from abroad as every household has a family member or a close relative working abroad who support the families and their spouses living in the country.

#### 4.3.14 Cultural Heritage:

Cultural notions of Neelum valley inhabitants are reflected in different walks of life. Some aspects of their cultural notions are given below:

- **Believing System:**

The villages are occupied by believers of Islam. Islam is the dominant religion in district Neelum. Religion has played a key role in shaping their cultures, customs, rites, rituals, festivals, ceremonies, fasts, food etc. Therefore most of the festivals are religious like "Eid-ul-

Fitar”, “Eid-ul-Azha”, “Id-Milad” and “Miraj-i-Alam” etc. Each festival brings enjoyment and socio economic activity in the district.

- **Handicrafts:**

Azad Kashmir is famous for making traditional handicrafts and artifacts. Mostly women are used to make Cashmere Shawls, Pashmina Shawls and Carpets which are hand woven and knotted by women inside their houses. Before the introduction of tourism, these handicrafts were used to send to other cities for sale for which in return they used to get low incomes due to high transport fares. But since 1990’s the demand for the locally made handicrafts is growing with the increase of tourism activities. People of the valley also make good Carpet, Namda and Gubba. They are also famous for their Silk Woolen Clothing. People also make Woolen shawls.



- **Food and Drink:**

Food system of a community forms one of the important aspects of their culture. Majority of the inhabitants in the villages are non-vegetarians. The meat of Buffalo, cattle, sheep and hen is eaten on the condition of “Halal” chopping according to the Islamic viewpoint. Rice is the traditional stable diet of village dwellers. The area is also famous for its dishes like Gushtaba. The Kashmiri people love this food and are their most favorite. People eat rice a lot. They don’t consider a lunch or a meal with not having rice. Tabak Maaz is also quite eaten in the valley and the preparation of which is considered an art and a point of pride in Kashmiri culture.

- **Dressing Style:**

Local dress of Neelum valley and its nearby areas is Shalwar Kameez, which is commonly famous among men and women. The usual male headdress of a common Kashmiri is a cotton round cap. While the Kashmiri females wear a local traditional lady costume i.e. Phirak-yezar. The nature of the costume varies according to the seasonal changes.

The men mostly wear a weskit because in summers also the weather there is pleasant and cool and when we talk about winters the sweaters and the normal jackets comes into play.

#### 4.3.15 Cultural Heritage Sites:

Some cultural sites of Neelum valley, Azad Jammu and Kashmir also have cultural importance and residents have associated with these places.

- **Sharda Fort:**

Sharda Fort, also known as Sharda Peeth, is an ancient fort and a national heritage monument in Neelum Valley, Azad Kashmir, Pakistan. Situated at an altitude of 1981m near the Neelum River, it is a major tourist attraction in Neelum Valley. The heritage site is not

just a fort but is a combination of ancient Buddhist and Hindu temples as well as a ruined Buddhist University. The ruins of the famous temple and Hindu pilgrimage site Sharada Peeth, dedicated to the goddess Sharada who represents learning.

- **Chitta Katha Lake:**

Chitta Katha Lake is located in Shonter valley, Azad Kashmir, Pakistan at the altitude of 13,500 feet (4,100 m). Chitta' in local language means White and 'Katha' means water reservoir, so it is a reservoir of crystal clear water. "Chitta Katha Lake" is a deep bowl shaped body of water is mostly snowbound during the year. The surrounding of lake is very calm and peaceful. The major attraction of the lake is its milky white colors of water from which the name of the lake is derived.

However, the plant does not have any impact on the cultural heritage sites.





## 5. Impact Identification, Assessment and Mitigation Measures

In the examination study the potential impacts of the proposed projects have been identified and evaluated which are likely to occur during the exploration and developmental phase of the project. Further to mitigate the significant adverse impacts of the proposed project different measures are proposed to avoid, minimize and reduce consequences of the project activities. The propose mitigation and control measures are based on the magnitude of the impact, sensitivity and behaviour of the environmental and social receptors at the project site, regulatory requirements, and best industry management practices. An environmental monitoring plan is also devised to measure the levels of uncertainty in impact assessments and to set a course of action to manage the unpredicted impacts, if any occurs.

### 5.1 Environmental Impacts Screening

The potential environmental and social impacts during different phases of the project were identified and measured. These impacts are broadly classified as physical, ecological, socio-economic and cultural. Each of these classes is further divided into different aspects. In impacts assessments following parameters have been considered;

**Table 5-1: Shows impact assessment parameters and their characteristics**

| Parameter       | Characteristics   |
|-----------------|---|
| Nature          | <p><b>Direct:</b> when an environmental receptor is directly affected by the project activity</p> <p><b>Indirect:</b> when an environmental receptor is affected by change in another environmental receptor. Indirect impacts are less obvious and can occur later in time.</p>                                    |
| Magnitude       | Estimating the magnitude of the impact is of primary importance. Typically, it is expressed in terms of relative severity, such as major, moderate or small.  |
| Extent/Location | The spatial extent or zone of impact influence is predicted as local at site / regional / global.   |
| Timing          | During construction phase or operational phase  |
| Duration        | <p><b>Short-term;</b> impacts lasting for short duration such as noise from construction activities.</p> <p><b>Long-term;</b> impacts lasting for life of the project such as inundation caused be reservoir filling.</p> <p><b>Intermittent;</b> projects occurring in intervals such as industrial operations</p> |

|               |   |
|---------------|---|
|               | <p>occurring only for few hours.</p> <p><b>Continuous;</b> persistent impacts occurring continuously without any break</p>  |
| Reversibility | <p><b>Reversible;</b> when an environmental receptor can resume to its original state after ending the project activity</p> <p><b>Irreversible;</b> when an environmental receptor cannot regain its original state even the impacting activity has been stopped.</p>                             |
| Likelihood    | <p><b>Almost Certain;</b> expected to occur under most circumstances.</p> <p><b>Likely;</b> probable to occur under most circumstances.</p> <p><b>Possible;</b> may possibly occur at some time.</p> <p><b>Unlikely;</b> could possibly be occur but only under exceptional circumstances.</p>    |
| Significance  | <p>Impact significance depends on the sensitivity and value of the impact receptor. For instance, drinking water resources are critically important to the local communities and likewise endangered species have global importance. Significance can be categorized as High, Medium and Low.</p> |

After identifying and assessing impacts appropriate mitigation measures are devised in accordance with the impact characteristics in order to minimize them if not entirely eliminate them. The impact screening matrix of both construction and operational phases is provided here in the tables.

**Table 5-2: Impact Matrix – Unmitigated Impacts of Developmental Phase for Dolerite and Granite in Kel Seri area, District Neelum, AJK**

| Project Activities                             | Physical Environmental Impacts |                             |                       |                     | Ecological impacts |                 | Socio-Economic Impacts |       |                    |                |                          |              |                | Cultural Impacts                             |
|--|--------------------------------|-----------------------------|-----------------------|---------------------|--------------------|-----------------|------------------------|-------|--------------------|----------------|--------------------------|--------------|----------------|--|
|  | Soil erosion / degradation     | Air quality degradation and | Surface Water Impacts | Groundwater Impacts | Vegetation Losses  | Wildlife Losses | Solid Waste            | Noise | Traffic Congestion | Safety hazards | Health and Safety of the | Employment / | Drinking Water | Impacts on Cultural and Archaeological sites |
| <b>Exploitation Phase</b>                      |                                |                             |                       |                     |                    |                 |                        |       |                    |                |                          |              |                |  |
| Land Acquisition                               | 0                              | 0                           | 0                     | 0                   | 0                  | 0               | -1                     | 0     | 0                  | 0              | 0                        | +1           | N              | 0  |
| Site preparation                               | N                              | N                           | N                     | N                   | N                  | N               | N                      | N     | N                  | N              | N                        | N            | N              | N  |
| Geological Mapping                             | -1                             | -1                          | -1                    | -1                  | -1                 | 0               | 0                      | -1    | -1                 | 0              | 0                        | +1           | 0              | 0  |
| Movements of heavy machinery                   | -1                             | -1                          | 0                     | N                   | -1                 | 0               | 0                      | -1    | 0                  | -1             | -1                       | +1           | 0              | 0  |
| Land disturbance                               | -1                             | -1                          | -1                    | -1                  | 0                  | 0               | -1                     | -1    | 0                  | 0              | -1                       | +1           | 0              | 0  |
| Blockage of road during exploration activities | -1                             | -1                          | -1                    | -1                  | 0                  | 0               | -1                     | -1    | 0                  | 0              | -1                       | +1           | 0              | 0  |
| Labour Residences                              | -1                             | 0                           | -1                    | N                   | 0                  | -1              | 0                      | 0     | 0                  | 0              | -1                       | +1           | 0              | -1   |
| Labour Needs                                   | N                              | N                           | 0                     | N                   | N                  | N               | -1                     | 0     | 0                  | 0              | 0                        | +1           | N              | N  |

Key: -3 = High –Ve Impact; -2 = Moderate –ve Impact; -1 = Low –ve Impact; 0 = Insignificant/Negligible Impact; +1 = Low +ve Impact; +2 = Moderate +ve Impact; +3 = High +ve Impact; N= No Impact

**Table 5-3: Impact Matrix – Unmitigated Impacts of Exploitation Phase for Dolerite and Granite in Kel Seri area, District Neelum, AJK**

| Project Activities    | Physical Environmental     |                                  |                       |                     | Ecological        |                 | Socio-Economic Impacts |       |                    |                                  |                                  |                       |                | Cultural                                     |
|-----------------------|----------------------------|----------------------------------|-----------------------|---------------------|-------------------|-----------------|------------------------|-------|--------------------|----------------------------------|----------------------------------|-----------------------|----------------|--|
|                       | Impacts                    |                                  |                       |                     | impacts           |                 |                        |       |                    |                                  |                                  |                       |                | Impacts                                      |
|                       | Soil erosion / degradation | Air quality degradation and dust | Surface Water Impacts | Groundwater Impacts | Vegetation Losses | Wildlife Losses | Solid Waste            | Noise | Traffic Congestion | Safety hazards and Public Health | Health and Safety of the Workers | Employment / Economic | Drinking Water | Impacts on Cultural and Archaeological sites |
| Developmental Phase   |                            |                                  |                       |                     |                   |                 |                        |       |                    |                                  |                                  |                       |                |  |
| Land Acquisition      | N                          | N                                | N                     | N                   | N                 | N               | N                      | N     | N                  | N                                | N                                | N                     | N              | N  |
| Labour Residences     | 0                          | 0                                | 0                     | 0                   | 0                 | 0               | -1                     | 0     | 0                  | 0                                | 0                                | +1                    | N              | 0  |
| Movements of Vehicles | -1                         | -1                               | 0                     | N                   | -1                | 0               | 0                      | -1    | 0                  | -1                               | -1                               | +1                    | 0              | 0  |
| Drilling              | -1                         | -1                               | -1                    | -1                  | -1                | 0               | -1                     | -1    | -1                 | -1                               | -1                               | +1                    | 0              | N  |
| Plant Workshop        | -1                         | 0                                | 0                     | 0                   | 0                 | 0               | -1                     | -1    | 0                  | 0                                | -1                               | +1                    | 0              | 0  |
| Plant Operations      | 0                          | -2                               | -1                    | N                   | 0                 | 0               | 0                      | -2    | N                  | -1                               | -1                               | +3                    | N              | N  |
| Stones Transportation | -1                         | -1                               | N                     | N                   | N                 | N               | 0                      | -1    | -1                 | -1                               | -1                               | +2                    | N              | N  |
| Labour Needs          | N                          | N                                | 0                     | N                   | N                 | N               | -1                     | 0     | 0                  | 0                                | 0                                | +1                    | N              | N  |

Key: -3 = High –ve Impact; -2 = Moderate –ve Impact; -1 = Low –ve Impact; 0 = Insignificant/Negligible Impact; +1 = Low +ve Impact; +2 = Moderate +ve Impact; +3 = High +ve Impact; N= No Imp

## 5.2 Environmental Impacts and Mitigation Measures

Different mitigation measures will be proposed for the excavation of valuable stones for exploitation and developmental phases of the project to reduce or to minimize their effects on the socio-economic and biophysical environment. Among the proposed mitigation measures specialized equipment are utilized and they are then serviced regularly in order to minimize noise and dust emissions during exploitation phase and also good site management system is proposed to overcome the risk of accidents during the process of stone exploration.

In order to ensure that the proposed mitigation measures will be implemented, an environmental management plan has been developed to guide all activities of the project during all its phases concerning the protection of the environment.

There are going to be many activities at the plant which may lead to have significant environmental impacts, if not dealt carefully. The activities can impair various components of physical and ecological environment and social settings of the area. The activities may cause various environmental impairments and the impacts that have been identified in impact matrix of the plant under consideration are as under;

### Physical Environmental Impacts

- Soil erosion and degradation
- Air quality degradation and dust
- Groundwater contamination

### Ecological Impacts

- Vegetation and Wildlife loss

### Socio-Economic Impacts

- Noise
- Solid waste
- Traffic Congestions
- Safety hazards and Public Health
- Health and Safety of the Workers
- Employment Generation

#### 5.2.1 Soil erosion and degradation

The soil related impacts due to developmental and exploitation phase may include *soil erosion, top soil removal, slope stability, and soil contamination*. During the exploitation phase for the site preparation activity generation of excavated soil, debris and construction waste will lead to contaminate the surrounding environment.

Use of heavy machinery including drill machines, compressors and equipment for the quarrying of dimension stones will also lead to the production of dust, debris and also causing visual impacts. The project activities that probably can cause such impacts are movement of vehicles, plant workshop, excavation of site, generation of solid and stony waste after exploitation phase.

The unmitigated impacts related to soil erosion and degradation is characterized below;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility: reversible
- Magnitude: Small
- Likelihood: Likely
- Significance: Low

### **Mitigation Measures**

Following measure will be taken to avoid, minimize and reduce the impacts on soils;

- The vehicle should move on the designated tracks and should avoid other areas to minimize soil compaction and degradation.
- Leakage of oils, grease and other liquids should be managed and controlled while repairing the parts of machinery to avoid its seepage to soil to contaminate it.
- Regular water sprinkler was done in order to reduce the magnitude of dust generate during the exploration phase.
- The transportation of the mined stones to the plant site was managed properly in good quality and properly tuned vehicles to avoid any negative environmental impacts
- The explored precious stone transporting vehicles should not be over filled and should travel on designated tracks to avoid soil compaction.

### **Residual Impact**

After adopting and implementing above mentioned mitigation measures the impacts on soil will be reduced to considerable extent and residual impact would be of very negligible extent.

#### **5.2.2 Air quality degradation and dust**

Dust is one of the most visible, invasive, and potentially irritating impacts associated with quarrying. Dust may occur as fugitive dust from excavation, from haul roads, and from blasting, or can be from point sources, such as drilling, crushing and screening. Site conditions that affect the impact of dust generated during exploitation of dimension stones (Granite/Dolerite) include rock properties, moisture, ambient air quality, air currents and prevailing winds, the size of the operation, proximity to population centres, and other nearby sources of dust.

Land excavation, levelling, vehicles movement, machinery and equipment for construction, installation of plant may deteriorate air quality with emissions of dust, Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>), Sulphur Oxides and Nitrogen Oxides. Only few vehicles (compressors, drilling machinery, trolley tractors and small dumpers) move around the plant site, which may not cause any significant impact on the air quality. However, plant exploration and operational phase because of using heavy machinery may deteriorate air quality significantly with particulate matter and fugitive dust emissions if measures to control that are not implemented.

The unmitigated impacts related to air quality deterioration can be characterized as under;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility: reversible
- Magnitude: Small
- Likelihood: Likely
- Significance: Medium

### **Mitigation Measures**

A carefully prepared and implemented dust control plan commonly can reduce impacts from dust emission.

Following measures will be implemented to minimize the impacts on the air quality;

- Quarrying machinery and vehicles will be kept in good conditions and will be properly tuned time to time to reduce vehicular exhaust emissions.
- Water will be sprayed at regular intervals to avoid fugitive dust emissions.
- Aggregates materials such as concrete and sand, stones and gravel extracted during exploration phase will be kept under sheet covers.
- Use of water trucks, sweepers, and chemical applications on haul roads, control of vehicle speed, and construction of windbreaks and plantings.
- Fugitive dust from blasting can be controlled by proper design and execution of blasts.
- Workers are protected from dust through the use of enclosed, air-conditioned cabs on equipment and, where necessary, the use of respirators. Worker safety may include regular health screening.
- The impacts from plant-generated dust commonly can be mitigated by use of dry or wet control systems.
  - Dry techniques include covers on conveyors, vacuum systems, and bag houses, which remove dust before the air stream is released to the atmosphere.
  - Wet suppression systems consist of pressurized water (or surfactant treated water) sprays located at dust generating sites.

## **Residual Impact**

After adopting and implementing above written mitigation measures the air quality emissions will be reduced to large extent and remaining would not be significant.

### **5.2.3 Water contamination**

Quarrying can substantially modify the routing of recharge and water quality may be degraded. Commonly the first impact of quarrying is to remove the overlying vegetation and soil. In temperate areas removing vegetation and soil reduces evapotranspiration and increases the effective rainfall. Unless measures are taken to control runoff and sedimentation, deterioration of ground water is likely. Dust can enter conduits and smaller openings and can be transported by ground water (Gunn and Hobbs, 1999). The fine debris produced by the cutting of dimension stones can be worked through the ground-water system during storm events. Blasting may cause problems with ground-water quality, but may also be erroneously identified as a cause of problems. It is also mentioned that shock waves from blasting operations loosened clay particles from solution cavities causing “muddying” of the ground water. Large amounts of silt and other effluents from quarries (waste, fuel, oil) may pollute rivers as well as underground water bodies within and far beyond the boundaries of the study area. However, these impacts are not much significant as plant does not involve such activities which could seriously impact the ground water quality or quantity. On the other hand during exploitation phase heavy machinery and equipment’s will be utilized. So the spills of oil from the Lorries and mechanical parts of the plant and storage tanks will lead to the contamination of the underground water and surface water courses.

Following measures will be implemented to minimize or reduce the impacts on the quality and quantity of ground and surface water;

- The machinery and heavy vehicles should be kept in good condition.
- Inspection of the machines will be done at regular intervals
- Used oil will be collected, stored in water tight recipient and taken to reuse or recycling plants.
- Use special quarrying techniques in areas of steep slopes, erodible soils, and stream crossings.
- Construct drainage ditches only where necessary. Use appropriate structures at culvert outlets to prevent erosion.
- Do not alter existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.
- Handle earth materials and runoff in a manner that minimizes the formation of acid mine drainage, prevents adding suspended solids to stream flow, and otherwise prevents water pollution.
- Apply erosion controls relative to possible soil erosion from vehicular traffic.
- Avoid creating excessive slopes during excavation and blasting operations.
- Closely monitor activities near aquifer recharge areas to reduce potential contamination of the aquifer.



- Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.
- Reclaim or apply protective covering on disturbed soils as quickly as possible.
- Backfill or recontour strip-mined or contour-mined areas with excess excavation material generated during exploitation activities.
- Maintain storage and disposal areas to prevent accidental release.
- Provide spill mitigation equipment.

#### 5.2.4 Wildlife loss

Disperse vegetation is present near the plant site. Vehicles movement, dust from the plant exploration and developmental actions by settling on the leaves may cause some impacts on vegetation loss and/or micro fauna loss. While the noise generated may affect wild fauna activities in the vicinity. However, no major wild fauna activities were observed during the survey in the vicinity of the project site.

The impact on the soil insects, worms, and beetles is characterized as below;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility: Irreversible
- Magnitude: Small
- Likelihood: Possible
- Significance: Low

The plant operations noise would be not much as the hoppers will be confined with lids and further the noise will be attenuated by layers of trees surrounding the plant area.

#### 5.2.5 Noise

Noise causes mental disturbance, nuisance and high level of noise effects hearing. The primary source of noise from exploitation of valuable stones is from earth-moving equipment, processing equipment, and blasting. However during the development and operation phase different heavy vehicles may cause noise but the level of it will not be allowed to exceed 75 dBA at a distance of 100 meters away from the proposed plant. As the noise level measured average values are in range of 55.6 dBA to 63.2 dBA.

Noise impact of the project construction can be characterized as under;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility: reversible
- Magnitude: Small
- Likelihood: Almost Certain
- Significance: Medium

## **Mitigation Measures**

Noise level of the plant exploitation activities will not be allowed to exceed NEQS limits and will be reduced by adopting following measures;

- The plant will be operated only in day time to avoid night time disturbance and not to violate the NEQS limits.
- The machinery and vehicles used at the plant will be kept tuned and serviced to avoid unnecessary noise generation.
- Machinery and vehicles will have good exhaust mufflers to minimize noise generation.
- No pressure horns will be allowed on install on vehicles. Un-necessary making of horns will also be avoided.
- The impacts of noise can be mitigated through various engineering techniques. Landscaping, berms, and stockpiles can be constructed to form sound barriers.
- Noisy equipment (such as crushers, compressors and drilling machines) can be located away from populated areas and can be enclosed in sound-deadening structures.
- Conveyors can be used instead of trucks for in-pit movement of materials.
- Noisy operations can be scheduled or limited to certain times of the day. The proper location of access roads, the use of acceleration and deceleration lanes, and careful routing of trucks can help reduce truck noise.
- Workers can be protected from noise through the use of enclosed, air-conditioned cabs on equipment and, where necessary, the use of hearing protectors. Worker safety may include regular health screening.

## **Residual Impact**

With implementing above mitigation measures, the residual level of noise should not exceed 75 dBA during the operational hours.

### **5.2.6 Solid waste**

There are different types of solid waste which is generated during quarrying operation of dimension stones, these are differ in their physical and chemical nature and how they contaminate the environmental compartment and the way in which they are dispose off and managed at mine site.

The solid waste is categorized according to the activities that are given below:

**Overburden:** It includes the soil and rock that is removed to gain access to the ore deposits at open pit mines. It is usually piled on the surface at mine site where it will not impede further expansion of the mining operation. Overburden generally has a low potential for environment al contamination, and is often used at mine site for landscape contouring and revegetation during mine closure.

**Waste rock:** It is a material that contains minerals in concentrations considered too low to be extracted at a profit. It is often stored in heaps or dumps on the quarry site, but may be stored underwater with tailing if it contains a lot of sulphide minerals and has a high

potential for acid rock drainage formation. Waste rock dump are generally covered with soil and Revegetate following mine closure.

**Mine water:** it is produce in a number of ways at mine sites, and can vary in its quality and potential for environmental contamination. Water at exploitation site is frequently monitored and various water management strategies have been followed to reduce the amount of water produced and treated the water before it is discharged to the environment.

The unmitigated solid waste impacts can be characterized as below;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility Reversible
- Magnitude Small
- Likelihood Likely
- Significance Low

#### Mitigation Measures

- Mine waste requires careful management to ensure the long term stability of storage and disposal facilities, and to prevent and minimize air, water and soil contamination.
- A proper system will be established for management of discarded materials at plant for recycling with placing collection bins for plastic, metals and bags etc. The organic waste will be collected separately in a bin with plastic bag to dispose that off properly instead of letting that scattered around the plant site.

After implementing mitigation measures, the residual impact will be minimized to considerable extent and will not be considered significant.

#### 5.2.7 Traffic Congestions:

Traffic keeps flowing on the road that connects to the project site round the clock but the intensity of the traffic is not much higher. Traffic intensity will be 5 minimum vehicles on day time and approximate no traffic at night time. During the exploitation phase of the project different heavy machinery will be used (drilling machines, compressors and small trolleys) which can add further traffic on the road. Considering the quantum of traffic on the road, 6-8 mini-trolleys and trucks adding on the road will have a negligible impact on the traffic congestion.

The traffic congestion unmitigated impact is characterized as under;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility Reversible
- Magnitude Small

- Likelihood Unlikely
- Significance Low

### **Mitigation Measures**

- The impact is already of low magnitude and it will be further controlled by using the off-peak traffic hours for incoming and outgoing of transporting vehicles.
- The trucks will be loaded with the weight that would not be exceeding the road bearing capacity so that the damage to the roads is avoided.

### **5.2.8 Safety hazards and health and safety of workers**

The project site is located away from the main valley and general passage of public. There is no general public roam around in the area but the plant workers, drivers and helpers etc. remain in the area during the day time. During the exploitation and developmental phase of the project different activities can pose threat to the general safety and health of the worker. These may include plant noise, dust and accidents at plant site etc.

The unmitigated impacts related to safety hazards and general health can be characterized as under;

- Nature: Direct
- Duration: Short
- Spatial Extent: Local
- Reversibility Reversible
- Magnitude Small
- Likelihood Likely
- Significance Medium

### **Mitigation Measures**

Following mitigation measures will be adopted to avoid hazards and risks to health of the workers;

- Warning signs will be installed around the hazard posing sites.
- All the workers will be educated about the risks and trained to adopted safety measures.
- Workers will be ordered to use masks to reduce dust impacts, and ear muffs to reduce noise impacts.
- Workers will be ordered to use personal protective equipment such as helmets to reduce injury risks in case of accidents.
- Machinery operators and drivers will be trained to avoid all sort of impacts associated with their machines and vehicles.
- Machinery operators and drivers will not be permitted to use machines and vehicles without helpers.
- First aid boxes will be kept all the time at site.

## **Residual impact**

After implementing above mentioned mitigation measures the remaining probability of impact will be negligible extent.

### **5.2.9 Cultural and Heritage Impacts**

Mining activities can cause direct and indirect impacts to cultural resources. Direct impacts can result from exploitation and other quarrying activities. Indirect impacts can result from soil erosion and increased accessibility to current or proposed exploited sites.

Potential impacts include:

- Complete destruction of the resource through surface disturbance or excavation;
- Degradation or destruction, due to topographic or hydrological pattern changes, or from soil movement (removal, erosion, sedimentation);
- Unauthorized removal of artifacts or vandalism as a result of increased access to previously inaccessible areas; and
- Visual impacts due to clearing of vegetation, large excavations, dust, and the presence of large-scale equipment, and vehicles.

#### **Mitigation Measures:**

- The key concerns from a heritage perspective should be the design and installation of disaster-protection systems or mechanisms in ways which will minimize impact on heritage values. Hence, approaches to preparedness design that remain sensitive to heritage will generally require review of a large range of alternatives, in order to ensure that the least-impact option has been identified.
- Heritage properties, their significant attributes and the disaster-response history of the property should be clearly documented as a basis for appropriate disaster planning, response and recovery.
- It is to ensure that adequate attention in advance planning is given to identification of heritage attributes, the risk to these attributes and appropriate response measures for these risks.

However on the other hand, the current exploitation project of dimension stones (Granite/Dolerite) has no impact on the cultural heritage as the project site has no significant cultural resources and the existing cultural sources are far away.

**Table 5-4: Impact Matrix – Mitigated Impacts of Developmental Phase for Dolerite and Granite in Kel Seri area, District Neelum, AJK**

| Project Activities                              | Physical Environmental Impacts |                                  |                       |                     | Ecological impacts |                 | Socio-Economic Impacts |       |                    |                                  |                                  |                       |                | Cultural Impacts                             |
|---|--------------------------------|----------------------------------|-----------------------|---------------------|--------------------|-----------------|------------------------|-------|--------------------|----------------------------------|----------------------------------|-----------------------|----------------|--|
|   | Soil erosion / degradation     | Air quality degradation and dust | Surface Water Impacts | Groundwater Impacts | Vegetation Losses  | Wildlife Losses | Solid Waste            | Noise | Traffic Congestion | Safety hazards and Public Health | Health and Safety of the Workers | Employment / Economic | Drinking Water | Impacts on Cultural and Archaeological sites |
| <b>Developmental Phase</b>                      |                                |                                  |                       |                     |                    |                 |                        |       |                    |                                  |                                  |                       |                |  |
| Site preparation                                | N                              | N                                | N                     | N                   | N                  | N               | N                      | N     | N                  | N                                | N                                | N                     | N              | N  |
| Land Acquisition                                | 0                              | 0                                | 0                     | 0                   | 0                  | 0               | 0                      | 0     | 0                  | 0                                | 0                                | +1                    | N              | 0  |
| Movements of heavy machinery                    | 0                              | 0                                | 0                     | N                   | 0                  | 0               | 0                      | -1    | 0                  | 0                                | 0                                | +1                    | 0              | 0  |
| Geological mapping                              | -1                             | -1                               | -1                    | -1                  | -1                 | 0               | 0                      | -1    | -1                 | 0                                | 0                                | +1                    | 0              | 0  |
| Land disturbance                                | 0                              | 0                                | 0                     | 0                   | 0                  | 0               | 0                      | -1    | 0                  | 0                                | 0                                | +1                    | 0              | 0  |
| Blockage of road during exploitation activities | 0                              | 0                                | 0                     | 0                   | 0                  | 0               | 0                      | -1    | 0                  | 0                                | 0                                | +1                    | 0              | 0  |
| Labour Residences                               | 0                              | 0                                | -1                    | N                   | 0                  | 0               | 0                      | 0     | 0                  | 0                                | 0                                | +1                    | 0              | 0  |
| Precious stones Transportation                  | 0                              | 0                                | N                     | N                   | N                  | N               | 0                      | 0     | 0                  | 0                                | -1                               | +2                    | N              | N  |
| Labour Needs                                    | N                              | N                                | 0                     | N                   | N                  | N               | 0                      | 0     | 0                  | 0                                | 0                                | +1                    | N              | N  |

Key: -3 = High –ve Impact; -2 = Moderate –ve Impact; -1 = Low –ve Impact; 0 = Insignificant/Negligible Impact; +1 = Low +ve Impact; +2 = Moderate +ve Impact; +3 = High +ve Impact; N= No Impact

**Table 5-5: Impact Matrix – Mitigated Impacts of Exploitation Phase for Dolerite and Granite in Kel Seri area, District Neelum, AJK**

| Project Activities    | Physical Environmental     |                                  |                       |                     | Ecological impacts |                 | Socio-Economic Impacts |       |                    |                                  |                                  |                       |                | Cultural Impacts                             |
|-----------------------|----------------------------|----------------------------------|-----------------------|---------------------|--------------------|-----------------|------------------------|-------|--------------------|----------------------------------|----------------------------------|-----------------------|----------------|--|
|                       | Soil erosion / degradation | Air quality degradation and dust | Surface Water Impacts | Groundwater Impacts | Vegetation Losses  | Wildlife Losses | Solid Waste            | Noise | Traffic Congestion | Safety hazards and Public Health | Health and Safety of the Workers | Employment / Economic | Drinking Water | Impacts on Cultural and Archaeological sites |
| Developmental Phase   |                            |                                  |                       |                     |                    |                 |                        |       |                    |                                  |                                  |                       |                |  |
| Land Acquisition      | N                          | N                                | N                     | N                   | N                  | N               | N                      | N     | N                  | N                                | N                                | N                     | N              | N  |
| Labour Residences     | 0                          | 0                                | 0                     | 0                   | 0                  | 0               | 0                      | 0     | 0                  | 0                                | 0                                | +1                    | N              | 0  |
| Movements of Vehicles | 0                          | 0                                | 0                     | N                   | 0                  | 0               | 0                      | -1    | 0                  | 0                                | 0                                | +1                    | 0              | 0  |
| Drilling              | -1                         | -1                               | -1                    | -1                  | -1                 | 0               | -1                     | -1    | -1                 | -1                               | -1                               | +1                    | 0              | N  |
| Plant Workshop        | 0                          | 0                                | 0                     | 0                   | 0                  | 0               | 0                      | 0     | 0                  | 0                                | -1                               | +1                    | 0              | 0  |
| Plant Operations      | 0                          | -1                               | 0                     | N                   | 0                  | 0               | 0                      | -1    | N                  | 0                                | -1                               | +3                    | N              | N  |
| Aggregates Storage    | 0                          | N                                | N                     | N                   | N                  | N               | 0                      | 0     | N                  | 0                                | 0                                | 0                     | N              | N  |
| Stones Transportation | 0                          | 0                                | N                     | N                   | N                  | N               | 0                      | 0     | 0                  | 0                                | -1                               | +2                    | N              | N  |
| Labour Needs          | N                          | N                                | 0                     | N                   | N                  | N               | 0                      | 0     | 0                  | 0                                | 0                                | +1                    | N              | N  |

Key: -3 = High –Ve Impact; -2 = Moderate –ve Impact; -1 = Low –ve Impact; 0 = Insignificant/Negligible Impact; +1 = Low +ve Impact; +2 = Moderate +ve Impact; +3 = High +ve Impact; N= No Impact

### **5.3 Positive Impacts of the Project**

There are many positive impacts for locals and for nearby towns of this plant. The major positive features of the project are;

- The successful execution of the project will increase the assessed potential of Granite and Dolerite dimension stones.
- Employment generation for at least 20 workers.
- Provides business and employment opportunities to the locals.
- Provision of good quality stones not only for industrial application but also to be used to make beautiful buildings and decorative tiles at local and as well as regional level.
- Commercial exploitation of these dimension stones would bring in revenue for the area.
- Reduction in un-employment in the district of Neelum.
- Improvement in the living standards of the local residents.
- Revenue generation for Neelum District.



## **6. Public Consultation**

Consultation process is considered as an important component for Initial Environmental Examination (IEE) assessment report. The consultation process is a crucial mechanism to inform the public, local authority and community leaders about the proposed project, purpose and aims of the project. A high priority was placed on the views of the public, local officials, community leaders in the proposed project site in order to ensure a fair environmental assessment process.

The local residents, passengers, workers, drivers and nearby property owners were consulted to get their views, opinions and concerns regarding the exploitation and development of dimension stones under consideration.

They were firstly briefed about the developmental and exploitation phases, its main features, important activities, about the negative and positive impacts of the project and mitigations measures planned to reduce the negative impacts. Then their views, opinions and concern were taken by the IEE team and also by the project owner.

All of the people consulted did not say that the proposed project for exploitation of Granite and Dolerite stones will be a nuisance in the area. They seem that they did not bother it rather they consider it a positive project in the area as many of them said that the availability of dimension stones at cheaper rates can improve their life style and income level. The availability of decorative stones at lower rate can help the local residents to make their localities more beautiful and attractive for the tourists. So it is best for them to have worthy stone exploitation at their vicinity at lower cost without showing any potential negative impacts on the physical and biological environment.

Respondents respond that this investment is a beneficial step towards the development and betterment of Neelum as it generates employment opportunities to the locals present in far-away areas. Apart from this, the business community of Neelum valley are favoured this project as it fulfils their requirements and also a source of revenues.

Written statements were taken about their views on the project from those who were willing to provide in written. In short, the locals did not show any objection in exploitation and operation of the dimension stones for the proposed project.



**Figure 6-1: IEE Team consulting locals**

## **7. Impact Mitigation and Management Plan (IMMP)**

### **7.1 Introduction**

IMMP is prepared for all the identified environmental impacts that will likely to be occurred during exploitation and operation of proposed project activities. It summarizes the organizational requirements, management and monitoring plans to ensure that the necessary measures are taken to avoid potentially adverse effects and maximize potential benefits of the project and to operate in conformance with applicable laws and regulations of AJK.

This part of the report highlights Impact Mitigation and Management Plan and defines institutional arrangements required for its implementation. IMMP provides implementation mechanisms and ensure that the recommended mitigation measures identified during the IEE study in the previous section are followed, adopted and implemented in good spirit.

### **7.2 Purpose and Objectives of IMMP**

An impact mitigation and management plan provides a delivery mechanism to address the adverse environmental impacts of a project during its execution by adopting appropriate impact mitigation measures to enhance project benefits and reduce its negative consequences and to introduce standards of good practice to be adopted for all project works.

The primary objectives of the IMMP are to;

- Facilitate the implementation of the mitigation measures identified earlier.
- Develop a proper monitoring mechanism and identify requisite monitoring parameters to confirm effectiveness of the mitigation measures proposed.
- Define the responsibilities of the project proponent, construction engineers, site managers, and project operation managers, and defines means of effective communication among them.

### **7.3 Management Approach**

The Initial environmental Examination has been prepared to comply with AJK EPA under Section 11 of the Environmental Protection Act 2000.

The procedure followed for preparing the IMMP will consists of the following steps:

- Deriving mitigation/protection measures for identified impacts using impact evaluation method.
- Rationalize and combine series of mitigation, compensation and enhancement measures from each identified impacts and risks to prepare overall measures.
- Developing a mechanism for monitoring the proposed mitigation measures.
- Estimating budget requirements for implementation mitigation and monitoring measures.
- Identifying responsibilities of various agencies involved in the Project for implementation and monitoring of mitigation measures.

The management plan for the proposed project has fallen into three categories according to the proposed project activities.

- Developmental phase
- Exploitation phase
- Reclamation phase

### 7.3.1 Developmental Phase

Development is the preparation the facilities, equipment, and infrastructure required for exploitation of dimension stones, and the phase includes land acquisition, equipment selection and specification, infrastructure and surface facilities design and construction, environmental planning and permitting, and initial quarrying planning. During this phase of the project, there may also be a need for involuntary relocation of communities located in proximity to the proposed mining area. This can be a fatal flaw of a project and should be facilitated by qualified and experienced consultants. However in this case relocation of localities is not required as nobody reside near the site.

The developmental phase is associated with a number of environmental impacts resulting from excessive site clearance, poor waste management, poor site water management and socio-economic impacts.

- The inside roads will be designed in such a way as to avoid soil erosion and to cause as little disturbance to flora as possible.
- Maintenance workshops will be designed to avoid contamination of soil and water by spilled fuel and lubricants.
- An important factor at this stage is the choice of location of the waste dumps, and these will be sited in such a way as to minimise the visual impact where possible.

### 7.3.2 Exploitation phase:

The exploitation phase would involve major activities that could have impact on environmental resources such as drilling, quarrying and development of pits. These activities, if not carried out

carefully, may have aesthetic visual impacts on landscape along with localized dust generations and piling of excavated material.

The impacts can be significant but localised to the disturbed area if the site is not managed properly. A proper environmental impact management process will be implemented to avoid and minimise impacts to a negligible extent.

- The site machinery will be kept serviced and muffled.
- Infrastructure found on most small to medium sized dimension stones quarries includes offices, stockyards, workshops, and dressing yards and waste dumps.
- Offices usually generate domestic waste, stockyards and dressing yards may impact on soil structure in the form of compaction. They will be minimized by collection of solid waste generated in separate bins so that they are degraded easily without sorting.
- If fuel is stored on site, there is a possibility of spontaneous combustion that may lead to uncontrollable fire and soil contamination. To minimize the leakage of fuel from drilling machinery, compressors and other heavy vehicles, proper conditioned and timely tuned vehicles will be used for extraction phase.
- The waste piles of each drilling and excavation will be used to fill up holes and pits of previous exploration to minimize piling of waste.
- Each filled up pit/site will be vegetated with grasses and bushes and trees will be planted so that reclamation process keeps going along with exploitation.

### 7.3.3 Reclamation phase:

We prefer the term reclamation, defined as “a response to any disturbances to the earth and its environment caused by explored activities”. As it is wider in scope and includes all aspects of management of negative environmental impacts caused by quarrying.

The dimension stone exploitation is a clean operation; the main aims of reclamation are as follows:

- Ensure that worked-out areas are safe for future uses;
- Minimise visual impact of disturbed areas;
- Revegetate worked-out areas with suitable plant species;
- Achieve long-term stabilization of all worked out areas to minimise ongoing erosion; and
- Monitor and manage reclaimed areas until the vegetation is self-sustaining.

## 7.4 Recommendations

- Train the workers on safety regulations on exploitation activities and take an insurance cover to buffer any accidents.

- Ensure no idlers and pedestrians are exposed to the impacts of exploitation activities by enclosing the site.
- Take all possible measures to reduce noise levels at site by the use well-tuned work machinery and through setting work hours at specific times during the day to prevent disturbance to the community and biodiversity.
- The workers should be provided with
  - First aid kits
  - Workman's compensation and medical insurance covers
  - Hospital emergency telephone number
  - Appropriate personal protective equipment's
- In order to show respect on social and cultural issues regularly address all complaints from neighbours as soon as they arise.
- Firefighting appliances should be installed within the site, particularly the generator room and equipment room.
- Ensure compliance with safety procedures during fuel delivery and refuelling of generator.
- Ensure noise level monitoring of generator to ensure that noise is within NEQS limits.
- Maintenance should be ensured including checks for leaks and spills.
- Proper operating procedures that provide for training and good maintenance practice should be implemented.
- Security guards from the nearby community will be hired so that they are familiar to the residents.
- Guards will be available both at day and night time.

## **7.5 Environmental Monitoring**

Project manager will be responsible for making arrangements and collection of key parameters' information for all exploitation and developmental phase activities that can have any environmental or social impacts for both phase environmental monitoring.

## **7.6 Documentation and Communication**

The plant manager will document all the matters related to IMMP. He will record all the monitoring parameters and document the results. If any parameter exceeds the predicted values or mitigation measure fails or unexpected incident / accident occurs, the plant supervisor will document and communicate the matter immediately to the project plant manager and to the AJK EPA.

## 7.7 Implementation

Project owner, manager and supervisor will be responsible for legislative compliance, meeting approval conditions and successful implementation of the IMMP by following and adopting management approach mentioned above and by proper documentation and following standard communication procedures.

## 7.8 Environmental Impact Mitigation and Management Cost

| Sr. No. | Type of Input     | Description                                     | Cost in PKR  |
|---------|-------------------|---|--------------|
| 1       | Capacity Building | Training of workers and supervisory staff       | 50,000.00    |
| 2       | Workers Safety    | Procurement of PPEs                             | 150,000.00   |
| 3       | Dust Control      | Vegetation, Water Sprinkling, covers            | 800,000.00   |
| 4       | Monitoring        | Environmental parameters measuring              | 100,000.00   |
| 5       | Site improvement  | Vegetation, plantations and decontamination etc | 200,000.00   |
|         |                   | <b>Total Cost</b>                               | 1,300,000.00 |

## **8. Conclusion**

The IEE for the exploitation of Dolerite and Granite stones from Kel Seri area, district Neelum, AJK has been conducted in accordance with the legislated procedures and guidelines provided by the Environmental Protection Agency of Azad Jammu and Kashmir and by Environmental Protection Agency of Pakistan.

The IEE is carried out with objectives of identification and assessment of the potential environmental impacts of the proposed project. The IEE report contains description of the project, description of the existing environment, potential impacts and their mitigation measures. An implementation mechanism for the mitigation measures in the form of IMMP is also included in the IEE report.

The major conclusions of the IEE for the extraction of dimension stones (Granite/Dolerite) are as follows;

- The project is environmental friendly as it does not involve any blasting or other hazardous actions as the stones were explored through drilling methods to extent possible, and the small scales impacts will be minimized or mitigated through IMMP implementation.
- However, there could be few environmental and social impacts in the area such as dust and noise. These impacts will largely be reduced by adopting and implementation appropriate mitigation measures which are discussed in the report.
- The potential adverse impacts during the operational phase include air quality deterioration, solid waste generation, noise, potential threat to the health and safety of the workers and visual impacts.
- However, these impacts have been reduced and minimized to negligible extent by adopting and implementing mitigation measures as discussed in preceding three chapters.

It is concluded that the exploitation and developmental phase of dimension stones will generate employment opportunities. The high quality and friendly working environment will provide the workers with stress free working condition and occupation. The project will generate revenue for the town and the district.

On the basis of overall impact assessment, more specifically, nature and magnitude of the residual environmental impacts identified during this study, it is concluded that the plant under consideration is unlikely to cause any significant, long-lasting impacts on the physical, ecological and /or socio-economic aspects of the area, provided that the proposed activities are carried out as mentioned in the report and the mitigation measures and IMMP included in the report are fully and effectively implemented.



Based on the recommended mitigation measures in chapter 5, the impacts identified in the Table 5.2 and 5.3 (unmitigated) will be reduced considerably and residual impacts would be of insignificant levels. The tables 5.4 and 5.5 present the assessment of impacts after including mitigation measures.

There are no remaining issues that warrant further investigation for the activities of the project under consideration. This IEE is considered adequate for the environmental justification of the project.

Social Questionnaire Form – Sample

Questionnaire

1. Demographic Information;

Name of the Respondent. MUHAMMAD NASIR MAHMAD

Age. 24 Gender: Male  Female

Education: MIDDLE Occupation: AGRICULTURE / SELF-EMPLOYED .

Marital Status: Single  Married

2. Respondent Views about the proposed project?

The project will be beneficial for local community,  
in terms of employment.

3. Any suggestions/requirements for better management of the project environmental and social issues?

Continious co-operation & communication of project  
managment with local community will be  
beneficial. for managment for effective results.